MACROECONOMIC INSTABILITY AND ITS ROLE ON INCOME INEQUALITY IN DEVELOPING COUNTRIES: A PANEL DATA ANALYSIS

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Abstract. Present study is an attempt to analyse the role of macroeconomic instability on income inequality in developing countries. This study investigates the short run and long run relationship between macroeconomic instability and income inequality by using panel data of 22 developing countries over the period 1992-14. For this purpose, comprehensive macroeconomic instability index has been constructed by using principal component analysis with macroeconomic variables including inflation rate, real exchange rate, external debt to GNP ratio and public deficit to GNP ratio. Time-dimension relationship has been analysed by using panel co-integration and pooled mean group estimation techniques. The empirical findings of the study reveal that macroeconomic instability significantly increases income inequality and the relationship appeared to be stable and bi-directional both in the short run and in long run. The study suggests that income inequality can be reduced through macroeconomic stability along with increasing

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foreign direct investment and public health expenditures in selected developing countries.

I. INTRODUCTION

After great depression, with the growing recognition of government role in the management of an economy within the context of Keynesian framework one of the unresolved issues in macroeconomic debate is the nature of relationship between macroeconomic instability and income inequality, which are generally the features of developing countries. Macroeconomic instability posits huge challenges particularly for developing countries especially for addressing the issues of income inequality, poverty and poor living standards. The literature has pointed out that several factors such as high inflation rate, enormous external debt, high fluctuating real exchange rate and balance of payments deficit are responsible for poverty and income inequality in developing countries.

It has been observed that developed countries which have minimum macroeconomic instability experienced relatively low income inequality and stable economic growth with social development. Furthermore, these countries have achieved relatively higher economic growth as they faced relatively less social problems in the past due to less income inequality prevailed in these countries. It was due to proper attention paid by these countries to overcome the problem of income inequality during the past several decades. For this purpose, these countries have introduced several policy measures to tackle the foresaid problem. However, it was observed that the issue of income inequality primarily rests with the developing countries. This issue gravitated over years due to inconsistent and sometimes controversial development policies introduced in these countries.

There are three main sources of macroeconomic instability in developing countries. Firstly, huge exogenous shocks arise from financial

markets which primarily cause huge fluctuation in real exchange rate and worsen terms of trade. Secondly, developing nations experience domestic shocks due to inherent uncertainty and self-inflicted policy mistakes which consequently causes stagflation. Thirdly, the underdeveloped countries have weak shock absorption capacity (For details, see Loayza *et al*, (2007).

The introduction of structural changes in the setup of developing economy brings considerable changes in social factors such as income inequality, living standard and availability of social infrastructure. Raddatz (2007) points out that macroeconomic instability is influenced more from domestic shock than external ones if the economy is hard hit through domestic shock rather than external one; it is more prone towards income inequality. The low middle economies are the typical example of it as these are not well organized and connected with the world economy. The internal shocks created by large and sudden changes in aggregate demand and aggregate supply which are the source of macroeconomic instability in these countries. Furthermore, the operational and procedural changes during the implementation of fiscal and monetary policies which are non-congruent with the economic structure exert negative impact on the inclusive socio-economic development.

There is a growing consensus that the increasing income inequality is one of the major hurdles in the way of social development with the achievement of principles of equity and reciprocity in developing countries. The difference between the poor and rich has increased overtime. Since 2015, the richest 1% has kept more wealth than the rest of world. Increasing trend in income of the poor is 10% less than $3 over the period of 1988- 2011. However, the income of the rich 1% increases 182 times more over the same period. So, the growing inequality creeps up to appeal the whole world especially in developing countries (for detail, see World Economic Forum 2012, Hardoon, Ayele and Fuentes-Nieva2016).

The current trends in income inequality and macroeconomic instability are shown in the following figures; it is obvious that there are rising trends both in income inequality and macroeconomic instability in selected twenty-two developing countries.

