



Income inequality-economic growth and non-linearity: a case of Pakistan

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Abstract

Purpose – The purpose of this paper is to investigate the relationship between income inequality and economic growth, both in linear and non-linear specifications.

Design/methodology/approach – The paper has employed annual time series data over the period of 1971 up to 2005. Autoregressive distributed lag model (ARDL) bounds testing approach has been used for cointegration and error correction model for short run behavior. Unit root problem is handled by the use of augmented Dickey-Fuller unit root test.

Findings – The analysis findings are sharply contrasted to the significant association between income inequality and economic growth found in 1994 by Alesina and Roderick and by Persson and Tabellini. The empirical evidence provides support for the existence of Kuznets inverted-U as well as inverted S-shaped curve in Pakistan.

Practical implications – This paper opens up new directions for policy-making authorities to equalize income distribution in the case of a small transition economy like Pakistan.

Originality/value – This paper convincingly argues that there is a need for case-by-case study on such a project in view of each country's unique characteristics. This paper makes a unique contribution to the literature with reference to Pakistan, being a pioneering attempt that employs ARDL cointegration approach.

Keywords Economic growth, Incomes policy, National economy, Pakistan

Paper type Research paper

I. Introduction

Economic growth and distribution of income or wealth inequality are two important issues, which are concerned with economic development. This territory is staked out by founding scholars. Smith (1976) discussed the first issue while Ricardo (1817) concerned with the second. Both topics were until neglected in the mainstream of macroeconomics. More than five decades ago, the relationship between economic growth and income inequality had captured the attention of the line of work in the world. 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,

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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)[1].

II. Literature review

Hypothesis of economic theories is that income inequality is associated negatively with economic growth. It can be divided into three categories. First, it is hypothesized by the political-economy approach that median voter supports the governmental policies which improve the access of resources from rich to poor individuals in developing economies with unequal income distribution (Alesina and Roderick, 1994; Persson and Tabellini, 1994). Redistributive policies affect economic decisions adversely by adopting tax-promoting activities. So in resulting, increase in income inequality lowers economic growth.

Second, economic growth is declined by income inequality because of social conflict within societies (Alesina and Perotti, 1994; Benhabib and Rustichini, 1996). This promotes crimes and unlawful activities which threatens investment and property rights. Moreover, Knack and Keefer (2000) seem to link social capital (trust and civic norms) with economic growth. Further they argue that, in polarized societies, individuals have different backgrounds (cultural and ethical) and mutual expectations about their behaviors. In this manner, it is difficult for them to take decisions about self-enforcing agreements. Finally, in imperfect capital market hypothesis, income inequality is linked with low access to credit for the lower classes that creates obstacles for them to invest in physical and human capital (Banerjee and Newman, 1993; Aghion and Bolton, 1992).

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 sectoral distribution of labor force (Ahluwalia, 1976; Crenshaw, 1992; Gupta and Singh, 1984; Kuznets, 1955, 1963; Paukert, 1973; Robinson, 1976; Weede and Tiefenbach, 1981b). It is also documented that social and political variables such as differential access to education is main cause of income inequality (Adelman and Morris, 1973; Chenery and Syrquin, 1975; Ahluwalia, 1976; Meyer, 1977; Stewart, 1978; Milner, 1987; Simpson, 1990; although challenged by Bollen and Jackman, 1985; Jackman, 1974; Rubinson and Quinlan, 1977; Weede and Tiefenbach, 1981b). Some argue that economic dependency is also responsible for income inequality in the society (Crenshaw, 1992; Simpson, 1990; Weede and Kummer, 1985; Weede and Tiefenbach, 1981a; Bornschieer and Chase-Dunn, 1985; Bollen and Jackman, 1985; Bornschieer, 1983; Evans and Timeberlake, 1980; Weede, 1980; Bornschieer and Ballmer-Cao, 1979; Robinson, 1976; Chase-Dunn, 1975)[2].

The investigation of relationship between growth and inequality is one of the recent routs that have followed to study the evolution of income distribution. This analysis has reviewed old issue such as Kuznets' (1955, 1963) inverted-U hypothesis contributing to recent discussions like the pattern of income distribution during the age of globalization (Adelman and Morris, 1973; Paukert, 1973; Ahluwalia, 1976; Ahluwalia *et al.*, 1979;

Aghion and Bolton, 1992; Anand and Kanbur, 1993; Aghion *et al.*, 1998)[3]. Some other studies follow the traditional work and focus on the question whether high inequality stimulates the economic growth. This hypothesis has been investigated by Anand and Kanbur (1993), Alesina and Roderick (1994), Persson and Tabellini (1994) and Perotti (1996). They have found a negative relationship between economic growth and income inequality. Different interpretations are documented for this relationship including the political economy; consequences of inequality (Alesina and Roderick, 1994). Inequality may spoil education (Galore and Zeira, 1993), and inequality in natural resources (Gylfason and Zoega, 2003). Barro (2000) finds inverse correlation between inequality in income and economic growth in the case of poor countries, but a positive relationship for rich economies. Peñalosa and Turnovsky (2004) conclude in their study that if capital endowments are unequally distributed than labor endowments then any structural change raises the relative return to capital. The improved return on capital pushes the income distribution towards more inequality in the society. This tends to induce a positive relationship between distribution of income and economic growth[4].

In contrast some studies, which support the inverted U-curve, use cross-country evidence in the absence of adequate longitudinal data on income distribution (Bourguignon, 1994; Milanovic, 1995; Jha, 1996; Doyle, 1996). However, it has been contented that this approach does not make appropriate conclusions as it does not deal with inter temporal relationships (Deininger and Squire, 1998; De Gregorio and Lee, 2002). Most of the studies have adopted a panel data approach by using Deininger and Squire (1996) data set and have obtained different conclusions on the growth – inequality relationship (Ram, 1997; Barro, 2000; Forbes, 2000; Wan, 2002; Eicher and Stephen, 2003). The panel data studies show an overall inverted-U relationship between income inequality and economic growth at different levels of development, giving weak evidence of the presence of local maximum over the long run. But time series investigation shows diverse pattern but generally illustrating that the majority of countries capture minimum turning point in different years along the whole period and other countries display a negative trend or systematic relationship (Anand and Kanbur, 1993; Bruno *et al.*, 1998; Kim, 1997; Li *et al.*, 1998; Lipton, 1997; Ravallion, 1995; Doyle, 1996).

