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Can Piketty's Interest Rate – Growth Rate Framework Explain Increasing Income Inequality in Pakistan?

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Abstract
Inequality in income distribution has important ramifications for economic growth, development, and social justice (see Atkinson (2000), Piketty (2013), Milanovic (2016), etc.). Piketty (2013) explains the phenomena of growing income inequality in high-income countries by comparing the interest rates (r) and growth rates (g) over time. The crux of the argument is that since the upper income groups generate a significantly greater proportion of their income from investments as compared to lower income groups (due to higher savings rate compared to lower income group), interest rates performing better than the national income growth rates in the high-income countries in the post-cold war era (r-g) explain growing income inequality in these countries. This paper examines the use of this methodology to explain income inequality in Pakistan. It compares the evolution of income of the top 20 percent of Pakistan's population with the income of the bottom 20 percent, using Piketty's lens of interest rate growth rate dynamics. Empirical results show that r-g methodology does not capture the income distribution dynamics of Pakistan. Upper income group appears to be negatively affected by increases in interest rates as compared to the lower income group. Prices, international trade, taxes, and financial development tend to be the leading reasons for reducing the impact of r and g framework to explain the income distribution. This paper makes novel contributions to the methodology and implications of Piketty's framework for studying income inequality in small, open, less developed countries like Pakistan.
Keywords: interest rate, growth rate, top 20 percent income, bottom 20 percent income

1. Introduction

Income inequality refers to a state when there is a difference in living standard among group of peoples. It is due to the uneven distribution of income among individuals/households (Atkinson and Morelli, 2010). This phenomenon is a concerned now a day by every nation and it is rich in research in contemporary literature. From the multiple reasons there are two main reasons for which income inequality is popular. They are:

- Income unrest creates social unrest. In 2009 there was an Occupy movement and its slogan was "We are the 99%" which refers to the concentration of wealth among the top 1% of income earners compared to the other 99 percent. Top 1% of income holders hold quarter income of the nation (Stiglitz, 2011).
- Economic side. As inequality effects total productivity. From the distribution of wealth economic output is affected.

From the classical point of view income inequality is good for the development of the economy. According to them with wealth marginal propensity to save increases and hence an increase in MPS will lead to the increase in aggregate savings and capital accumulation and thus the result will be economic growth according to Lewis (1954). In the context of Keynes *"the outstanding faults of the economic society in which we live are its failure to provide for full employment and its arbitrary and inequitable distribution of wealth and incomes"* (Keynes, 1936b). Fighting against inequality is the main roots for Keynes philosophy.

Simon Kuznets (1955) states a hypothesis that income inequality increases and then decreases as economy develops this make the inverted U-shape curve. Kuznets collected the data for three countries: UK, US and Germany. According to him distribution of income is becoming even in these countries as industrialization is taking place. In the process of growth there is a shift from agricultural sector to industrial sector. Low-income labors working in the agricultural sector migrate to urban areas. In this process when expected average income is achieved by the economy then inequality start decreasing.

His work was considered as one the influential work on growth and inequality (Moran, 2005). Many studies have been done supporting the Kuznets curve and confirming the relationship of income inequality and economic development as stated by Kuznets (Anand & Kanbur, 1993a) (Barro, 2000). Whereas, critics of Kuznets curve have argued that there is a more work needed to be done. East Asian is an example which shows that Kuznets curve theory is invalid where the manufacturing and exports sectors grew rapidly, life expectancy increases and population living in absolute poverty decrease. The development process in this case was conflicting to Kuznets curve theory. As for Kuznets theory quick capital accumulation will lead to an initial increase in inequality.

Kuznets himself admitted that the empirical basis of his work was weak. Different empirical studies have been taken place showing invalidity of Kuznets curve (Deininger & Squire, 1998) (Tam, 2008). Different peoples have given the different reasons for supporting or for criticizing Simon Kuznets work. Thomas Piketty is one of them who oppose Kuznets idea which in recent literature has given of the reasons for opposing the idea of Kuznets's U-shape curve.

Thomas Piketty (2014) in his book Capital in the Twenty-First Century has argued that how inequality rises comes from the relation: $r > g$. According to this formula the net rate of return to capital (r) exceeds the growth rate of output (g) (Piketty, Capital in the Twenty-First Century, 2014). Explaining this phenomenon by saying that economy is like a pie. "g" is the growth rate of pie. "r" is the interest rates which the economy pays for the use of capital to the people who own this capital. So in our analogy r is the slice of pie that is appropriated by the owners of capital.

