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Economic Growth and Income Inequality: Empirical Evidence from North African Countries

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Abstract: This paper examines the empirical relationship between economic growth and income inequality for 4 countries of North Africa (Tunisia, Algeria, Morocco and Egypt) over the period 1970-2007. The results of this paper indicate that the long-run growth elasticity of income inequality is negative and significant implying that keeping other factors constant; more income inequality reduces economic growth. Moreover, this paper finds evidence that more physical and human capital investment and higher openness to trade have statistically significant impact on enhancing economic growth and reducing poverty.

Keywords: Economic Growth, Income Inequality, Panel cointegration

JEL Classification: O4, I3, O15

Introduction

Economic growth is considered to be a powerful force for reducing poverty. High and sustained economic growth increases the labor demand and wages which in return will reduce poverty. Similarly, better earnings as a result of reduction in poverty lead to increase productivity and growth. But the extent of poverty reduction as a result of economic growth depends on how the distribution of income changes with economic growth and on initial Inequalities in income. If income inequality increases, then economic growth does not lead to a significant poverty reduction. Many developing countries achieved high growth rates in different periods but poverty does not reduce significantly in these periods due to increase in income inequalities. Most South and

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East Asian economies grew at higher per capita rates since early 1970 along with rise in income inequality over time. In contrast, Latin American countries grew by less than the half of average growth rates in South and East Asia while maintaining high income inequality.[2] The differences in income inequality at a given rate of growth require that efforts to reduce poverty by stimulating growth are not sufficient and need to be complemented by efforts to reduce income inequalities.

A large number of empirical studies have attempted to explore the relationship between income inequality and economic growth.[3] But there are only few studies that discuss the role of credit market imperfections in growth inequality relationship. Most of earlier studies that highlight the role of credit market imperfections in growth inequality relationship used Ordinary Least Squares to estimate the cross-country growth regression, which has a problem of omitted variable bias. Secondly, due to limited availability of comparable inequality statistics, sample selection remained a problem in most of earlier studies. The resulting estimates of most of these studies found a negative coefficient on inequality suggested that countries with a more equal income distribution (that is a lower Gini index) tend to have higher levels of income.[4]

No country has achieved rapid economic growth by closing themselves off to international trade. Trade openness is defined as the degree to which foreigners and domestic citizen can transact without government imposed costs that are levied on a transaction between them. For example, tariff, non tariff barriers, local content requirements, inspection delays raise the cost of buying from abroad. Despite of having consistent emphasis on how trade promotes growth**,** the theory also suggested in the presence of distortions like Credit market imperfection, political instability, less improved infra structure etc., free trade might not be best for growth. For instance, a high real return to capital in unskilled labour abundant countries exploits their comparative advantage. Even if trade openness leads to more rapid growth, it does not necessarily imply that it is an effective instrument for reducing poverty. If a growth strategy based on trade openness leads to a significant worsening of income inequality of households, it does not lead to significant reduction in poverty. How trade affects income distribution of a country is purely an empirical question. This paper also considers the role of trade openness, physical and human capital investment and government spending in enhancing economic growth and reducing inequalities.

This study uses panel cointegration methods and improved data on income inequality to assess the possible steady-state relationship between income inequality and economic growth for four countries of North Africa (Tunisia, Algeria, Morocco and Egypt) over the period 1970-2007. This article is organized as follows. Section 2 presents the general theories describing the causal relationship from income inequality to economic growth. Section 3 presents the data and reports the results of panel unit root and cointegration tests. Estimation details and results are given in Sect. 4 and Sect. 5 concludes.

Economic Growth and Income Inequality: Theory and Evidence

Economic Growth and Income Inequality

Empirical research on economic growth-income inequality relationship started in 1955 when Simon Kuznet published his study. Kuznet composed data from three developed countries (USA, Germany and Britain). The results of his study suggested that income inequality increases in the initial phase of development and then decreases in the course of development. However, this study was based on simple OLS estimation technique that did create the problem of omitted variable bias. If region, country or some group specific factors affected growth rates, explanatory variables would capture the effects of these factors and estimates would not represent the true effect of explanatory variables. The data on growth and inequality used in that study was highly questionable.