While time series suggest that rising income inequality is likely to decline at higher levels of per capita gross domestic product (GDP) as a few countries achieve a maximum turning point after mid-1990s[5]. For instance, Furquim and Garcia (2002) overview the literature linked to relationship between income inequality and economic growth based on neoclassical approach for economic growth. This rapport is investigated for 17 Latin American countries over 1970-1995. Their exercise indicates positive link between GDP per capita growth and income inequality and also prove the Kuznets hypothesis. Gelan and Price (2003) estimate an explicit Kuznets-type association between growth (skilled and unskilled labor are determinants of growth) and income inequality. The empirical evidence seems to suggest that sub-Saharan African economies are dualistic and situated on the segment of Kuznets' curve where income inequality is positively associated with economic development.

Furthermore, Banerjee and Duflo (2003) also conclude that in political economy, inverted U-shaped curve exists. Mora (2004) investigates the relationship between economic growth and inequality in income for European region. He puts forward that empirical exercise indicates the existence of a fractional Kuznets convergence process. This means that economic growth tends to reduce disparities, in instead of the reverse

effect exerted by regional funds. Bengoa-Calvo and Sánchez-Robles (2005b) test to test the theoretical and empirical link between economic growth and income inequality using data from 1975 up to 1995 for representative sample of Latin-American countries. Their findings show quadratic association for said variables. Furthermore, they suggest in focusing on investment in infrastructure especially in less-advanced economies. This is absolutely necessary to obtain the “social capacity” for the stimulation of economic growth rate.

Similarly, Bengoa-Calvo and Sánchez-Robles (2005a) tend to examine the connection between growth and inequality for Latin American Countries. Their results posit that impact of income inequality on economic growth may be different at different stages of economic development. Moreover, Nahum (2005) checks the impact of inequality on growth for Swedish countries. He seems to find optimistic impact on economic growth of income inequality. Heyse (2006) reevaluates growth-inequality nexus for developing economies. It is posited that developing countries with high-income inequality are not associated with less economic growth as compared to those developing economies where income distribution is more equal. Further, he puts forward that 0.3 percent rise in economic growth is linked with 1 percent increase in income inequality over the next five years. Malinen (2008) re-estimates long-run association between income distribution and economic growth for Latin American Countries. The results indicate that income inequality is inversely linked with economic development in majority of countries, but association is also positive for some countries of sample. It is also observed that the controversial findings made on the short-/medium term for said variable may be due to heterogeneity. In case country studies, Wan *et al.* (2006) investigate the alliance between income inequality and growth in post-reform by the application of polynomial inverse lag framework for China. It is found that link for inequality in income and economic growth is non-linear and inverse irrespective of time horizons. Bahmani-Oskooee and Gelan (2007) find that economic growth favors income inequality in short span of time but improves income distribution in long run for the USA. Their results also support for inverted U-shape hypothesis.

Some researchers explore relationship between economic growth and income inequality to state level of the country. For example, Rangel *et al.* (2002) test the impact on economic growth of income inequality for the case of Brazilian cities in minimum comparable area. They check non-linear or inverted U-shaped phenomenon for these variables. Several regressions are estimated using socio-economic variables to observe said link between inequality and per capita income growth over the time period, i.e. 1991-2001. The empirical evidence shows that the inverted U-shaped curve is the best functional specification to signify the relation between inequality and economic growth. Akaike information criterion (AIC) has been used to verify the results. Panniza (2002) examines link between income inequality and economic growth for the USA. He uses data of 48 states from 1940 to 1980 with fixed effect generalized movements method technique. The empirical findings confirm that increase in per capita income equalizes income distribution in the USA but the relation between income inequality and growth is not robust. Frank (2002) re-examines the impact of income inequality on economic growth in US states. The results show negative relationship between income inequality and economic growth but this negative link to be higher in low-income states. Moreover, monotonous or non-linear association is also checked and concluded that the estimates are relatively robust to alternative estimation approaches including

additional supporting variables. Cañadas (2008) uses Partridge (2005) framework for the investigation of inequality within income inequality. The income growth of different quintiles has been related to economic growth for each province for the case of Argentina. He seems to employ two models: first is the spatial lag model and latter is spatial error model. It is concluded on the basis of their findings that income inequality in one province and inequality in other neighboring provinces is inversely correlated with the economic growth of all provinces in Argentina.

Some studies assumed in their models that economic growth is the consequence of investment in physical capital while others put the emphasis on education, or public education specifically. These entire models suggest that causality runs from redistribution to growth rather than GDP per capita to income inequality. Alesina and Roderick (1994) suggest that, government revenue from taxation must be spent on productive services. It means that pretax marginal product of capital decreases as the tax rate increases. However, private agents can lower an appropriate fraction of it, so that these opposite effects may explain the inverted U-shaped relationship between taxes and economic growth. In contrast, Persson and Tabellini's (1994) argue that tax revenues are only used for redistributive purposes. A high tax rate depresses the after-tax return to private investment and hence economic growth. In such circumstance, income inequality is negatively correlated with subsequent growth.

While Saint-Paul and Verdier (1993) and Amparo and Domenech (2002) suggest that taxes are only used for public education is the main determinant of growth. So, there is a positive association between economic growth and public expenditures on education and at the same time the income distribution becomes more equal. Furthermore, Perotti (1996) posits that economic growth is a consequence of private investment in education but it creates gap between rich and poor segments of population. In the former, since the relative cost of higher education decreases with per capita income, only the upper income class can potentially invest in human capital. But to bring about such an investment, the median voter has implemented a smaller redistribution than he would normally find optimal. This is likely to occur only if middle class is not too distant from the high-income group. Vanhoudt (2000) documents that higher investment shares in physical capital and growth of population are linked to improve income distribution in industrialized economies but not for less-developed countries.