- g>r: If the growth rate of output is more than the interest rate than the total pie will be increased. Speed of the growth of pie is more than the slice of the pie. Now wealth is now concentrated in more hands of the people.
- r>g If interest rate is more than the growth rate of output. Now the pie will not increase by the speed of slice. So distribution will become unequal and bigger share of the pie will go in the hands of capital class which means that rentiers are the winner of the game.

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Capitalist's class whom have higher capital income relatively will be able to accumulate wealth which will concentrate into the hands of small number of owners. Piketty referred this as how greater wealth can escalate returns on investment in an asset portfolio. Already greater volume of wealth will make it possible to invest in all kind of assets around the world which will increase the returns on investment. An individual who owns lower wealth have limited opportunities and uses the traditional financial method for the investment and hence receive lower return. In Piketty's point of view inequality is a central property of capitalism. Richest individuals are more powerful and gain opportunities from economic and political perspective. This should be corrected by imposing higher taxes on top income earners and government should adopt redistributive measures (Lyubimov, 2017; Ali, 2018; Ali and Audi, 2016; Ullah and Ali, 2024).

In Pakistan, extreme inequalities have been seen. According to one of the report only 22 individuals in Pakistan possess the billions of reserves and wealth and the rest of the population lives their life in poverty and hunger (Talpur, 2017). Data from the Household Integrated Economic Survey have been collected for the periods when Pakistan economy was expanding between 2002 and 2006, when the economy was tapering off between 2006 and 2008, when the economy is slowed down between 2008 and 2011. In every phase it was seen that top quintile incomes holder of urban households income is increasing and bottom quintile income earners of rural areas income is decreasing (Tirmizi, 2012; Andreou, 2021; Karim and Said, 2024; Aydemir, 2024). It has been discovered that there are various root causes for which income inequality is increasing in Pakistan. Inflation which is an important variable in fiscal stabilization plays a negative role in income distribution. Two digit inflation rates are deteriorating income distribution and enlarging the gap between rich and poor (Rashid et al. 2015). In this paper effect of inflation will be seen on both groups that is top 20 income holders and bottom 20 income holders. Piketty (2014) suggested that government should use tax policy against rising inequality. In this paper tax to GDP ratio is used to see the impact on income inequality. Till 1988 Pakistan tax incidence was higher for the rich class but now under the Structural Adjustment and Stabilization Program the tax burden have been increased on the poor and producers have been benefited. Malik and Saqib (1985) have suggested that through tax system resources of the economy should be evenly distributed which will significantly remove the gap between both groups.

Another tool with which income distribution can be made even is the government expenditures. There are number of literatures which indicate that government spending plays a positive role in redistributing the resources evenly among the nation (Evelyne, 1995). But in Pakistan the rising income inequality shows that government is fail in attempt to design the policies regarding income distribution and the government spending is not significantly working to upgrade the level of bottom income holders (Naz, 2015). The next variable in the model which is also used for the purpose to see the allocation of resources are evenly distributed among the ones who have and who have not. If gains from trade are allocated properly then it will contribute in economic growth and will reduce income inequality. According to one of the study it is concluded that trade may benefits the nation on a whole but can hurts a group of people at least in short run (Krugman & Obstfeld, 2003).

As in this study growth variable is used to check the methodology given by Piketty (2014) and simultaneously it is also used to analyze its impact on income distribution that whether economic growth increases the prosperity for only rich one or for the both. Kuznets (1955) stated the phenomena of trickle down in which benefits from rich are transferred to the poor ones too. This becomes invalid when different studies have been conducted and found that economic growth is purely a pro-rich. When economic development takes place share of top income earners also increases. While the bottom income earners loose out (Waldenstrom, 2009).

The study has also analyzed the impact of interest rate on both groups. Discount rate has been taken as the proxy for this. Both groups will face different impact of interest rate. As the top income holders have opportunities to invest globally so the interest rate of a nation will not affect their income. Whereas, the bottom income group have less opportunities so the interest rate will affect their income. Through different evidence it is found that financial development (private credit) boosts income of lowest quintile (Levine et al. 2007).