Deininger and Squire (1996) using the data for 108 countries over the period 1960-1974 found no systematic relationship between growth and changes in aggregate inequality. According to their analysis, periods of aggregate growth were associated with increased inequality in forty-three cases and with a decrease in inequality in forty-five cases. Similarly, periods of economic decline were associated with increased inequality in five cases and with a more equitable distribution of income in two cases. The simple relationship between current as well as lagged income growth and the change in the Gini coefficient is insignificant for the whole sample as well as for sub samples defined in terms of country characteristics like rich or poor, equal or unequal, fast-growing or slow-growing economies, suggesting no strong relationship between growth and changes in aggregate inequality. The data set used in this study overcome many weaknesses of earlier data set as it should be based on household surveys, rather than estimates drawn from national accounts statistics. It had comprehensive coverage of all sources of income or uses of expenditure rather than covering, say, wages only; and be representative of the population at the national level, rather than dealing with only the rural urban population, or with taxpayers. But countries in the Middle East and North Africa, and especially Sub-Saharan Africa, are not well represented in this data. The coverage of Sub-Saharan Africa and the Middle East and North Africa is also thin with in countries, with less than two observations or each country on average.

Forbes (2000) found positive relationship between inequality and growth**.** The author argued that most likely reasons for the contradiction of results are country specific, omitted variable bias, data quality issues and length of period under consideration. In order to overcome such problems, the author used fixed effect model and the sample contained 45 countries whose income inequality data was deemed to be of high quality. The author also concluded that in the long run the relationship is negative while it is positive in the short.

Deininger and Squire (1998) argued that inconsistency in results was basically due to the fact that income inequality data might be poor proxy for wealth inequality**.** They used the data on land inequality as a proxy for wealth inequality. They argued that data on land holdings are attractive for a number of reasons. First, possession of land could be a major determinant of individuals' productive capacity and their ability to invest, especially in agrarian economies where land is a major asset. Second, in contrast to income, the measurement of which is often associated with large errors, is relatively easily ascertained and does not require assumptions regarding the mapping from income flows into stocks of assets. The available data, however, refer to the operational rather than the ownership distribution of land.

The results could be summarized in three points. First, initial inequality in the distribution of land appears to be associated with lower subsequent growth. Second, there is no support for a redistributive median-voter based explanation of initial inequality's effect on growth. Third, imperfections in financial markets for credit appear to be more relevant for investment in human capital rather than physical capital. However, data on land inequality was very limited and it could not be used in the panel data model to check if cross sectional results hold after controlling for omitted variable bias.

Role of Credit Market Imperfection

The income approach emphasizes the effect of income inequality on savings and on physical capital accumulation. Credit market imperfections approach considers the effect of income inequality on the accumulation of human capital (Galor and Zeira 1993). In a model by Galor and Moav (2004), the engine of economic growth changes from physical capital to physical and human capital in the process of economic development. The process of economic development is divided into two regimes, which have their own steady-state growth paths.

Economies in the first regime are underdeveloped, aggregate physical capital is small, and the rate of return to human capital is lower than the rate of return to physical capital (Galor and Moav 2004). There are two types of individuals in the economy: those who own the physical capital (the rich) and those who do not (the poor). The poor consume their entire income (wages) and are not engaged in saving and on capital accumulation. Thus, there is temporary steady-state equilibrium where the poor are in poverty trap and the rich get richer. Inequality increases aggregate savings by increasing the income of the rich and greater aggregate savings fuel physical capital accumulation.[5]

In the second regime, physical capital accumulation by the rich has increased the rate of return to human capital so high that it induces human capital accumulation (Galor and Moav 2004). In this regime, both human and physical capital are engines

for economic development. Since individuals' investment in human capital is subjected to diminishing marginal returns, the return to human capital investments is maximized when investment in human capital is widely spread among the population. Because access to credit is constrained, human capital investment is maximized when income in the economy is distributed evenly. However, in a certain phase of economic development income of every individual becomes so high that credit-constraints become less binding. In this locally stable steady-state equilibrium, the effect of inequality on growth becomes less significant.