In rich economies, on the contrary, high growth will exist only if the low-income class also invests in education so that enough redistribution may take place in its favor. This happens only if the median voter, and as a consequence, the middle class, is not too much richer than the low-income class. It is clear that such a process may generate a Kuznets' inverted U-curve[6]. Recently, some models have made an attempt to distinguish political participation, which depends solely on the education level, and human capital accumulation is the determinant of growth (Bourguignon and Verdier, 1996). Finally, remarks of Milanovic (1995) show the emphasis more on institutional constraints related to historical development such as the extent of regional inequality in per capita income or the importance of stat sector. The latter, for example, will tend to reduce income inequality because there exists, usually, less dispersion in wages in the public sector than in the private sector.

Recently, List and Gallet (1999) and Tribble (1996, 1999) have observed that the Kuznets' inverted U-curve is in fact an S-curve. This has been proved by consideration of panel data (pooled ordinary least squares (OLS), fixed effects, and random effects) and

time series data as well. It may be concluded that association between income inequality and economic growth is positively linked up to a critical level as economic activity continues. By incorporating cubic term of per capita income observed relation is termed as an S-curve neither it is neither Kuznets' U-shaped nor Kuznets' inverted U-shaped by Tribble (1996). The empirical results with statistically significant coefficients having low R^2 provided by Tribble (1996) support the Kuznets' hypothesis and it is termed as extension of the inverted U-shaped. It seems that the Kuznets' inverted U-curve is in fact an S-curve where first turning point shows the relationship between income inequality and economic growth with the change from agriculture sector to manufacturing sector (ATM). In contrast, second turning point indicates the structural change from manufacturing sector to services sector in the economy (MTS). Dawson (1997), Bound and Johnson (2000) and Fishlow (1995) have observed said relation through parabolic formation. On contrary, Tribble (1999) seems to argue that the Kuznets inverted U-curve is an incomplete picture of relationship between economic growth and income inequality during economic activity. He uses time series data for the USA to find out S-curve hypothesis and to reject Kuznets inverted U-shaped curve. Furthermore, he documents that the "S-curve has the traditional inverted U-curve at lower levels of development, but in contrast to the Kuznets, it shows increasing inequality for countries at higher levels of development". In case of India, Sinha (2004) finds S-curve relation between income inequality and economic growth (extended Kuznets' U-shaped hypothesis) for both periods, i.e. 1951-1998 and 1981-1998. Recently, Theyson (2008) also finds a same type of relation between income inequality and economic growth as recognized by List and Gallet (1999) and Tribble (1996, 1999).

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 Pakistan utilizing the long-time series data-set from 1971 to 2005. The present study deals with the investigation of association between economic growth and income inequality with the battery of determinants in short run as well in long run. For this purpose, advanced autoregressive distributed lag model (ARDL) technique employed to find out dynamic effects of its determinants on growth in long run and error correction model (ECM) for short-run dynamics. The remaining part of this part is designed as: Section III explains the Kuznets' specification while methodology and data in Section IV. Section V explains the empirical results and finally, the conclusion is in Section VI.

III. Model specification and Kuznets relation

Kuznets (1955) documents 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. Two equations are being modeled for this to check linear and non-linear relation for economic growth and income inequality:

$$\ln(\text{GINI}_t) = \beta_1 \ln \text{GDPC}_t + \alpha_0 + \varepsilon_t \quad (1)$$

$$\ln(\text{GINI}_t) = \beta_2 \ln \text{GDPC}_t + \beta_3 (\ln \text{GDPC}_t)^2 + \alpha_1 + \varepsilon_t \quad (2)$$

where GINI is measure for income inequality proxies by Gini-coefficient and economic growth is by GDPC (GDP per capita). In equation (2) $\beta_2 > 0$ and $\beta_3 < 0$ ($|\beta_2| > |\beta_3|$) is usually expected in testing for the Kuznets inverted U-curve. It may be suggested that in equations (1) and (2) the error term is normally distributed satisfying the standard

assumption, i.e. i.i.d. $\sim (0, \delta^2)$. If the assumption of zero serial correlation is not satisfied then standard errors of the estimates are biased. This makes the empirical results inefficient. In this manner, usually AR(1) procedure is applied to models following Baltagi and Wu (1999) modified form of equation is given as:

$$\ln(\text{GINI}_t) = \beta_1^* \ln \text{GDPC}_t + \alpha_0^* + \varepsilon_t \quad (3)$$

where $\varepsilon_t = \rho\varepsilon_{t-1} + \eta_t$ and equation (2) is modified as:

$$\ln(\text{GINI}_t) = \beta_2^* \ln \text{GDPC}_t + \beta_3^* (\ln \text{GDPC}_t)^2 + \alpha_1^* + \varepsilon_{it} \quad (4)$$

where $\varepsilon_t = \rho\varepsilon_{t-1} + \eta_t$

where ρ is a coefficient of correlation among $(\varepsilon_t - \varepsilon_{t-1})$ and η_t is again conventional white noise satisfying the i.i.d. $\sim (0, \delta^2)$ assumption.

The right side of tail of equation (4) shows turning point of income scale. This has been evidenced by support of Conceição and Galbraith (2001) conjecture. Furthermore, it is called the “augmented Kuznets hypothesis”. A second way to look at the serial correlation problem is more complicated. If serial correlation in residuals (ε_t) comes from another source, from some influence of omitted lagged dependant variables (LDVs), then not only standard errors of the estimates but also coefficient estimates could be biased. This is a reasonable notion that the current year’s income inequality may have some persistency in determining the future year’s income inequality. To address this problem, an LDV specification is adopted. Then equation (1) can be modified as:

$$\ln(\text{GINI}_t) = \gamma^* \ln(\text{GINI}_{t-1}) + \gamma_1^* \ln \text{GDPC}_t + \alpha_0^* + \varepsilon_t \quad (5)$$

However, this model is also under restrictions. To get unbiased and consistent estimates, the LDV [$\ln I_{t-1}$] should not be correlated with current error term. $E(\ln I_{t-1}) = 0$ and time dimension should be expected to infinity, which is particularly not feasible. Model (5) can be modified as:

$$\ln(\text{GINI}_t) - \ln(\text{GINI}_{t-1}) = \varphi^* [\ln(\text{GINI}_{t-1}) - \ln(\text{GINI}_{t-2})] + \varphi_1^* [\ln \text{GDPC}_t - \ln(\text{GDPC}_{t-1})] + \nu_t - \nu_{t-1} \quad (6)$$