1.1. Objectives

- To check inequality through r>g phenomena in Pakistan
- To examine the existence of r>g phenomena in Pakistan
- Providing policy tools to incorporate with existing inequality in Pakistan

2. Literature Review

Kuznets (1955) implied that income inequality initially rises and then decreases as economic development takes place. Graphically, this would appear as an inverted U shape curve, which is now famously referred to as Kuznets curve (Kuznets, 1955). Various studies have been conducted to show this phenomenon. Some of such studies supports the existence of Kuznets curve, both empirically and theoretically (Ganaie, 2015) (Shahbaz, 2010) while others reject the existence of such phenomenon. Various studies have been conducted to shows a different shape of Kuznets curve (Hossain, 2013); (Gallup, 2012). As the validity of Kuznets curve is doubtful and it is also criticized by Thomas Piketty (2014) by giving an approach that is r>g which means that net return on capital is greater than growth rate of an economy. Only the capitalist enjoy a major share of income and hence creates inequality and in various studies it was seen the approach given by Thomas Piketty to see existence of inequality (Waldenstrom, 2015; Góes, 2016) through r>g phenomena in different countries.

Inequality is a worldwide issue which leads to the problem of gap between rich and the poor. This issue seems more apparent in developing countries (Block, 2012). Pakistan is a developing country with uneven income distribution. In this state, rich are getting richer and poor are getting poorer (Amir and Bilal, 2011). Increase in income inequality divides the economy in the two classes: rich and poor. How the economic development and other determinates are important and effect on these two groups is a concern of many researchers (Waldenstrom et al. 2015).

GDP growth is one of the main indicators for development. This is mostly found to be the pro-rich. Kuznets idea "trickle down" seems to be failed when different empirical studies showed that the bottom income holders are not benefited from the fruits of economic development and top income holders are enjoying on the expense of poor ones (Becker and Gordon, 2005). In case of Pakistan some studies support this trickle-down effect given by Kuznets and shows that in Pakistan growth is positively related to income inequality (Tabassum & Majeed, 2008). Whereas, in some studies it is concluded that the growth

is pro-rich in Pakistan and it only benefits the upper class and poor are negatively affected by increasing growth of the economy and it widen the gap between the rich and the poor (Zaman, 2012).

Interest rate as discussed by Thomas Piketty (2014) plays an important role in measuring income inequality. According to him it should be greater than the growth rate if inequality is increasing in an economy. In some studies it has been proved that inequality is beneficial for the poor ones (Levine, 2007). As poor ones cannot invest globally they are limited to their own state. Whereas, top income holders have a chance to invest globally so interest rate prevailing in a country do not affect them.

Government spending is an important tool for redistribution. Income inequality could be decreased by increasing the government spending especially for citizens who belongs to low income groups. Through different researches it is revealed that the developing countries with high inequality have weak redistribution measures and most of the public spending is captured by the top income earners (Mello and Tiongson, 2003). If government expenditure is categorized into sub-group like government consumption expenditure then it can be implied that the relationship between government consumption spending and both income shares have a negative relation (Esposito et al. 2014). Through literature mixed results have been seen between government spending and inequality in Pakistan. In some literature it is found that in Pakistan case government redistribution has a negative and significant impact on income inequality (Naz et al. 2015) (Mehmood and Sadiq, 2010). Whereas, in some of the literature it is seen that government redistribution has a positive impact on income inequality and gives benefit to the rich class and increase inequality by not proper allocating the resources (Ali and Nishat, 2009) (Nelson, 2018). From many economists point of view trade is used as an engine of growth. If gains from trade are evenly distributed among the nation then it can help to reduce income inequality. Many studies have been conducted to check the impact of trade openness on income inequality and income distribution. It is observed that trade in developing countries worsen income distribution and increases income inequality (Vivarelli and Elena, 2009). In Pakistan different studies have also taken place to see this relation and it is seen that trade openness effect income inequality and increases poverty as the distribution from it is not evenly distributed (Khan and Bashir, 2012). Empirically it has been seen that trade may assist the upper class and on the other hand creates harm for the poor one (Majeed, 2010).

Inflation being purely monetary phenomena affects income inequality of a country. Many studies have been conducted and found that income inequality is affected by a rise in inflation as it affects poor one disproportionately because they mostly have their income in cash form which is affected by inflation. Poor class feels severity of inflation than rich class (Easterly and Fischer, 2001). Empirical studies show that there is a positive relation between income inequality and inflation and different policies have been recommended regarding distributional consideration (Hudson and Namini, 2015) (Mir et al. 2015)). Money supply is an important tool for monetary policy which in some views is not an important tool for increased inequality as it is neutral in long term relation that is it has limited effect on the distribution of income (Bernanke, 2015). But in some studies the statistical effect of it is seen on the income inequality (Mondragon et al. 2014). Printing money is one of the source for government to finance deficit which in turn underpinned by the distributional conflict. Growth in money supply results rise in prices which increases inflation and detriment the poor ones of the society (Mir et al. 2015).