FIGURE 1

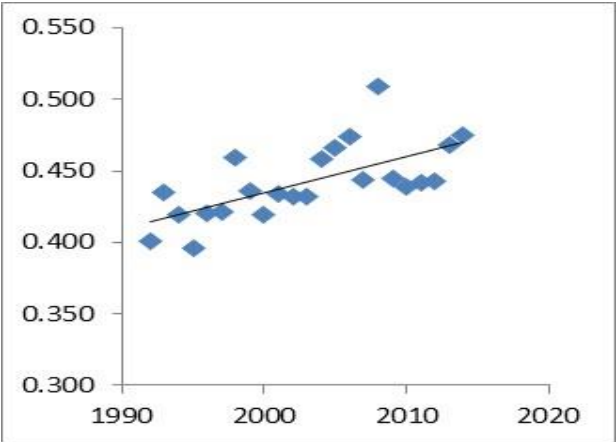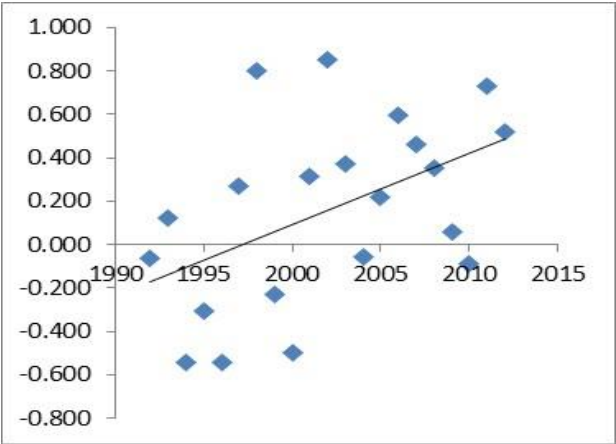Macroeconomic Instability Index over Period 1992-2014

FIGURE 2

Average GINI over Period 1992-2014

The above facts give rise to certain macro-economic policy issues which include; (a) what are the sources of income inequality and macroeconomic stability? (b) Is there any causal relationship exist between income inequality and macroeconomic instability? If it exists, then what is the nature of that relationship especially with regard to time

dimension? (c) How income inequality and macroeconomic instability may be addressed in these countries

To respond the above macro-economic policy questions, the present study firstly, investigates the factors of macroeconomic instability based on review of literature and develops an index of macroeconomic instability using principal component analysis. The reason for using macroeconomic instability index is that it is multidimensional phenomenon which may exert substantial impact on income inequality. Secondly, the study examines the effect of macroeconomic instability index on income inequality using panel data of 22 developing countries for analyzing the long run and short run association between macroeconomic instability index and income inequality. For this purpose, the study uses recent econometric dynamic Panel ARDL technique. Thirdly, only a few time series studies (see for example Ismihan, 2003, Ali and Rehman, 2015) have used the index of macroeconomic instability. This study is an attempt to examine the composite effect of inflation rate, real exchange rate, external debt to GNP ratio and public deficit to GNP ratio on income inequality across developing countries using panel data techniques. Furthermore, this study uses Hurlin and Venet (2001) to examine the panel causality among the variables. The results of the study would be helpful for the policy makers to address the policy issues regarding macroeconomic instability and income inequality in the selected developing countries.

The study includes the analysis of low middle income countries like Egypt, El Salvador, Indonesia, India, Kyrgyz Republic, Kenya, Morocco, Mongolia, Philippine, Pakistan, Sri Lanka, and Tunisia and upper middle income countries like Belarus, Bulgaria, Costa Rica, Jamaica, Jordan, Peru, Romania, South Africa, Thailand, and Turkey. The selection criteria of these countries are based on the classification by World Bank and availability of data. This study is organized as follows: section II offers review of literature. Section III highlights the theoretical framework. Data and econometric methodology are given in section IV, the empirical results and discussions are accessible in section V, while conclusion and suggestions are presented in unit VI

II. LITERATURE REVIEW

The literature has pointed out that that high inflation rate, high unemployment; instable economic growth and external as well as internal sector imbalances with high budget deficit are the common features of developing countries. Furthermore, the social conditions of these countries are also miserable with increasing income inequality and low level of standard of living. It opens up a macroeconomic debate on the causes of income inequality and its association with macroeconomic instability especially in the context of developing countries.