The independent variable $\ln(\text{GDPC}_t)$ should be predetermined (weakly exogenous): $E(\ln Y_t, \varepsilon_i) = 0$ for $s \geq t$ and there should be no presence of second-order autocorrelation in the first-differenced residuals, where as first-order autocorrelation is allowed. So, final versions of linear model as in equation (7) and non-linear in equation (8):

$$\ln \text{GINI}_t = \partial_0 + \partial_1 \ln \text{GDPC}_t + \partial_s \text{CV} + \varepsilon_t \quad (7)$$

While:

$$\ln \text{GINI}_t = \lambda_0 + \lambda_1 \ln \text{GDPC}_t + \lambda_2 \ln \text{GDPC}_t^2 + \lambda_s \text{CV} + \mu_t \quad (8)$$

It is also discussed in empirical literature that in fact S-curve is an extended specification of Kuznets’ inverted U-shaped curve (List and Gallet, 1999; Tribble, 1996, 1999). To observe this phenomenon in the case of Pakistan cubic term of GDP per has been included instead of squared term[7]:

$$\ln \text{GINI}_t = \delta_0 + \delta_1 \ln \text{GDPC}_t + \delta_2 \ln \text{GDPC}_t^2 + \delta_3 \ln \text{GDPC}_t^3 + \delta_s \text{CV} + \eta_t \quad (9)$$

where “GDPC” indicate GDP per capita measure for economic growth and “GINI” is inequality measure while CV represents the control variable in the model which are like as foreign direct investment (FDI) as share of GDP (FDI), unemployment rate (UEMP), human resource development (HDI)[8], life expectance (LE), literacy rate (LR), remittances as share of GDP (REM) and urbanization (URB) as mentioned in equations (7)-(9). In shows log-transformation of time series data except UEMP and FDI as share of GDP and t stands for time period.

IV. Methodology framework and data

This paper employs advanced ARDL approach proposed by Pesaran and Shin (1999) and Pesaran *et al.* (1996, 2001). Recent research in social sciences has indicated that the ARDL approach to co-integration is more superior and has many advantages to other conventional cointegration approaches such as Engle and Granger (1987), Johansen and Juselius (1990) and Johansen (1991, 1992). First advantage of ARDL approach is that if variables are integrated at $I(0)$, $I(1)$ or $I(0)/I(1)$ then it is valid for cointegration. The estimation method under this approach is same to Wald or F -statistic in a generalized Dickey-Fuller type regression. This is simply used to check the significance of lagged levels of the variables which are considered in conditional unrestricted equilibrium ECM (Pesaran *et al.*, 2001). Second, ARDL is more dynamic and provides better results for small sample data set than traditional techniques in the economic literature.

This approach involves estimating the conditional error correction version of the ARDL model for variables under estimation. The equation of extended ARDL (p, q_1, q_2, \dots, q_k) is being modeled as given below (Pesaran and Pesaran, 1997; Pesaran *et al.*, 2001):

$$\alpha(L, p)y_t = \alpha_0 + \sum_{i=1}^k \beta_i(L, p)x_{it} + \lambda'w_t + \varepsilon_t \quad \forall t = 1, \dots, n \quad (10)$$

where:

$$\alpha(L, p) = 1 - \alpha_1 L - \alpha_2 L^2 - \dots - \alpha_p L^p$$

$$\beta_i(L, q_i) = \beta_{i0} + \beta_{i1} L + \beta_{i2} L^2 + \dots + \beta_{iq_i} L^{q_i} \quad \forall i = 1, 2, \dots, k$$

y_t is an independent variable, α_0 is the constant term, L is the lag operator such that $Ly = y_t - 1$, w_t is $s \times 1$ vector of deterministic variables such as intercept term, time trends, or exogenous variables with fixed lags.

The long-term elasticities are estimated by:

$$\phi_i = \frac{\hat{\beta}_i(1, \hat{q})}{\alpha(1, \hat{p})} = \frac{\hat{\beta}_{i0} + \hat{\beta}_{i1} + \dots + \hat{\beta}_{i\hat{q}}}{1 - \hat{\alpha}_1 - \hat{\alpha}_2 - \dots - \hat{\alpha}_p} \quad \forall i = 1, 2, \dots, k \quad (11)$$

where \hat{p} and $\hat{q}_i, i = 1, 2, \dots, k$ are the selected (estimated) values of \hat{p} and $\hat{q}_i, i = 1, 2, \dots, k$.

The long-run coefficients are estimated by:

$$\pi = \frac{\hat{\lambda}(\hat{p}, \hat{q}_1, \hat{q}_2, \dots, \hat{q}_k)}{1 - \hat{\alpha}_1 - \hat{\alpha}_2 - \dots - \hat{\alpha}_p} \quad (12)$$

where $\hat{\lambda}(\hat{p}, \hat{q}_1, \hat{q}_2, \dots, \hat{q}_k)$ denotes the OLS estimates of λ in the equation (11) for the selected ARDL model.

The ECM of the ARDL version ($\hat{p}, \hat{q}_1, \hat{q}_2, \dots, \hat{q}_k$) is being obtained from equation (11) in terms of lagged levels and the first difference of $y_t, x_{1t}, x_{2t}, \dots, x_{kt}$ and w_t :

$$\begin{aligned} \Delta y_t = & \Delta \alpha_0 - \alpha(1, \hat{p})EC_{t-1} + \sum_{i=1}^k \beta_{i0} \Delta x_{it} + \lambda' \Delta w_t - \sum_{j=1}^{\hat{p}-1} \alpha \cdot j \Delta y_{t-j} \\ & - \sum_{i=1}^k \sum_{j=1}^{\hat{q}_{i-1}} \beta_{ij} \Delta x_{i,t-j} + \varepsilon_t \end{aligned} \quad (13)$$

where ECM is the error correction model and it is defined as follows:

$$ECM_t = y_t - \alpha - \sum \hat{\beta}_i x_{it} - \lambda' w_t \quad (14)$$

x_t is the k -dimensional forcing variables which are not co-integrated among themselves. ε_t is a vector of stochastic error terms, with zero means and constant variance-covariance.