3. Data Description and Model Specification

This chapter will discuss the variables used in the study and the sources of data and will discuss the model. Study is based on two models both are time series. This section will also discuss the expected relationship between dependent and independent variables of both models.

3.1. Data Description

This study is concerned with the relationship between Income share held by top 20 and bottom 20 percent, interest rate, GDP growth, government expenditure, trade openness in Pakistan for the time period of 1980 to 2013. Data has been collected from HIES, World Development Indicator, State Bank of Pakistan.

Table 1: Variables Description and Data Sources

Variables	Variables Description	Data Sources
top20	Income Share held by top 20%	HIES
bot20	Income share held by bottom 20%	HIES
Ir	Discount rate	State Bank of Pakistan
G	GDP per capita growth (annual %)	World Development Indicator
gov.exp	General government final consumption expenditure (% of GDP)	World Development Indicator
gov.exp(growth)	Government expenditure (Annual % Growth)	World Development Indicator
g^2	Square of GDP growth	World Development Indicator
Tax	Tax to GDP ratio	World Development Indicator
Inf	Inflation, GDP deflator (annual %)	World Development Indicator
Trade	Trade openness (Exports +Imports/GDP)	World Development Indicator

3.2. Model Specification

To check the relationship between income shares held by top and bottom 20 people with interest rate, GDP growth, trade openness, government expenditure in Pakistan we have developed two time series model.

Model A

In model A the relationship and impact of interest rate, GDP growth, square of gdp growth, government expenditure, trade openness, tax, inflation have seen on income share held by top 20 percent in Pakistan.

$$top20 = f(g, ir, g^2, gov.exp, inf, trade, tax, m2)$$

Below equation is written to check the responsiveness of dependent variable to independent variables

$$TOP20_t = \alpha_0 IR_t^{\alpha_1} G_t^{\alpha_2} G^2{}_t^{\alpha_3} GOV.EXP_t^{\alpha_4} TRADE_t^{\alpha_5} INF_t^{\alpha_6} TAX_t^{\alpha_7} M2_t^{\alpha_8} e^{t\alpha_9}$$

The model may be written in the following way:

$$TOP20_t = \alpha_0 + \alpha_1 LIR_{t-2} + \alpha_2 G_{t-2} + \alpha_3 G^2{}_{t-2} + \alpha_4 GOV.EXP_{t-2} + \alpha_5 LNINF_{t-2} + \alpha_6 TRADE_{t-2} + \alpha_7 TAX_{t-2} + \alpha_8 M2_{t-2} + e_t$$

Where, LINF is the log of inflation and rest of the variables are described before. α_0 is the constant term and $\alpha_1, \alpha_2, \alpha_3, \alpha_4 \alpha_5, \alpha_6, \alpha_7 \; and \; \alpha_8$ are coefficients of interest rate, GDP growth, government expenditure, square of GDP growth, tax, inflation, trade and money supply respectively. $\boldsymbol{e}$ is the error term.

Interest rate is calculated by using discount rate of State Bank of Pakistan as a proxy. GDP growth is GDP per-capita growth in percent. Government expenditures is calculated as general government final consumption expenditure (% of GDP). Square of GDP growth is computed by taking square of GDP growth in excel to check linearity between dependent and independent. Trade variable is computed as imports plus exports of goods and services as share of GDP. It is used for trade openness. Tax variable is computed as tax to GDP ratio by adding all the revenues as percentage of GDP. GDP deflator is used as proxy of inflation rate. Interest rate and GDP growth rate are taken to check existence of inequality and to see their effects on dependent variables. Other variables are the control variables to see the influence of public sector.