Openness to Trade, Economic Growth and Income Inequality

The idea that trade liberalization has an impact on the country's growth is not new and goes back at least to Adam Smith. New classical model based on constant and decreasing returns to scale as in Solow (1956) and Swan (1956) predicted that a country would have static gains from lowering its trade barriers. Most of the recent studies including Dollar (1992), Edwards (1993), Sachs and Warner (1995) and Dollar and Kraay (2001a) have found a positive association between trade liberalization and growth. There are number of channels through which trade promotes growth rates by allocating the resources more efficiently. Trade promotes growth by encouraging economies to specialize and produce in areas where they have relative cost advantage over other economies. Overtime, this helps economies to employ more of their human, physical and capital resources in sectors where they get returns in open international markets, boosting productivity and returns to workers. Trade also expands the markets that local producers can access, allowing them to produce at most efficient scale to keep down the costs. Trade disperses new technologies and ideas, increasing the productivity of local workers and managers. Technology transfers through trade are also more valuable for developing countries, which employ less advance technologies and have little capacity to develop new technologies themselves. Removing trade barriers e.g. tariff on imports gives consumers access to cheaper products, increasing their Purchasing power and living standard. It also provides producers an access to cheap inputs, reducing costs and boosting their competitiveness.

Frankel and Romer (1999) in his study including 100 countries during the period since 1960 found that openness in general does have a statistically and economically significant effect on Growth. Hiranya and Abdullah (2004) in his study Trade Liberalization, Growth and inequality in Bangladesh found some evidence of trade liberalization accelerating growth in Bangladesh and also found little evidence affecting income distribution or of income distribution affecting growth or investment. Data on income inequality used in study is of poor quality.

Dollar and Kraay (2001a) using data on trade liberalization as a share of GDP in constant prices for 101 countries including 73 developing countries between 1975-79

and 1995-97 found that trade openness leads to declining inequality between countries, and declining poverty within countries. The poor countries that have reduced trade barriers and participated more in international trade over the past twenty years have seen their growth rates accelerate. In the 1990s they grew far more rapidly than the rich countries, and hence reduced the gap between themselves and the developed world. At the same time the developing countries that are not participating in globalization are falling further and further behind. Within the globalizing developing countries there has been no general trend in inequality**.** Thus, rapid growth has translated into dramatic declines in absolute poverty in countries such as China, India, Thailand, and Vietnam. OLS estimation results showed that in the 1990s the globalizing developing countries grew at 5.0 percent per capita; rich countries at 2.2 percent per capita; and no globalizing developing countries at only 1.4 percent per capita. While 100 percent increase in the trade share would have the cumulative effect of raising incomes by 25 percent over a decade. The data used on income inequality and poverty is highly questionable. Most developing countries did not have good household surveys conducted each year, so they had to work with the limited data that were available at that time.

Framework of Analysis and Estimation Technique

Framework of Analysis

There are different channels through which income inequality affects growth rates. Kaldor (1957) suggests that marginal propensity to save of the rich is higher than that of the poor, implying that that a higher degree of inequality will yield higher aggregate savings, higher capital accumulation and growth**.** In contrast, Persson and Tabellini (1994) and Alsenia and Rodrick (1994) emphasize the four main channels through which income inequality lowers growth rates. First, the impact of inequality on encouraging rent-seeking activities that reduce the security of property rights; second, unequal societies face more difficulties in collective action--possibly reflected in political instability, a propensity for populist redistributive policies, or greater volatility in policies--all of which can lower growth; third, the median voter in a more unequal society is relatively poorer and favours a higher (and thus more inefficient) tax burden; fourth, to the extent that inequality in income or assets coexists with imperfect credit markets, poorer people may be unable to invest in their human and physical capital, with adverse consequences for long-run growth.

Galor and Zeira (1993) and Fisherman and Simhon (2002) found that under imperfect capital market, a higher inequality means more individuals facing credit constraints. Consequently, they cannot carry out productive investments in physical or human capital. These can take place in the short run or long run. Second, a worsening

inequality generates a rise in the fertility rate among, and less investment in human capital of the poor.

Galor's (2000) argues that the classical approach holds at low-income levels but not at later stages of development. In the early stage of development, inequality would promote growth because physical capital is scarce at this stage and its accumulation requires saving. Inequality in income would then result in higher savings and rapid growth. In later stages of economic development, however, as the return to human capital increases owing to capital-skill complementarily, human capital becomes the main engine of growth. Credit constraints, however, become less binding as wages increase, and the adverse effect of income inequality on human capital accumulation subsides, and thus the effect of inequality on the growth process becomes insignificant.

Galor and Weil (1999, 2000) who developed unified models that encompasses the transition between three distinct regimes that have characterized the process of economic development: the Malthusian Regime, the Post-Malthusian Regime, and the Modern Growth Regime, focusing on the historical evolution of the relationship between population growth, technological change, and economic growth.