Gibrat (1931) provides experiential and hypothetical outline for income distribution to analyze the income inequality arising from fluctuations in real and nominal macroeconomic variables. This model explains that individual income is subject to random impartial changes which occur due to change in inflation rate and consequently in aggregate demand. Kalecki (1945) extends the Gibrat (1931) original model and explore that the adverse shocks in income aggravate income inequality. The author comments that increasing level of income inequality affects low income community more rather than high income community especially in consumption decisions. However, his study remained silent on the causes of shocks, either that are from supply side or demand side or both. Afridi *et al*. (1984) bridge up this gap by analyzing the link between demand pull inflation and income differences in pakistan. They estimate the gap among poor and rich over time. The outcomes of the study illustrate that inflation has significant and positive impact on income inequality in developing nations.

Demery and Addison (1987) further extended Afridi *et al*. (1984)) work by incorporating other variables like deficit in balance of payment and budget deficit along with inflation to analyze their joint impact on income distribution. The study explains that rising government expenditure increases domestic demand along with exacerbating income inequality. Therefore, the final impact of macroeconomic instability arising from budget deficit may increase the distributional issues among different segments of the population. However, this study is silent on the nature of policies adopted by incumbent governments and did not explain either the monetary or fiscal policies were responsible for income inequality.

Valentine (1993) explains that the monetary liberalization and denationalization primarily deteriorated income variation. Clark and Oswald (1994) explain the transmission mechanism among inflation caused by expansionary monetary policy, fiscal liberalization and income inequality. The study explains that inflation decreases the purchasing power of the people and people are unable to meet the basic necessities of life. The study concludes that inflation and unemployment have negative relationship with education and health facilities accessible to people and consequently cause increase in income inequality.

Kemal (1994) discovers the role of structural changes on income inequality in case of Pakistan. The outcomes of the study show that structural changes increase gap between labour demand and supply due to lack of skills required in new rising sectors of the economy and hence creates income dissimilarity. The study accomplishes that structural change program raises competence but it has contrary result on income inequality and employment in Pakistan.

Adger (1999) highlights income difference for the districts of Vietnam applying a primary review in 1995 to 1996. The study observes the causal connection between poverty and income inequality. The results of the study show that wages and remittances play an important role in the existence of inequality in Vietnan. Furthermore, the estimated results show that attraction of wealth causes income inequality. Frey and Stutzer (2000) investigate the relationship between misery index and welfare. They find that economic misery which is index of inflation and unemployment puts negative impact on social welfare measured in terms of income inequality. Calderon and Chong (2001) analyzed association among exchange rate, foreign direct investment and income inequalities using panel data over the period 1960 to 1995 in developing nations. They find that exchange rate increases income inequality while, foreign direct investment reduces income inequality in the long run.

Ismihan (2003) analyzed the relationship between macroeconomic instability and social development. He uses fluctuations in inflation, budget deficit, external debt and exchange rate as drivers of macroeconomic instability and inter alia their effect on investment in Turkey over the period 1963-1999 using time series data. The study develops the macroeconomic instability index using the aforementioned

variables and concludes that macroeconomic instability has negative impact on social and economic development along with capital formation in Turkey. However, this study does not throw light on the application of the findings on other developing countries.

Hanson and Woodruff (2003) examine the relationship between remittances and social sector development in case of Mexico using data of population Census and housing data. The study finds that remittances play a vital role in determining human well-being and increase the education, health and resources for the poor people but increases income inequality. Schultz (2005) explores the impact of health expenditures on total factor productivity in case of developing nations. The outcomes of study reveal that good health has positive and significant impact on workers and wages in developing countries, which reduces income inequalities. Furthermore, the study points out that due to lack of resources developing countries do not provide better health facilities. The study suggests that fair income distribution and improves health facilities help in improving the standard of living of the people. In such situation, the income of poor population may improve overall health condition and consequently it will reduce income inequality.