Model B

In model B the relationship and impact of interest rate, GDP growth, square of gdp growth, government expenditure, trade openness, tax, and inflation have seen on income share held by bottom 20 percent in Pakistan.

$$bot20 = f(g, ir, g^2, gov.exp.growth, inf, trade, tax, m2$$

Below equation is written to check the responsiveness of dependent variable to independent variables

$$BOT20_t = \beta_0 IR_t^{\beta_1} G_t^{\alpha_2} G^2{}_t^{\beta_3} GOV.EXP.GROWTH_t^{\beta_4} TRADE_t^{\beta_5} INF_t^{\beta_6} TAX_t^{\beta_7} M2_t^{\beta_8} e^{t\alpha_8}$$

The model may be written in the following way:

$$TOP20_t = \beta_0 + \beta_1 LIR_{t-2} + \beta_2 G_{t-2} + \beta_3 G^2{}_{t-2} + \beta_4 GOV.EXPGROWTH_{.t-2} + \beta_5 LNINF_{t-2} + \beta_6 TRADE_{t-2} + \beta_7 TAX_{t-2} + \beta_8 M2_{t-2} + e_t$$

Where, LINF is the log of inflation and rest of the variables are described before. β_0 is the constant term and $\beta_1, \beta_2, \beta_3, \beta_4 \beta_5, \beta_6, \beta_7 \; and \; \beta_8$ are coefficients of interest rate, GDP growth, government expenditure, square of GDP growth, tax, inflation, trade and money supply respectively. $\boldsymbol{e}$ is the error term.

4. Empirical Results and Discussion

In section one model A results have been discussed and in section two results of model B have been discussed.

Table 2

Augmented Dickey-Fuller Unit root test

Variables	T-Statistic	Prob.
At level		
TOP20	-3.554410	0.0127
BOT20	-0.925481	0.7673
TRADE	-2.969530	0.0484
TAX	2.668937	1.0000
LNIR	-3.189663	0.0303
LNINF	-4.491967	0.0011
M2	-1.465685	0.5382
G	-4.042907	0.0037
G^2	-4.989021	0.0003
GOV.EXP	-1.334630	0.6016
At First Difference		
TOP20	-5.126206	0.0002
BOT20	-7.055717	0.0000
TRADE	-8.050767	0.0000
TAX	-3.616428	0.0110
LNIR	-4.760111	0.0006
LNINF	-6.781082	0.0000
M2	-4.919955	0.0004
G	-7.210648	0.0000
G^2	-6.634072	0.0000
GOV.EXP	-4.516090	0.0011

The above table is stationarity of variables. Trade, log of interest rate and inflation, GDP growth and its square are stationary at level. Whereas, income of top 20 people, income of bottom 20, tax, government expenditure and money supply are stationary at first difference. As there is a mix order of integration so ARDL bound testing approach can be applied in both models.

4.1. Empirical Results of Model A

Model B results will be discussed in this section. First short and long run dynamics will be discussed in the light of literature and then in the end diagnostic and stability test of residuals will be analyzed. In model B only dependent variable is changed. All the independent variables will be same as of Model A.

Table 3

ARDL Bound Testing Approach of Model A
Dependent Variable TOP20
ARDL (1,2,2,2,2,2,2,2,2)
F-Statistics 6.123767

Critical values	Lower Bound	Upper bound
99%	2.79	4.1
97.5%	2.48	3.7
95%	2.22	3.39
90%	1.95	3.06

Next, bound testing approach have been performed in which the existence of long run relationship is checked against the the null hypothesis that no long run relationship exist. F-statistics of the bound test of the model is 6.12 which is greater than the upper bound value at 1 percent level. Hence, we can reject null hypothesis and conclude that cointegration exists among the variables.

Table 4

Model A
Estimated Long Run Coefficient using the ARDL Approach
ARDL (1, 2, 1, 2, 2, 2, 2, 2, 2)
Dependent variable TOP20
Time Period 1980-2013

Regressors	Co-efficient	Standard-Error	T-Ratio (Prob)
TRADE	1.621873	0.723797	2.240783 (0.0600)
TAX	-0.000063	0.000024	-2.609761 (0.0349)
G	4.190804	1.691759	2.477188 (0.0424)
G^2	-0.667124	0.304006	-2.194445 (0.0643)
M2	0.627106	0.258036	2.430301 (0.0454)
LNIR	-10.950809	3.383793	-3.236253 (0.0143)
LNINF	4.607846	2.257355	2.041259 (0.0806)
GOV.EXP	-0.177899	0.655267	-0.271491 (0.7938)
C	-22.536896	21.795875	-1.033998 (0.3355)