An error-correction term among co-integrated variables shows the changes in dependant variable. These changes are not only the function of both the levels of dis-equilibrium in the co-integration relationship but also in the other explanatory variables. This indicates the divergence in dependant variable from short span of time to long-run equilibrium relationship (Masih and Masih, 1997). In the second step, we estimate the coefficients both long- and short-run relationships from same equation. The ARDL approach involves two steps for estimating long-run relationship (Pesaran *et al.*, 2001). The first step is to investigate the existence of long-run relationship among all variables in the equation under estimation. The second step is to estimate the long- and short-run coefficients of the same equation. We run second step only if we find a long-run relationship in the first step (Narayan and Smyth, 2004). This study uses a more general formula of ECM with the both unrestricted intercept and trends (Pesaran *et al.*, 2001):

$$\Delta y_t = c_0 + c_1 t + \pi_{yy} y_{t-1} + \pi_{yx} x_{t-1} + \sum_{i=1}^{p-1} \psi'_i \Delta z_{t-1} + w' \Delta X_t + \mu_t \quad (15)$$

where $c_0 \neq 0$ and $c_1 \neq 0$. The Wald test (F -statistics) for the null hypothesis:

$$H_0^{\pi_{yy}} : \pi_{yy} = 0, \quad H_0^{\pi_{yx}} : \pi_{yx} = 0'$$

and alternative hypothesis:

$$H_1^{\pi_{yy}} : \pi_{yy} \neq 0, \quad H_1^{\pi_{yx}} : \pi_{yx} \neq 0'$$

Hence, the joint H_0 of the interest in above equation is given by:

$$H_0 = H_0^{\pi_{yy}} \cap H_0^{\pi_{yx,x}},$$

and alternative hypothesis is correspondingly stated as:

$$H_0 = H_1^{\pi_{yy}} \cap H_1^{\pi_{yx,x}}.$$

F -statistics' asymptotic distributions are non-standard having H_0 of no cointegration correlation among the variables either variables are integrated at $I(0)$ or $I(1)$, or mutually co-integrated. These are also called the assumptions of ARDL approach. Pesaran and Pesaran (1997) have generated two series of asymptotic critical values. First series is generated for $I(0)$ variables while second is for $I(1)$ variables. H_0 of no cointegration is rejected if the calculated of F -statistics is higher than the upper bound critical value. This leads to conclude that there exists steady state equilibrium among the variables. H_0 is accepted (no cointegration among variables) if calculated F -statistics is lower than the critical value of lower bound. The results are inconclusive if value of calculated F -statistics falls between the lower and upper critical values. In such case, ECM is appropriate approach to determine the cointegration (Kremers *et al.*, 1992; Banerjee *et al.*, 1998). In this case, following Kremers *et al.* (1992) and Banerjee *et al.* (1998), the error correction term will be a useful way of establishing cointegration.

Correlation descriptive in Table I explains bivariate-correlations among the variables, while theory intuition and expected signs are described in Table II. For data collection, World Development Indicators (WDI, 2008), *Economic Survey of Pakistan* (various issues) and annual reports by Social Policy and Development Centre have been combed. The data for real GDP per capita, FDI, urbanization and remittances have been obtained from world development indicators. Unemployment is from economic survey of Pakistan (various issues). Annual report by Social Policy and Development Centre has been used to collect data for Gini-coefficient proxy for income inequality, life expectancy, LR and human development index.

V. Empirical interpretations

Initially, order of integration of all variables has been determined by augmented Dickey-Fuller (ADF) test. This step is used just to ensure that no variable is integrated at $I(2)$ and to avoid spurious results. ARDL cointegration approach is based on assumption that either variables are integrated at $I(0)$ or $I(1)$. If any variable in model is integrated at $I(2)$ then ARDL approach for cointegration is not applicable. ADF test has been employed on each variable to find out the order of integration of variables. The lag length for the ADF test has selected to ensure that the residuals are white noise.

Results in Table III describing that GINI, GDPC, UEMP, HDI, LE, LR, URB, and REM are non-stationary at level or $I(0)$ while stationary at first difference or $I(1)$ as shown in Table III in third and fourth column. The test regressions have included both drift and trend in the investigation of order of integration of variables. This similarity of order of integration lends to support for the implementation of bounds testing. ARDL approach has three steps to estimate. In the first step, lag order is select on the basis of AIC because computation of F -statistics for cointegration is very much sensitive with lag length. So, lag order 2 is selected on the basis of lowest value of AIC (Table IV).

Variables	LGINI	LGDPG	FDI	UEMP	LHDI	LLE	LLR	LURB	LREM
Observation	35	35	35	35	35	35	35	35	35
Mean	3.5954	9.4557	0.5473	1.3899	-0.8313	4.0595	3.4999	3.3973	1.2010
Median	3.6076	9.4803	0.4219	1.3083	-0.8141	4.0690	3.5204	3.4037	1.5581
Maximum	3.7581	9.9942	1.9714	2.1126	-0.6033	4.1780	3.8856	3.5431	2.3608
Minimum	3.4134	8.9502	0.0094	0.5306	-1.0996	3.9239	3.0373	3.2265	-2.3382
Skewness	-0.2367	0.0675	1.1830	-0.1757	-0.2309	-0.2418	-0.2240	-0.1945	-1.5128
Kurtosis	1.8443	2.0540	4.1998	2.0596	1.7778	1.9165	1.9391	1.9456	5.5312
LGINI	1.0000								
LGDPG	0.9310	1.0000							
FDI	0.8100	0.7664	1.0000						
UEMP	0.9344	0.8729	0.7213	1.0000					
LHDI	0.9976	0.9247	0.8045	0.9257	1.0000				
LLE	0.9987	0.9328	0.8038	0.9347	0.9963	1.0000			
LLR	0.9980	0.9173	0.8034	0.9356	0.9960	0.9959	1.0000		
LURB	0.9984	0.9249	0.8038	0.9419	0.9964	0.9979	0.9988	1.0000	
LREM	0.3294	0.1131	0.1593	0.3639	0.3079	0.3393	0.3362	0.3414	1.0000