Figini and Görg (2006) explore that the foreign direct investment exacerbates income inequality in developing nations in short run. Mukherjee and Banerjee (2010) analyze the impact of education and health on income inequality for 15 states of India using household integrated survey. The results of the study show that education and health have negative impact on income inequality. This confirms that education and health are main inputs of income inequality. Donald and Majeed (2011) observe the influence of openness on income inequality and poverty in 65 developing nations over the period of 1970 to 2008 using panel data analysis. The outcomes of the study show that openness barely influences on income inequalities while foreign direct investment decreases income inequality. However, the study does not explain anything about the role of technological changes on income inequality. Zhuang *et al.* (2014) point out that technological developments and market-oriented changes are the main powers to enhance economic progress particularly in case of developing countries. Ali and Rehman (2015) construct macroeconomic instability index using variables such as budget deficit, trade deficit, unemployment rate and inflation rate for

investigating the relationship among economic growth and macroeconomic instability for Pakistan. The results of the study indicate that there exists negative association among macroeconomic instability and economic growth. Furthermore, the study concludes that macroeconomic stability is necessary for achieving desired level of growth in Pakistan.

The above mentioned studies show that inflation rate, exchange rate, external debt, public deficit are the major variables which affect income inequality. However, not many studies are available in the literature examined the composite effect of aforementioned factors on income inequality across developing countries using panel data techniques. The present study is an attempt to explore the composite effect of aforementioned factors on income inequality in 22 developing countries using panel data techniques over the period 1992-2014. The present study will be valuable addition to existing literature as the results of this study provide a guideline to the policy makers to formulate and implement consistent policies to overcome the problems of instability and income inequality in developing countries.

III. THEORETICAL FRAMEWORK

The macroeconomic environment influences the skewness of income distribution and hence causes an increase or decrease in income inequality. The transmission mechanism of how macroeconomic variables contribute towards income inequality is debatable amongst the policy makers and academicians since the study of Kuznets, (1955). In addition, there are several studies available in the literature which pondered the association of macroeconomic instability and income inequality. The work of Dornbusch and Edwards (1990) and Onis (1997) determine that the macroeconomic instability arises in developing nations due to poor fiscal and monetary management. The research work conducted by them used budget deficit as an indicator for inefficient fiscal policy and their results reveal that there exists inverse association among macroeconomic instability and income variation.

In case of developing countries, the study of financial factors of spreading income and its well-being implication remain experimental matter by way of emerging nations. The macroeconomic variables like total income show rising tendency through increasing level of income

difference (Fofack and Zeufak, 1999). Anand and Kanbur (1993) focus the two key complications with Kuznets theory; firstly, employing cross-section data with no contrary U shaped association amongst wages difference and economic growth (Halkos and Tzeremes, 2011). Secondly, according to Kuznets theory there is few theoretic misspecifications as sectoral differences which may change the overall inequality. Furthermore, Bourguignon and Morrisson (1998) point out that the method of reversed U-shaped of Kuznets is difficult. Factor proprietorship and factor benefactions decide income distribution in competitive employment marketplace. But actually these markets are impossible and comparative employment output decides income circulation amongst factors. This leads us to conclude that difference in income inequality exist among the developing countries. Inflation is regarded as significant contributor as well as indicator of macroeconomic instability as it has been used by several researchers (see for example Ismihan 2003, Ali & Rehman 2015). Demery and Addison (1987) point out that the issue of distribution of income was created by increasing balance of payment, budget deficits, and inflation.

The existing literature on macroeconomic instability in developing countries has not covered the whole macroeconomic conditions of developing countries. Iqbal and Nawaz (2009) and shahbaz (2013) used inflation as proxy for macroeconomic instability in Pakistan. Iqbal and Nawaz (2010) used misery index as macroeconomic instability in Pakistan which is the sum of inflation rate and unemployment rate. Ali and Rehman (2015) use inflation rate, unemployment rate, trade deficit and budget deficit for measuring macroeconomic instability index for Pakistan. Ismihan (2003) constructs macroeconomic instability index for Turkey, using four indicators (inflation rate, external debt to GNP ratio, public deficit to GNP ratio, exchange rate).