Next are the long run results of the study which will be discussed. Coefficients of the variable in the long run are:
The long run relationship shows that the income of top 20 people will decrease by 10.95 units, on average, as interest rate will increase by one percent in long run. The relationship is significant and opposite of the Piketty's work in which interest rate is positive for the top income holder. GDP per-capita growth has a positive and significant impact on top 20 income holder. According to the results as Pakistan economy grows by a percent then, on average, income of top 20 people will increase by 4.19 units. This result is supported by the paper George (2017) in which he found that with development of an economy rich one's income increases. Hence it can be stated that in long run Pakistan top 20 income holder are benefited with the development of an economy. Results of this study confirm the nonlinear positive relationship between GDP per-capita growth and income of top 20 holders at 10 percent significant level. Government expenditure relationship with top 20 income holder is significant at 10 percent level. It shows the negative relationship. Government expenditure increases by one percent, on average, results in the decrease of income of top 20 people by 0.178 units. . This result is supported by Lago (1994). In high income group there are more tax evasion activities (Diamond and Saez, 2011). The coefficient of tax shows that as the tax increases by a percent, on average, the top 20 percent income holder share will decrease by 0.00 units. The relationship is negative and significant at 5 percent level and also reveals that there is no effect on the income of top income earners. Share of income of top 20 will decreases by 1.62 units as trade is increased by one percent. This relation is supported by Masche and vivarelle (2009) in which they stated that the trade openness worsen the income distribution. But the relationship in Pakistan case is insignificant at 5 percent level but significant at 10 percent level. If inflation increases by a percent than share of income of top 20 percent will increases by, on average, 4.61 units. This relationship is positive and significant at 10 percent significance level. This result is also supported by the study of Li and Zou (2002). The relationship between money supply is positive and significant. As money supply increases by one percent then income share of top 20 percent will also increases by 0.045 units. This relationship is significant at 5 percent level.

Table 5

Vector Error-Correction Model (VECM)
ADRL (1, 2, 1, 2, 2, 2, 2, 2, 2)
Dependent variable TOP20
Time Period 1980-2013

Regressors	Co-efficients	Standard-Error	T-Ratio (Prob)
D(TRADE(-1))	-1.083750	0.477292	-2.270623 (0.0574)
D(TAX)	0.000065	0.000063	1.039584 (0.3331)
$D(G^2(-1))$	0.501792	0.135902	3.692323 (0.0077)
D(M2(-1))	-0.457465	0.195219	-2.343338 (0.0516)
D(LNIR)	-20.778621	4.834644	-4.297860 (0.0036)
D(LNINF(-1))	-3.592373	1.373900	-2.614726 (0.0347)
D(GOV.EXP)	-0.071773	0.459796	-0.156098 (0.8804)
D(G(-1))	-2.685015	0.675007	-3.977761 (0.0053)
CointEq(-1)	-0.998477	0.209271	-4.771212 (0.0020)

The next table represents the VECM results. Variables in differenced form of variables show the effect on dependent variable in short run. Results shows that [D(TRADEt-1)], [D(TAXt-1)], [D(M2)], [D(LNIR)], [D(LNINF)], [D(GOV.EXP)], [D(Gt-1)], [D(G2t-1)] establishes the short run relation with the dependent variable which is the Income of top 20 percent. The independent variables are significant at different significance level except [D(tradet-1)], [D(taxt-1)], [D(M2t-1)], [D(Gov.Expt-1)] which has insignificant relation with dependent. In the last row is Error Correction Term (ECT) which measures speed of adjustment of converging short-run dynamics to long-run equilibrium path. The ECT value in our model is highly significant and negative. Value -0.99 shows that the 99 percent of the deviation form equilibrium is corrected within next year. Below the table is statistical summary in which R-square is 0.92 which shows that 92 percent of the variations are in dependent variable are explained by the independent variable for the time period of 1980-2013. F-statistics is 3.46 which represent the significance of the model and hence, we can say that the model of this study is overall significant at 5 percent significance level.

4.2. Empirical Results of Model B

Model B results will be discussed in this section. First short and long run dynamics will be discussed in the light of literature and then in the end diagnostic and stability test of residuals will be analyzed. In model B only dependent variable is changed. All the independent variables will be same as of Model A.

Table 6

ARDL Bound Testing Approach of Model B
Dependent Variable BOT20
ARDL (1,2,2,2,2,2,2,2,2)
F-Statistics 6.664164

Critical values	Lower Bound	Upper bound
99%	2.79	4.1
97.5%	2.48	3.7
95%	2.22	3.39
90%	1.95	3.06

Bound testing approach has been performed in which the existence of long run relationship is checked against null hypothesis that no long run relationship exist. F-statistics of the bound test of the model is 6.66 which is greater than the upper bound value at 1 percent level. Hence, we can reject null hypothesis and conclude that cointegration exists among the variables.