Table I.
Descriptive statistics and
correlation matrix

Variables	Theory intuition	Expected signs
GDPC	GDP per capita and GDP per capita squared capture the possible existence of a threshold effect in the relationship between income inequality and economic growth	±
FDI	The effect of FDI on the inequality is mixed in theory. On one hand, FDI leads to even income distribution in the long run by fostering economic growth in the leading sectors. On the other hand, inward FDI deteriorates income distribution by raising wages in the corresponding sectors in comparison with traditional sectors	±
UEMP	Unemployment is likely to have an inequality-increasing effect by pushing more people into the lower end of income distribution	+
HDI	It is worth mentioning that usually a higher level of human capital creation induces lower unemployment, which increases incomes of lower segments of population, and making income distribution more equal	-
LE	According to protagonists, one effect of equal distribution of income is to improve life expectancy. "Lower the income differences within population [...] the improve their health"	-
LR	Improvements in LR will have a beneficial impact on incomes of bottom population at expense of rich people	-
URB	There are contradictory assumptions about the influence of urbanization on income inequality. From one side, high-population density is associated with lower inequality, explaining it with better possibilities for advanced social organization in case of higher population density. On the other hand, higher population density and urbanization increase inequality: income inequality is usually higher in urban than in rural areas	±
REM	Increase in remittances may raise income inequality if rich individuals benefit from international migration at initial stages of migration. On contrary, income distribution is improved if poor individuals also move abroad for earnings	±

Table II.
Expected signs
of the variables

Variables	ADF test at level	Prob-value	ADF test first difference	Prob-value
LGINI	-0.9698	0.9348	-5.5903	0.0004
LGDPC	-2.6927	0.2459	-5.3076	0.0008
FDI	-2.7302	0.2318	-4.3155	0.0090
UEMP	-2.6857	0.2486	-3.6808	0.0390
LHDI	0.7452	0.9995	-3.7960	0.0304
LLE	-1.3809	0.8480	-8.3147	0.0000
LLR	-4.6728	0.0036	-8.12595	0.0000
LURB	-2.8101	0.2038	-4.8831	0.0044
LREM	-2.3730	0.3856	-3.2654	0.0903

Table III.
Unit-root estimation

When two lags are imposed, there is strong evidence for the cointegration because the calculated *F*-statistic is 9.841, which is greater than critical value of the upper level of the bound (i.e. 7.52) at the 1 percent level of significance. This result gives an indication for the existence of the long-run relationship among the variables. Given the existence of a long-run relationship, in the next, ARDL cointegration method is used to estimate

Table IV.
Lag length selection and
ARDL *F*-statistics

Order of lags	AIC	Schwartz Bayesian criteria	<i>F</i> -test statistics
1	-52.5318	-48.4504	6.996 ^a
2	-56.1164	-48.3617	9.841*
<i>Short-run diagnostic test-statistics</i>			
Serial correlation LM, <i>F</i> = 0.4492 (0.6450)			
Normality <i>J-B</i> value = 1.6117(0.4466)			
ARCH-test = 0.2114 (0.6489)			
Heteroscedasticity test, <i>F</i> = 1.6043 (0.2499)			
Ramsey RESET test, <i>F</i> = 5.1469 (0.0351)			

Notes: Significant at: *1 percent level; ^a*F*-statistics is also sensitive with lag length

the parameters of equation (1) with a maximum lag order that is 2 to avoid the loss of degrees of freedom. Selection of lag length is based on minimum value of AIC.

The long-run results of equation (1) based on AIC reported in column two of Table V along with their appropriate ARDL model. Results indicate that real GDP per capita is associated positively and significantly with income inequality, i.e. lower Gini-coefficient present with lower GDP per capita. Coefficient of human resource development seems to worsen the income inequality in the country. Unemployment, remittances, life expectancy, and FDI are also major contributors in income inequality to rise. Improvement in LR is positively associated with income inequality, i.e. more education creates more inequality in income. While local migration or urbanization improves distribution of income more equal and in resulting it lowers poverty in the country.

To investigate non-linear relationship between income inequality and economic growth (Kuznets hypothesis), squared term of GDP per capita has added in log-linear model.

Variables	Dependent Variable = LGINI					
	Coefficient	Prob-values	Coefficient	Prob-values	Coefficient	Prob-values
Constant	2.2658	0.0000	-1.1385	0.0135	-49.5796	0.0084
LGDPC	0.0263	0.0000	0.5699	0.0000	16.0417	0.0081
LGDPC ²	...	...	-0.0288	0.0000	-1.6615	0.0092
LGDPC ³	...	...	...	...	0.0573	0.0104
LHDI	0.2126	0.0049	0.0892	0.0111	0.1285	0.0022
UEMP	0.0070	0.0032	...	...	...	...
LURB	-0.6664	0.0010	...	...	...	...
LREM	0.0022	0.0000	0.0010	0.0398	...	...
LLR	0.3203	0.0004	0.2563	0.0000	0.2716	0.0000
LLE	0.5876	0.0079	0.2703	0.0000	0.1728	0.0711
FDI	0.0046	0.0000	0.0048	0.0002	0.0046	0.0002
<i>R</i> ² = 0.999555		<i>R</i> ² = 0.999788		<i>R</i> ² = 0.999804		
Adjusted <i>R</i> ² = 0.999418		Adjusted <i>R</i> ² = 0.999733		Adjusted <i>R</i> ² = 0.999753		
AIC = -8.9129		AIC = -9.7120		AIC = -9.7899		
Schwarz criterion = -8.5130		Schwarz criterion = -9.3565		Schwarz criterion = -9.4344		
<i>F</i> -statistics = 7304.204		<i>F</i> -statistics = 18209.26		<i>F</i> -statistics = 19684.25		
Prob. (<i>F</i> -statistics) = 0.000		Prob. (<i>F</i> -statistics) = 0.000		Prob. (<i>F</i> -statistics) = 0.000		
Durbin-Watson = 1.663		Durbin-Watson = 1.592		Durbin-Watson = 1.665		