The present study formulates the macroeconomic instability index for developing countries using principal component analysis consistent with Ismihan (2003). Furthermore, for measuring the income inequality the study uses GINI coefficient for selected developing countries developed by World Bank. To determine the best forecasting of the variables for the macroeconomic instability, this study uses early warning process used by Kaminski *et al*. (1998). The study incorporates inflation rate (INF), exchange rate(ER), external debt to GNP ratio(ED) and public

deficit to GNP ratio (PD) for formulating macroeconomic instability index for selected developing countries. Identical weight is assumed for every variable and then the average deviance of that variable from its minimum is taken as follow;

$$MII_{it} = \beta_1 \left(\frac{INF_{it} - \min INF_{it}}{\max INF_{it} - \min INF_{it}} \right) + \beta_2 \left(\frac{ED_{it} - \min ED_{it}}{\max ED_{it} - \min ED_{it}} \right)$$
$$+ \beta_3 \left(\frac{PD_{it} - \min PD_{it}}{\max PD_{it} - \min PD_{it}} \right) + \beta_4 \left(\frac{ER_{it} - \min ER_{it}}{\max ER_{it} - \min ER_{it}} \right) \quad (1)$$

where i denotes to a country t denotes to a year and min (max) refers to the minimum (maximum) value of indicators. The index value lies between zero and one. One means high macroeconomic instability and zero means no macroeconomic instability.

Lewis (1954), Kaldor (1956) contribute hypothetical background for defining and measuring the factors of income discrimination among different regions of the economy. Further, based on the theoretical and experimental model of Alesina and Perotti (1996) the study develops model as:

$$GINI_{it} = f(MII_{it}, PRR_{it}, FDI_{it}, HEP_{it}) \quad (2)$$

GINI   = Income inequality (Gini coefficient)

MII   = Macroeconomic instability (Macroeconomic Instability Index)

PRR   = Personal remittances

FDI   = Foreign direct investment

HEP   = Government Health expenditures as percentage of GDP

i   = refer to a country

t   = Time period

The model assumes linear relationship between dependent and independent variables. Moreover, the independent variables are mutually exclusive. Following the linear form of the model as:

$$GINI_{it} = \beta_o + \beta_1 MII_{it} + \beta_2 PRR_{it} + \beta_3 FDI_{it} + \beta_4 HEP_{it} + \mu_{it} \quad (3)$$

IV. DATA AND ECONOMETRIC METHODOLOGY

DATA

The study uses panel data for the period 1992-2014 for 22 developing countries. For measuring the income inequality, the study uses GINI coefficient which is one of the most standard representations of income variation and shows the discrepancy from 0 to 1, where 0 means perfect equality and one means perfect inequality. Principal component analysis has been used for the construction of macroeconomic instability index by estimating values of β_1 β_2 β_3 and β_4 given in equation 1. Based upon review of literature, personal remittances received as (% of GDP), public health expenditures (% of GDP) and net foreign direct investment inflow (% of GDP) have mentioned as control variables in this study. Data has been taken from world development indicators.

TABLE 1

List of dependent and control variables

Symbols	Name of variables	Data sources	Units
GINI	Income inequality	World development indicators	GINI index (estimated by World Bank)
MII	Macroeconomic instability index	Calculated by principal component technique and data taken from world development indicators	Index
PRR	Personal remittances	World development indicators	Personal remittances, received (% of GDP)
HEP	Public Health Expenditures	World development indicators	Public Health expenditures (% of GDP)
FDI	Net Foreign Direct Investment	World development indicators	Net Foreign direct investment inflows (% of GDP
TREND	Trend of variables	Calculated by author	Year

ECONOMETRIC METHODOLOGY

Several studies are available in the literature, which have used generalized method of moments (GMM), ordinary least square (OLS), Fixed Effect and Random Effect models for analysing the relationship

between the variables. There is assumption regarding OLS estimates that 'values must be fixed in repeated sampling' (Gujrati, 2009), but in time series data this assumption might not hold because in most of the cases data is function of time. Variables with such property is called non-stationary variables, if we ignore this property and carry in with OLS approach then our results will be spurious (Asteriou, 2007). For panel data if numbers of years per cross section are above 20, then such data set behaves as a time series panel data (Pedroni, 2008). This calls for the need of observing non stationarity of the variables, which will identify the order of integration of the variables. After panel unit root tests, if any one of the variable is non-stationary then the variables should be co-integrated in order to have reliable long run estimates.