Table 7

Model B
Estimated Long Run Coefficient using the ARDL Approach
ARDL (1, 2, 1, 2, 2, 2, 2, 2, 2)
Dependent variable BOT20
Time Period 1980-2013

Regressor	Co-efficient	Standard-Error	T-Ratio (Prob)
TRADE	-0.508266	0.061149	-8.311902 (0.0000)
TAX	0.000013	0.000004	2.975909 (0.0139)
G	-0.818349	0.332634	-2.460210 (0.0337)
G^2	0.165362	0.062920	2.628115 (0.0252)
M2	-0.041051	0.039033	-1.051710 (0.3177)
LNIR	4.562497	0.605510	7.534967 (0.0000)
LNINF	-1.634512	0.456246	-3.582526 (0.0050)
GOV.EXP	-0.024274	0.032020	-0.758097 (0.4659)
C	19.993219	2.688598	7.436298 (0.0000)

After estimating bound test now the concern is to estimate long run coefficients of the independent variables. Below equation shows the estimated coefficients in the long run.

In long run income of bottom 20 people will increase by 4.56 units, on average, as interest rate will increase by one percent in long run. The relationship is significant at 1 percent significant level and opposite of the Piketty's work in which interest rate is negative for the bottom income holder. GDP per-capita growth has a negative and significant impact on bottom 20 income holder people. According to the results as Pakistan GDP-per capita increases by a percent then income of bottom 20 people, on average, will decrease by 0.818 units. This is supported by the results of George (2017) in which he stated that growth hurts poor ones. It can be concluded as that in the long run Pakistan's bottom 20 income holders are harmed with the development of a nation. Results of this study confirm the nonlinear positive relationship of GDP per-capita growth and income of bottom 20 holders at 5 percent significant level. Government expenditure relationship with bottom 20 income holder is negative and insignificant. Government expenditure increases by one unit the income of bottom 20 people decreases by 0.03 units. This result is supported by Lago (1994). The coefficient of tax shows that as the tax increases by a unit the bottom 20 percent income holder share will increases by 0.00 units. The relationship is positive and significant at 1 percent level but shows an almost nil result. Share of bottom 20 will decrease by 0.51 units, on average, as trade is increased by one percent. This relation is supported by Masche and vivarelle (2009) in which they stated that the trade openness worsen the income distribution. The relationship in Pakistan is significant at 1 percent level. If inflation increases by a percent than income of bottom 20 percent will decrease by 1.63 units. This relationship is negative and significant at 1 percent significance level. This result is supported by the study of Li and Zou (2002). The relationship between money supply is negative but insignificant. As money supply increases by one percent, on average, the income share of bottom 20 will also decreases by 0.04 units.

Table 8

Vector Error-Correction Model (VECM)
ADRL (1, 2, 1, 2, 2, 2, 2, 2, 2)
Dependent variable BOT20
Time Period 1980-2013

Regressor	Co-efficients	Standard-Error	T-Ratio (Prob)
D(TRADE(-1))	0.374275	0.080187	4.667519 (0.0009)
D(TAX)	-0.000016	0.000013	-1.189475 (0.2617)
$D(G^2(-1))$	-0.093205	0.031245	-2.983047 (0.0137)
D(M2)	-0.035815	0.034501	-1.038094 (0.3237)
D(LNIR)	5.415871	0.817460	6.625240 (0.0001)
D(LNINF)	-0.461187	0.194961	-2.365537 (0.0396)
D(GOV.EXP)	-0.013796	0.011984	-1.151128 (0.2765)
D(G(-1))	0.371834	0.169790	2.189966 (0.0533)
CointEq(-1)	-0.872452	0.140861	-6.193693 (0.0001)

For the short run results we have estimated VECM. Below table shows the results of it. Differenced form of variables shows the effect of independent variables on dependent variable in short run. Results shows that $[D(TRADE_{t-1})]$, $[D(TAX_{t-1})]$, [D(M2)], [D(LNIR)], [D(LNINF)], [D(GOV.EXP)], [D(Gt-1)], $[D(G^2_{t-1})]$ establishes the short run relation with the dependent variable that is the income of bottom 20 percent. The independent variables are significant at different significance level except [D(M2], [D(TAX)], [D(GOV.EXP)], [D(G)] which have insignificant relationship with dependent. In the last row is Error Correction Term (ECT) measures speed of adjustment of converging short-run dynamics to long-run equilibrium path. The ECT value in the model is highly significant and negative. Value -0.87 shows that the 87 percent of the deviation form equilibrium is corrected within next year.