Galor and Moav (1999) argue that inequality has a positive effect on capital accumulation but negative effect on human capital accumulation in the presence of credit constraints. In the early stages of development physical capital is scarce, the rate of return to human capital is lower than the return on physical capital and the process of further development is driven mainly by capital accumulation. In the early stages of development, the positive effect of inequality on aggregate saving more than offsets the negative effect on investment in human capital and, since the marginal propensity to save is an increasing function of the individual's wealth, inequality increases aggregate savings and capital accumulation, enhancing the process of development. In the later stages of development, however, the positive effect of inequality on saving is offset by the negative effect on investment in human capital.

Based on theoretical literature on economic inequalities and some other potential factors that determine economic growth, we develop the following model, which is also in lines with Garbis (2005).

$$GR_{i,t} = \beta_1 GINI_{i,t} + \beta_2 y_{i,t-1} + \beta_3 INV_{i,t} + \beta_{54} SCH + \beta_5 TRADE_{i,t} + \mu_t + \eta_i + \varepsilon_{i,t} \quad (1)$$

Where,

GR = average growth rate of per capita GDP at 1993 prices and PPP adjusted;
$GINI$ = gini index in the current period;
$y_{i,t-1}$ = natural logarithm at the beginning of the period of per capita GDP in dollars at 1993 prices and PPP adjusted;
$INV_{i,t}$ = share of gross capital formation in GDP;

$SCH_{i,t}$ = secondary school enrolment rate (in percent of the total secondary school aged population). This variable is used as a proxy to human capital;
$TRADE$ = it is the summation of exports and imports as a share of real GDP;
η_i = it is a country-specific unobservable effect;
μ_t = it is a time-specific factor; and
ε_{it} = it is the disturbance term.

Time series analysis of panel data

The theoretical models presented above predict steady-state equilibrium relations, or stationary distributions, that may exist between income inequality and the evolution of output. The estimation of these theoretical stationary distributions requires that we know the time series features of the variables in the model. Many models also assume that income distribution and economic development are determined endogenously, which has to be taken into account in the estimation.[6]

Data

The Income inequality data may not be comparable across countries due to differences in definitions and methodologies. We use Gini coefficient to measure income inequality, which is one of the most popular representations of income inequality. It is based on Lorenz Curve, which plots the share of population against the share of income received and has a minimum value of 0 (case of perfect equality) and maximum value of 1 (perfect inequality). Missing values in Income inequality data are the major problem in cross country analysis. Many of developing countries have only one or two observations. Therefore, we expanded the existing database by including the comparable data on poverty and inequality from recent household surveys included in World Bank, IMF Staff reports and Poverty Reduction Strategy Papers. However, perfect comparability is not attainable. World Bank data on inequality and poverty has still had many problems. The questionnaires used in household surveys differ among countries and also with in countries over time leading to significantly different estimates of average income and consumption. Some surveys obtain information on income of household while others obtain information on consumption. More than half of the observations based on expenditure survey are considered to be more accurate than observations based on income of household because they are likely to have less errors of under-reporting. Data on expenditures also yield lower estimates of inequality due to higher saving rates of upper income class. There are also significant methodological differences across surveys in different countries but there has been no solution to solve these problems. There are also problems in converting nominal terms.

To make the data more comparable, we take data on variables in the form of averages between two survey years. Per capita real GDP growth rates are annual averages between two survey years. To find per capita real GDP growth rates, we subtract value in current year from the value in the previous year and then divide it by the value in the previous year. We use the same formula to find the previous year's growth rate and then took the average of the growth rates of two consecutive periods. The data on real GDP are derived from the IMF and the International Financial Statistics database.

To measure trade openness, we add exports and imports and then divide it by gross domestic product. Data on imports and exports are the annual averages between two survey years. Data on exports and imports are derived from IFS database. Population growth rates are taken from the World Bank development reports. The secondary school enrolment is at the beginning of the period and derived from World Bank database. Data on the ratio of government expenditure and investment as shares of GDP are averages for the period between two survey years and come from the IFS.[7] The data set includes countries 3 countries from North Africa (Tunisia, Algeria, Morocco and Egypt) over the period 1970-2007.