The present study uses Pooled Mean Group (also called Panel ARDL) approach to allow for mixed order of integration as well as the incorporation of the cross sectional heterogeneity and autocorrelation emphasized by Blackburne and frank (2007), where numbers of coefficients, intercepts vary through the groups. Pesaran et al. (1999) comment that when numbers of cross units turn out to be larger than number of time period at that time assumption of homogeneousness of coefficient come to be unpredictable. In mean group technique, a separate model is assessed for every group and calculates the average of coefficients. In this way, the error differences, coefficients and intercepts convert invariant through the groups. In this method, coefficients might differ in short-run, on the other hand homogeneous in the long period. So, main outcomes of this study are consistency of slope and coefficient in the long period across every group. Thus Panel ARDL has been used for estimating the long run effect of macroeconomic instability along with other control variables on income inequality. In order to explore the order of integration of the variables, this study uses commonly panel unit root tests such as Levin et al. (2002) and Im *et al*. (2003). Since in this study, balanced panel data is used. It is therefore Lvin, lin and Chu (2002) test was applied to examine the stationarity of data. The overall equation of the test is:

$$\Delta y_i,_t = \beta + \beta_i Y_i,_{t-1} + \sum_{k=1}^{n} \beta_i \Delta Y_{i,t-k} + \gamma_i t + \varepsilon_{i,t} \qquad (4)$$

Where y_{i_t} is a sequence for panel country i $(i = 1,2.......N)$ the period t $(t = 1,2.......T)$, β_i is the figure of lags in the ADF regression then the error term $\varepsilon_{i,t}$ are supposed to be IID $(0, \sigma^2)$ and furthermore independent crossways the units of the sample. The null hypothesis about non-stationary is such as:

$H_0 : \beta_i = \beta = 0$

Alternative hypothesis is

$H_1 : \beta_i = \beta < 0$

For all i

To ascertain the results regarding stationarity of data, the second test of Im, Pesaran and Shin (2003) has been used. This test offers separate outcomes of every cross section. ADF regression is such as

$$\Delta y_{i,t} = \beta + \beta_1 Y_{i,t^{-1}} + \delta_i t + \sum_{k=1}^{n} \theta_i t - \Delta Y_{i,t^{-k}} + \mu_{i,t} \qquad (5)$$

Null hypothesis of unit root

$H_0 : \beta_i = 0$

Alternative hypothesis non-appearance of unit root

$H_1 : \beta_i < 0$

The assumptions of alternative hypothesis are that slope coefficients should be less than zero which explains the non-existence of unit root. Where β_i the order of the ADF regression and errors stands ($\mu_{i,t}$) independently distributed. The rules of IPS test assumes that in balanced panel where t is taken to be static for all cross-section data to calculate t value in a way that it should be less than average of separate ADF test statistics.

$$\bar{t} = \frac{1}{N} \sum_{i-1}^{n} t_\gamma, i$$

where $t\gamma, i$ coverage to the statistics which is $iid \approx N(0, \sigma^2)$ IPS test statistics is offered in the next equation.

$$t_{IPS} = \frac{\sqrt{N\left[\bar{t} - \frac{1}{N}\sum_{i-1}^{N} E(t_{iT})\middle|\rho_i = 0\right]}}{\sqrt{Var\left[t_{iT}\middle|p_i = 0\right]}}$$

The study uses pooled mean group estimation method or panel ARDL style to examine the short and long run sound effects of independent variables on explained variable after estimating the stationarity of data. The equation suggests for panel ARDL is particular below:

$$Y_{i,t} = \sum_{j=1}^{p} \delta_{i,j} Y_{i,t-j} + \sum_{j=0}^{p} \gamma_{i,j} X_{i,t-j} + \mu_i + \varepsilon_{it} \tag{6}$$

Here dependent variable is income inequality and lagged values of income inequality are used as independent variable while $X_{i,t}$ variables comprise macroeconomic instability index, personal remittances, public health expenditures and foreign direct investment. To investigate short run as well as long run effects, pooled mean group estimation technique runs the outcomes individually. In the long period the negative value of error correction term, show the convergence of the variables and stability of long run relationship between macroeconomic instability index and income inequality. The model of pooled mean group estimation used in this study is as follows;

$$\Delta Y_{i,t} = \theta_i (EC_{i,t}) + \sum_{j=1}^{p-1} \alpha_{ij} \Delta Y_{i,t-j} + \sum_{j=0}^{q-1} \phi_{i,j} \Delta X_{i,t-j} + \varepsilon_{it} \tag{7}$$

Wherever

$$(EC_{i,t}) = Y_{i,t-j} - X_{i,t}\beta. \tag{8}$$

The above equation displays the error correction term, which expands the convergence of the model in long period. The convergence is determined by the sign of estimated value of the error correction term. The negative value explains the long run association among the variables. The equation reveals that lagged dependent variables are employed as independent

variable. The sign θ explains modification whereas β is the long-run coefficient.