Below the table is statistical summary in which R-square is 0.94 which shows that 94 percent of the variations in dependent variable are explained by the independent variable for the time period of 1980-2013. F-statistics is 7.08 which represent the significance of the model and hence, we can say that the model of this study is overall significant at 1 percent significance level.

5. Conclusion and Policy Recommendation

5.1. Conclusion

Income inequality is a phase from which every nation passes. For any government the basic objective is to minimize it and simultaneously improve the living standards of the public living in a country. Each nation have two categorize; richer class and poor class. Income inequality arises due to the concentration of wealth in few hands and winding of income gap between these two groups. This study focused on that how redistribution and growth of an economy affect both groups and the measurement given by the Thomas Piketty in his famous book Capital in the Twenty-First Century is applicable in Pakistan too.

The study is based on time series data of Pakistan from 1980 to 2013. ARDL approach has been applied on both models of top 20 income holders (rich class) and bottom 20 income holders (poor class) after analyzing the stationary results. Bound test of the study shows the existence of long run relationship in both models. VECM is applied for the short run results. Normality of data is checked by Jarque-Bera test. Various diagnostic tests have been applied to check residuals stability.

The r – g model of Piketty (2014) have earned too much attention of many policy makers, researcher at global level. In simple words, Piketty model states that rich capital owners will become richer, relative to those who do not own the capital, when the old capital grows and new capital is created from the accumulated incomes. Thus, income inequality rises. The empirical analyzes do not support r>g in Pakistan. Results of the long run show that the measurement given by Thomas Piketty is not valid in Pakistan. As r<g in top 20 income holders and g>r in bottom 20 income holders. Interest rate has a positive relation

with bottom 20 income holders and negative for top 20 income holders. Whereas, growth rate has an opposite effect: it positively affect top 20 income holders and negatively affect bottom 20 income holders. This shows that the gains from economic development are only underpinned by the top income holders. Bottom income holders are suffering from the winding gap of income. According to Piketty (Piketty, Capital in the Twenty-First Century, 2014) from 1977-2007 3/4th income growth goes to the top income households.

Empirical analyzes of other re-distributional variables have also be the aim of this study. Tax ratio, government expenditures, trade openness are the variables which are used to analyze the welfare gains on both groups. Unfortunately, in Pakistan all the redistributive measures have benefited more to the top 20 income holders. Government expenditures have an insignificant impact on both groups. Fruits of taxes in Pakistan are enjoyed more by top income holders and comparatively less by bottom income holders. Trade gains are not distributed evenly among the nation and hence, show the negative relationship in both groups. Results show that the fruits of growth and resources to re-distributional programs are not fully devoted in Pakistan.

5.2. Policy Recommendation

Above discussion clearly shows that inequality is becoming worse in Pakistan. Rich are getting richer and poor are getting poorer. Re-distributional factors are also not playing their role in shrinking the gap between rich and poor. In fact, the benefits are distributed more among the rich class.

In order to alleviate the income inequality there is need for appropriate policies that also take account of the institutional settings. There is a need to reform fiscal, monetary and other sectors. Lowering inequality does not mean to lower the efficiency instead there is a need to improve distribution of income in Pakistan. Different opportunities should be created for the assets creation for poor class. Programs should be initiated that distribute agricultural land in a transparent way. Government should provide subsides on insurance of livestock. As agriculture is a sector where mostly poor class works so creation of job in this sector would be helpful in lowering income inequality. Small and Medium Enterprises sector should provide easy credit available so it will accelerate the industries on small scale.

Expenditures on public depend on the public revenue which highly depends on the taxes. Upper group receives more public fund which upsurge inequality. Institutions in Pakistan benefit the rich one and increase the burden on poor (Junaidi, 2016). Low tax to gdp-ratio of Pakistan shows that tax evasion seems to be a problem in Pakistan. Tax system should be progressive instead of regressive. In some African countries, CRI index shows that government has controlled inequality through spending on social protection, education and health (Talpur, 2017). So it is highly recommended that Pakistan government should increase their spending on these sectors as inequality will not only increases the gap or concentrate wealth but also income inequality will lead to crimes in a nation and affect the literacy rate of a nation.

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