Unit root testing

To test for the presence of unit roots on panel data, we use the Im, Pesaran and Shin (2003) –IPS thereafter-. IPS using the likelihood framework, suggest a new more flexible and computationally simple unit root testing procedure for panels (which is referred as *t – bar* statistic), that allows for simultaneous stationary and non-stationary series. Moreover, this test allows for residual serial correlation and heterogeneity of the dynamics and error variances across groups. The IPS test is based on the estimation of the following equation:

$$\Delta y_{i,t} = \rho_i y_{i,t-1} + \alpha_{m,i} d_{m,t} + \sum_{j=1}^{p_i} \lambda_{i,j} \Delta y_{i,t-j} + \varepsilon_{i,t}, \quad t = 1,...,T, \quad i = 1,...,N \tag{2}$$

where T is the number of observations over time, N denotes the number of individual members in the panel and $d_{m,t}$ contains deterministic variables. The null hypothesis is defined as $H_0 : \rho_i = 0$ for all $i = 1,..., N$ and the alternative hypothesis is $H_a : \rho_i < 0$ for $i = 1,..., N_1$ and $\rho_i = 0$ for $i = N_1 + 1,..., N$, with $0 < N_1 \leq N$ that allows for some (but not all) of individual series to have unit roots.

IPS (2003) compute separate unit root test for the N cross-section units and define their *t – bar* statistic as a simple average of the individual ADF statistics, t_{iT}, for the null as: $t - bar = (1/N)\sum_{i=1}^{N} t_{iT}$. IPS (2003) assume that t_{iT} are i.i.d. and have finite mean and variance.

Therefore, the standardized $t-bar_{N,T}$ statistic converges to a standard normal distribution as $N \rightarrow \infty$ under the null hypothesis. In order to propose a standardization of the $t-bar_{N,T}$ statistic, the values of the mean and the variance have been computed via Monte Carlo methods for different values of T and p_i 's and tabulated by IPS (2003). The results of each one of our five variables are reported in table 1, where all the tests have a unit root under the null hypothesis.

Table 1. Panel unit root tests of IPS

Variables in levels			Variables in first differences	
	Constant	Constant with trend	constant	Constant with trend
Per capita GDP	3.22	2.02	-3.21***	-3.15***
Gini index	3.6	2.1	-3.22***	-3.75***
Trade	1.52	-0.74	-4.25***	-4.52***
Investment	-0.75	-0.4	-5.1***	-5.25***
Secondary School Enrol.	1.42	-0.62	-3.95***	-4.12***

Notes: * (resp.**,***): rejection of the null hypothesis at 10% (resp. 5%, 1%) significance level. Lags selected according to the SIC with a maximum lag length of 3.

As indicated in table1, the tests of panel unit root of according to IPS (2003) confirm that all variables are no stationary in levels but stationary in first differences. We now test for the existence of a long-run relationship between the income inequality and economic growth.

Cointegration tests

The possible cointegration between inequality and GDP is tested with panel cointegration test developed by Pedroni (1999, 2004). Pedroni proposes a residual-based test for the null of cointegration for dynamic panels with multiple regressors in which the short-run dynamics and the long-run slope coefficients are permitted to be heterogeneous across individuals. The test allows for individual heterogeneous fixed effects and trend terms and no exogeneity requirements are imposed on the regressors on the cointegrating regressions.

Specially, the tests ask for the residuals estimation from static cointegrating long-run relation for a time series panel of observables y_{it}:

$$y_{it} = \alpha_i + \delta_i t + \beta_{1,i} x_{1,it} + \beta_{2,i} x_{2,it} + ... + \beta_{k,i} x_{k,it} + e_{it}, \quad t = 1,...,T, \quad i = 1,...,N \qquad (3)$$

where as usual T is the number of observations over time and N is the number of units in the panel. It is possible to interpret the model (3) as N different equations, each of which has K regressors. The variables y_{it} and x_{it} are assumed to be I(1), for

each member *i* of the panel, and under the null of no cointegration the residual e_{it} will also be I(1). α_i and δ_i are scalars denoting fixed effects and unit-specific linear trend parameters, respectively and β_i are the cointegration slopes; note that all this coefficients are permitted to vary across individuals, so that considerable heterogeneity is allowed by this specification.

Pedroni considers the use of seven residual-based panel cointegration statistics, four based on pooling the data along the within-dimension (denoted 'panel cointegration statistics') and three based on pooling along the between-dimension (denoted 'group mean cointegration statistics').