V. RESULTS AND DISCUSSION

Table 2 presents the results of panel unit root test. The results of the study show that all variables are stationary at first difference both with intercept and intercept & trend. The rejection of null hypothesis might be at 5% significance level.

TABLE 2

Panel Unit Root Test

LLC (2002) TEST				
Variables	Level		At first Difference	
	Intercept	Intercept & Trend	Intercept	Intercept & Trend
GINI	-2.8148	-4.9560	-6.8338	-4.5929
	(0.0024)***	(0.0000)***	(0.0000)***	(0.0000)***
MII	-6.3532	-7.1777	-11.7421	-9.0371
	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***
PRR	-2.4321	-4.3073	-8.8113	-6.1992
	(0.0075)***	(0.0000)***	(0.0000)***	(0.0000)***
HEP	0.5833	1.1709	-5.6884	-3.1387
	(0.7201)	(0.8792)	(0.0000)***	(0.0008)***
FDIB	.05384	0.1397	-8.6405	-7.0000
	(0.7049)	(0.4444)	(0.0000)***	(0.0000)***
IPS (2003) TEST				
Variables	Level		At first Difference	
	Intercept	Intercept & Trend	Intercept	Intercept & Trend
GINI	-2.1017	-4.8955	-11.7183	-11.9687
	(0.0178)***	(0.0000)***	(0.0000)***	(0.0000)***
MII	-4.3405	-6.3231	-12.4388	-12.6823
	(0.0000)***	(0.0000)***	(0.0000)***	(0.0000)***
PRR	-0.9044	-3.0851	-10.1674	-10.5537
	(0.1829)	(0.0010)***	(0.0000)***	(0.0000)***
HEP	1.2745	0.6851	-8.8407	-6.1411
	(0.8988)	(0.7534)	(0.0000)***	(0.0000)***

FDIB	0.7767	-0.2805	-6.7850	-9.1133
	(0.7814)	(0.3895)	(0.0000)***	(0.0000)***

*Shows at 10%** indicate at 5% while, *** 1% significance level.

Table 3 presents the results of panel co-integration. The results show that out of seven Pedroni (2000) tests, four (i.e. PP, ADF common Cointegration and group co-integration) explain that residuals are stationary by homogenous cross sectional effects whereas the remaining three explained that residuals are stationary with heterogeneous cross sectional properties. Most of the results show the existence of cointegration among the particular variables.

TABLE 3

Results for Panel Cointegration Test

Common Cointegration		
Tests	Statistics value	Probability values
V	0.957	0.169
Rho	-1.396	0.081*
PP	-7.061	0.000***
ADF	-6.812	0.000***
Group Cointegration		
Rho	1.105	0.865
PP	-7.474	0.000***
ADF	-6.334	0.000***

* sign shows at 10%, ** at 5% while *** indicate at 1% significance level.

The long run results of pooled mean group are shown in Table 4. The results show that macroeconomic instability index, personal remittances have significant and positive impact on income inequality. It implies that macroeconomic instability and personal remittances worsen the income inequality situation in developing countries. However, public health expenditures and foreign direct investment have negative role on income inequality at 1% and 5% significance. This indicates that improved public health expenditures and foreign direct investment may contribute in reducing income inequality. The estimated value of the coefficient of macroeconomic instability index reveals that 1% rise in macroeconomic instability will increase income inequality by 3.93%. Similarly, 1% increases in personal remittances increases income inequality by 1.13%,

it reveals that the proportion of the people who are sending remittances belong to the affluent segment of the population in their motherland. These results are in line with Adams, (2005), Kemal, (1994) and Adger (1999). Health expenditures and foreign direct investment have negative effect on income inequality. These results are supported by Preston (1975) and figini (2006). The coefficient of health expenditures is -0.51 which illustrates that income inequality falls by 0.51 as a result of 1% increase in health facilities provided by government. The coefficient of foreign direct investment is -0.034 which shows that 1% increase in FDI decreases income inequality by 0.034% on average. The results of the study are consistent with that of MacDonald and Majeed (2011). The coefficient of trend 0.014 shows that 1% increase in structural changes, rise income inequality by 0.014. This result is supported by (kemal 1994, Kuznets 1955).