Table V.
Estimated long-run
coefficients using the
ARDL approach

Empirical evidence supports for the existence of Kuznets inverted U-shaped curve in the case of Pakistan in long run as shown in Table V in column four. It is documented by List and Gallet (1999) and Tribble (1996, 1999) that the Kuznets' inverted U-curve is in fact an S-curve. This is checked through the inclusion of cubic term of GDP per capita in non-linear model (linear and squared terms of GDP per capita) as suggested by List and Gallet (1999) and Tribble (1996, 1999) that the Kuznets' inverted U-curve is in fact an S-curve. The results support the existence of inverted S-shaped curve against an S-shaped curve. This finding is similar as found by Theyson (2008)[9]. It is against with suggestion given by List and Gallet (1999) and Tribble (1996, 1999) that the Kuznets' inverted U-curve is in fact an S-curve where first turning point shows the relationship between income inequality and economic growth with the change from agriculture sector to manufacturing sector (ATM). In contrast, second turning point indicates the structural change from manufacturing sector to services sector in the economy (MTS). After the investigation of long-run relationships among the variables, to obtain the short dynamics of these variables, short-run version of ARDL is estimated and results are presented in Table VI.

The coefficient of ECM term shows speed of adjustment from short- to long-run equilibrium. The sign of ECM coefficient should be negative with high level of significance, i.e. significant at 1 percent level of significance. It is further proof of the existence of stable long-run relationship (Banerjee *et al.*, 1998). Indeed, it is argued that testing the significance of ECM_{t-1} , which is supposed to carry negative coefficient, is relatively more efficient way of establishing cointegration. The coefficient of ECM_{t-1} is equal to (- 0.4957) for short-run model, respectively. This implies the deviation from short run in income inequality is corrected by 49.57 percent over the each year in long

Variable	Coefficient	Dependent variable = $\Delta LGINI$ SD error	T-statistic	Prob-value
Constant	- 0.0012	0.0018	- 0.6652	0.5135
$\Delta LGDPC$	0.0184	0.0085	2.1626	0.0429
ΔFDI	0.0030	0.0011	2.6614	0.0150
ΔFDI_{t-1}	- 0.0015	0.0017	- 0.8865	0.3859
$\Delta LHDI$	0.0578	0.0650	0.8894	0.3843
ΔLLE	0.3539	0.0963	3.6737	0.0015
ΔLLE_{t-1}	0.1573	0.0511	3.0766	0.0060
ΔLLR	0.2253	0.0312	7.2095	0.0000
ΔLLR_{t-1}	0.1234	0.0399	3.0936	0.0057
$\Delta LREM$	- 0.0018	0.0008	- 2.0660	0.0520
$\Delta UEMP$	0.0030	0.0012	2.4620	0.0230
$\Delta LURB$	- 0.2249	0.2281	- 0.9862	0.3358
ECM_{t-1}	- 0.4957	0.1450	- 3.4168	0.0027

$$R^2 = 0.9325$$

$$\text{Adjusted } R^2 = 0.8921$$

$$AIC = - 10.3042$$

$$\text{Schwarz criterion} = - 9.7147$$

$$F\text{-statistic} = 23.053$$

$$\text{Prob. (F-statistic)} = 0.0000$$

$$\text{Durbin-Watson} = 1.692$$

Table VI.

Error correction
corresponding
to the ARDL
(1, 1,2,1,2,2,1,1 and 1)

span of time. The lag length of short-run version of ARDL model is selected on the basis of AIC.

Short-run dynamics results also indicate that inequality increases with the real GDP per capita means more GDP per capita caused more inequality in income. Similarly, increase in FDI is associated with worsening of income distribution but its lag has income inequality declining impact with insignificance. Impact of human resource development raises income inequality but insignificant. LR and life expectancy seem deteriorate income distribution. Improved situation of foreign remittances improves income distribution in short span of time. Unemployment is also increasing income inequality but its impact is minimal with significance. Finally, more local migration or urbanization means more general employment opportunities and activities improve the distribution of income among individuals but insignificant.

The regression for the underlying ARDL equation fits very well at $R^2 = 96.37$ percent and also passes the diagnostic tests against serial correlation, autoregressive conditional heteroskedasticity, white heteroskedasticity and normality of error term (Table IV). The cumulative sum (CUSUM) and cumulative sum of squared (CUSUMsq) tests are also conducted to check the stability of coefficients over the sample period in long run (Figures 1 and 2). It is argued by Brown *et al.* (1975) CUSUM test detects systematic changes from regression coefficients and CUSUMsq test tends to detect unexpected changes from constancy of regression coefficients.

Figure 1 shows that CUSUM statistics does not lie within the 5 percent confidence interval bands. This indicates the instability of parameters. Parameter instability is around the year 2000-2005 in cumulative test but not in cumulative squares test.

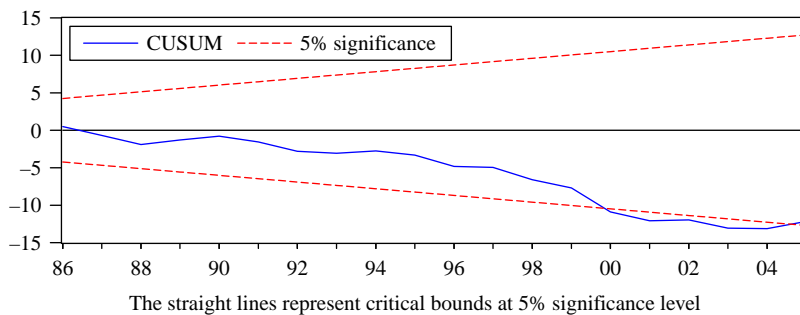


Figure 1.
Plot of CUSUM
of recursive residuals

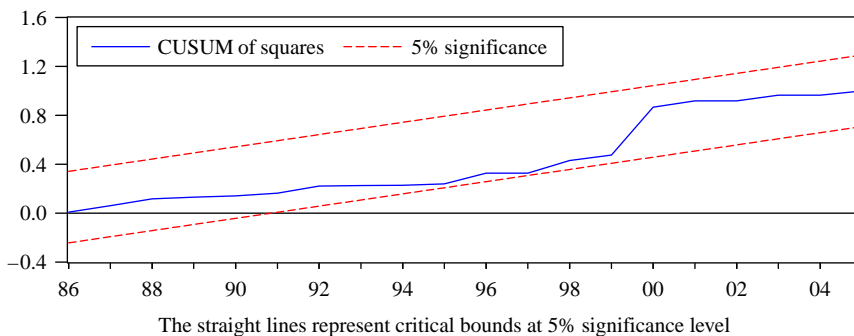


Figure 2.
Plot of CUSUMsq
of recursive residuals

The break point in the economy can be detected and linked to 9/11 in the USA as a major event that affected the economy of Pakistan.