Another distinction between the two sets of test is based on the alternative hypothesis specification. In fact, even if both sets of test verify the null hypothesis of no cointegration: $H_0 : \rho_i = 1 \ \forall i$ where ρ_i is the autoregressive coefficient of estimated residuals under the alternative hypothesis ($\hat{e}_{i,t} = \rho_i \hat{e}_{i,t-1} + v_{i,t}$), alternative hypothesis specification is different:

- the panel cointegration statistics impose a common coefficient under the alternative hypothesis which results: $H_a^w : \rho_i = \rho \prec 1 , \ \forall i$

- the group mean cointegration statistics allow for heterogeneous coefficients under the alternative hypothesis and it results: $H_a^b : \rho_i \prec 1 \quad \forall i$.

It is straightforward to observe that the first category of four statistics includes a type of non - parametric variance ratio statistic, a panel version of a non-parametric Phillips and Perron (1988) ρ-statistic, a non-parametric form of the average of the Phillips and Perron *t*-statistic and an ADF type *t*-statistic.

The second category of panel cointegration statistics is based on a group mean approach and includes a Phillips and Perron type ρ-statistic, a Phillips and Perron type *t*-statistic and an ADF type *t*-statistic. The comparative advantage of each of these statistics will depend on the underlying data-generating process.

After the calculation of the panel cointegration test statistics the appropriate mean and variance adjustment terms are applied, so that the test statistics are asymptotically standard normally distributed:

$$\frac{\chi_{N,T} - \mu\sqrt{N}}{\sqrt{v}} \Rightarrow N(0,1)$$

where $\chi_{N,T}$ is one of the seven statistics of Pedroni, μ and v are the functions of moments of the underlying Brownian motion functional. The appropriate mean and variance adjustment terms for different number of regressors and different panel cointegration test statistics are given in Table 2 in Pedroni (1999).[8]

Pedroni (2004) explored finite sample performances of the seven statistics. He showed that in terms of power all the proposed statistics do fairly well for T > 100. Moreover Pedroni's (1997) simulations showed that for small time span (T < 20), the between dimension (group t-statistic) is the most powerful.Given our relatively short

time span (T = 29), we will pay a particular attention to the group parametric-t statistic ($ADF - stat$) when testing for cointegration. The result of panel cointegration tests are displayed in table 2.

Table 2. Pedroni's panel cointegration tests

	Test Statistic	p-value
Panel cointegration tests		
$v - stat$	0.06	0.26
$rho - stat$	1.31	0.62
$PP - stat$	-0.12	0.31
$ADF - stat$	-2.36***	0.002
Group mean cointegration tests		
$rho - stat$	-4.25***	0.001
$PP - stat$	-1.06	0.12
$ADF - stat$	-2.12**	0.012

Notes: *(resp.**,***): rejection of the null hypothesis at the 10% (resp. 5%, 1%) significance level. Lags selected according to the SIC with a maximum lag length of 3.

Since simulations made by Pedroni (2004) show that, in small samples, the group-mean parametric-test is more powerful than the other tests, we can conclude that the null hypothesis of no cointegration is rejected in our study, and now turn to the estimation of the long run relationship between the income inequality and economic growth.

Estimation of the cointegrating coefficient of inequality

As revealed from panel unit root and cointegration tests, our series are integrated of order 1 and cointegrated. It is thus possible to proceed to the estimation of the long-run relationship (1). To this end, we rely on the Fully-Modified Ordinary Least Squares (FMOLS) methodology pioneered by Pedroni (1999, 2004). In this sense, the advantage of the FMOLS estimation procedure over other techniques such as the Pooled Mean Group (PMG) method proposed by Pesaran and al. (1999) and the Dynamic Ordinary Least Squares (DOLS) method developed by Kao and Chiang (2000) is that, while slope homogeneity is imposed, short-run heterogeneity is allowed for each member of the panel. The cointegration vector obtained is displayed in table 3.

Table 3. FMOLS estimates of the cointegrating coefficient of inequality

Dependant variable : Growth rate of GDP per capita	
Initial GDP per capita	- 0.24***
Inequality (Gini index)	-0.03**
Trade	0.017*
Investment	0.08**
Secondary School Enrolment	0.016**
Countries	4
Years	1970-2007
Observations	152

Notes: t-stat in parentheses. *, ** and *** indicates significance at 10%, 5% and 1% respectively.

The panel regression results regarding **growth inequality** relationship given in Table 3 confirms the negative relationship between **growth** and **inequality** in North Africa economies. The cointegrating coefficient of inequality is negative and statistically significant at the 5% level when panel FMOLS estimator is used.

The initial GDP per capita coefficient is negative, meaning that the conditional convergence hypothesis is evidenced: holding constant other growth determinants, countries with lower GDP per capita tend to grow faster. The initial position of the economy is thus a significant determinant of growth, as recognised by the neoclassical theory. The investment in physical and human capital generates positive spillovers on growth. Trade openness also positively affects growth. Thus, the more countries are outward-oriented the more this contributes favorably to economic growth. These results are in line with those found by Barro (2000), Malinen (2009), and, more generally with the neoclassical approach according to which the positive impact of trade on growth is explained by comparative advantages, be they in resource endowment or differences in technology.

Conclusion

This study attempts to examine the empirical relationship between growth and income inequality for 4 countries of North Africa over the period 1970-2007. The results of this paper clearly indicate that the long-run growth elasticity of income inequality is negative and significant when panel FMOLS estimator is used. The results also show negative and highly significant relationship between **growth** and initial income per capita. Physical capital investment has positive effect on economic growth. The results also suggest that coefficients of openness to trade and human capital investment are positive and robustly significant indicating that both factors have strong impact on economic growth.

A pro-poor economic growth leading to a rapid and sustainable poverty reduction depends upon the interaction of a wide range of policy measures which are discussed as follows:

(a) A pro-poor growth strategy does not have to only focus on economic growth, but could also be combined with an active policy of income redistribution.

(b) The higher the level of both physical and human capital investment, the higher is the level of output per capita. A better-educated labour force can improve productivity and technological level in the economy, which have a long-run positive effect on **economic growth**. Therefore, government has to take the responsibility for building up human capital. Policies must be based on a sound understanding of the factors that govern household decisions about schooling and of the means by which subsidized services can lead to better outcomes for the poor.

(c) Governments must create an environment that is conducive to growth**.** Macroeconomic policy should aim at stability, and openness towards the rest of the world. For all these efforts to be effective, the government must develop good institutions, and provide good governance.

NOTES

[1] The trends of Economic growth and Income Inequalities in selected countries are shown in Appendix.

[2] Ravallion (1997), Dollar and Kraay (2001), Barro (2000), Deininger and Squire (1996), Deininger and Squire (1998) etc.

[3] Galor and Zeira (1993), Banerjee and Newman (1993), Aghion and Bolton (1997) and Persson and Tabellini (1994), King and Levine (1993), Galor (2000) etc.

[4] In modern less developed economies, it is possible that also human capital drives growth, if the capital and skill-biased technology is imported. In this case, the effect of inequality on growth would be mixed or negative (Galor and Moav 2004).

[5] Bénabou (2005) has actually suggested that endogeneity of income inequality in growth regressions is the primary reason for the observed controversy in empirical growth studies.

[6] Description of variables is shown in Appendix.

[7] This table contains the mean and variance values for the cases when there is no heterogeneous intercept, or when there is a heterogeneous intercept or/and a time trend in the heterogeneous regression equation. k is the number of regressors without taking the heterogeneous deterministic terms into account.

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Appendix

Definitions and Sources of Variables Used in Regression Analyses

Variable Name	Definitions and Sources
Per capita real GDP	Per capita real GDP **growth** rates are annual averages between two survey years and are derived from the IMF, WDI and International Financial Statistics (IFS) databases.
Gini Coefficient	It is a measure of income **inequality** based on Lorenz curve, which plots the share of population against the share of income received and has a minimum value of zero (reflecting perfect equality) and a maximum value of one(reflecting total **inequality**). The **inequality** data (Gini coefficient) are derived from World Bank data and the IMF staff reports and Poverty Reduction Strategy Papers (PRSPs).
Secondary School Enrolment	The secondary school enrolment as percent of age group is at the beginning of the period. It is used as a proxy of investment in human capital and derived from World Bank database.
Investment	Investments as shares of GDP are annual average for the period between two survey years and are derived from IFS.
Poverty	The poverty is defined as the percentage of population living on less than $1 a day at 1993 prices and adjusted for purchasing power parity. The sources of the poverty data are the World Bank and recent IMF country reports and PRSPs.
Trade Liberalization	It is the summation of exports and imports as a share of real GDP. Data on exports, imports and real GDP are in the form of annual averages between survey years.