Structural break point is checked through application of Chow forecast test in the economy for the period 2000-2005. *F*-statistics computed in Table VII that also indicates existence of structural break in the economy.

VI. Conclusion

In this paper, we shared the existing literature about inequality-growth nexus. Empirically, our baseline estimation and the sensitivity analysis have shown that inequality is positively, and very often even significantly, associated with economic growth both in short run and in long run. Our findings are contrast to the significant correlation between income inequality and economic growth that has been documented by Alesina and Roderick (1994) and by Persson and Tabellini (1994). Empirical exercise provides supports for the existence of Kuznets' inverted U-curve in Pakistan under the investigation of time series data. The extension of Kuznets' specification is conducted and results confirm the occurrence of inverted S-shaped curve.

Coefficients estimate of human resource development and unemployment seem to increase income inequality in the country. On contrary, local migration or urbanization improves income distribution in long run but insignificant in short span of time. Impact of remittances on income inequality is positive in long run but negative in short span of time. LR, life expectancy and FDI show income inequality increasing impact in the country.

In context of policy implication, a key message is from current study is that the one favoring evenhanded distribution of income should be preferred along with reductions in tax. Cutting taxes would encourage economic activity and consequently economic growth. The government should focus to make a policy to reduce income inequality at urban areas through the promotion of small and medium enterprises. Furthermore, government can also play its role to decline income inequality by the generation of self-employment schemes in urban areas.

The government should promote rural-urban migration that will increase the incomes of poor individuals residing in rural areas and in resulting, improve their living standard. Moreover, the absorption of new migrants without declining the wages in urban areas will increase supply to urban regions. This will perk up the incomes of rural residents by improving their terms of trade. In such a situation, migrants will be able to buy land in their localities. There is low income in rural areas because major population living in rural regions is busy in agriculture sector at low wages. If government wants to improve income distribution then rural areas should be given priority on equal footings.

There is need of impending comprehensive policy to decline income inequality and reduce poverty in the country. The equal distribution of national income can handle the problem of high-income inequality and poverty. To reduce poverty and improve income distribution, there is need to allocate much finance to improve education and health facilities.

Chow forecast test: forecast from 2000 to 2005

Table VII.	<i>F</i> -statistic	2.582415	Probability	0.067344
Chow forecast test	Log likelihood ratio	24.58983	Probability	0.000407

Encouraging international migration may increase the economic development in less-developed areas or region of the country, which will improve the income distribution and lessen the poverty. A higher development of financial institutions and markets will allow an easier and cheaper transmission of migrants' remittances. Lower transactional cost will also allow local recipients or households to receive remittances, compared to how long they would have to wait if financial markets are less developed. Therefore, financial sector should regulate its institutions and markets to launch such policies to provide some particular incentives for remittance senders through proper formal banking system and prudential policies generally. More earnings by migrants' from abroad means national savings which is a pre-requisite for development process and economic growth.

Foreign investors are potential source of fiscal revenues for host country; in the case of Pakistan the fiscal revenues generated from foreign investors can in turn support economic and social development through increased public investment. However, much of this revenue is often foregone through overly generous incentive policies; and so, it is important for policy makers to balance their desire to attract and keep foreign investment through incentive policies with the need to maximize the fiscal revenue. FDI can make crucial contribution in sustained economic development and improve income distribution by provision of infrastructure services in particular.

How much FDI reduces poverty in the host country depends upon the nature of government policies and the effects of investment activities. These should be government attempts which direct the FDI to highly productive projects to reduce poverty in the country. The attempts must include macroeconomic and political stability, stipulation of sufficient property rights, transparency in accounting system and audit, and adequate skilled labor force. In such an environment, development and sound financial sector can contribute significantly in the process of economic development and in poverty reduction.

Notes

1. There is a positive relationship between income inequality and economic growth according to classical theories. Bell and Freeman (2001) find that greater inequality is associated with higher returns on working hours. Furthermore, Siebert (1998) seems to link income inequality to growth-promoting factors such as entrepreneurship, innovation, and risk taking. In contrast, Barro (2000) documents that economic growth is negatively linked with income inequality in developing countries while inequality in income seems to promote economic growth in developed world.
2. Dollar and Kraay (2002) document that growth is good for poor if economic policies are pro-poor.
3. To test for the Kuznets hypothesis, various kinds of functional specifications have been used in many empirical studies (for more details, see Deutsch and Silber, 2000).
4. The difference between vertical and horizontal inequality is that first refers to inequalities between individuals while latter refers to inequalities between groups that may be based on gender, ethnicity, caste or age. The vertical inequality is different from horizontal inequality on basis of its recommendations. If distribution of income does not seem to change, then only growth can influence the poverty. Without growth, poverty can be reduced through improved income distribution in the country.

5. There is an additional strand of high-income country inequality literature that focuses on the affects of wage-setting intuitions as shaping the relative labor supply/demand effects on inequality.
6. Even in the spirit of Kuznets (1955), there is no theoretical or empirical ground for one to confine to linear models. Thus, different forms of nonlinear functions will be proposed and estimated. Comparisons with the linear models will be undertaken. The experiment with nonlinear models in this paper is a valuable addition to the literature as both developed and developing countries are believed to possess inequality-growth curves with multiple turning points (Atkinson, 1999, Ikemoto and Uehara, 2000).
7. For model specification, see List and Gallet (1999), Tribble (1996, 1999), Sinha (2004), Angeles-Castro (2006) and Theyson (2008).
8. It is basically a human development index.
9. He explains that this type of relation is due to low frequency of data as used by List and Gallet (1999) and Tribble (1996, 1999).

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