TABLE 4

Outcomes for PMG Long Run

Variables	Coefficients	Standard Error	t-statistics values	Probability values
MII	3.932	1.76	2.23	0.026**
PRR	1.131	0.08	13.96	0.000***
HEP	-0.516	0.10	-4.73	0.000***
FDI	-0.034	0.01	-2.27	0.023**
TREND	0.014	0.00	38.78	0.000***

* sign shows at 10%, ** at 5% while *** indicate at 1% significance level

TABLE 5

Short run PMG outcomes

Variables	Coefficients	Standard Error	t-statistics values	Probability values
ECM(t-1)	-0.152	0.062	-2.45	0.014***
DMII	-2.257	2.498	-0.90	0.366
D(MII(-1))	0.899	1.516	0.59	0.553
D(PRR)	-0.727	0.274	-2.65	0.008***
D(HEP)	0.492	0.270	1.82	0.069*
D(FDI)	0.347	0.347	0.97	0.330

* sign shows at 10%, ** at 5% while *** indicate at 1% significance level.

Table 5 explores the outcomes of Pooled mean group estimation technique in short run. This study shows that personal remittances has significantly negative impact on income inequality while, coefficient of health expenditures is statistically significant and has positive impact on income inequality in the short run. The results explain coefficient of the ECM_{t-1} is negative and statistically significant. This shows that model converges to equilibrium.

The results of the panel causality test are presented in Table 6. The results disclose that there is bi-directional causality among income inequality and macroeconomic instability. There is bi-directional causality observed between income inequality and control variables which include personal remittances, health expenditures as percentage of GDP and FDI as percentage of GDP.

TABLE 6

Results for Panel Causality Test

Dependent Variable	GINI		MII		PRR		HEP		FDI	
	Probability	Decision	Probability	Decision	Probability	Decision	Probability	Decision	Probability	Decision
GINI	-	-	0.004***	Present Causality	0.000***	Present causality	0.000***	present causality	0.000***	Present causality
MII	0.002***	present causality	-		0.036**	present causality	0.001***	present causality	0.001***	Present causality
PRR	0.001***	present causality	0.057**	Present Causality	-	-	0.004***	Present causality	0.047**	Present causality
HEP	0.015***	present causality	0.167	No Causality	0.259	No Causality			0.000***	Present causality
FDI	0.096*	present causality	0.097*	Present causality	0.026**	present causality	0.000***	Present causality	-	-

* sign shows at 10%, ** at 5% while *** indicate at 1% significance level

VI. CONCLUSION

The major objective of this study is to examine the role of macroeconomic instability on income inequality for 22 developing nations. For analysing the impact of macroeconomic instability on income inequality a comprehensive macroeconomic instability index has been constructed including inflation rate, external debt to GNP ratio, public deficit to GNP ratio and exchange rate. Panel unit root test, Panel ARDL and panel causality techniques have been used for estimation purpose. The outcomes of the study reveal the existence of stable long-run relationship of macroeconomic instability, personal remittances,

public health expenditures and foreign direct investment with income inequality separately. The results indicate that foreign direct investment and public health expenditures are more effective tools for reducing income inequality, while macroeconomic instability and personal remittances have significant and positive impact on income inequality. The negative sign of error correction term confirms convergence of the variables from short run to long run equilibrium. The estimated results of panel causality test explain that there is overall bidirectional causality observed among macroeconomic instability and income inequality. These results are helpful for policy makers to formulate and implement economic policies consistent with the prevailing economic conditions in developing countries. Furthermore, it may be helpful to form strategies for effective reduction in income inequality through minimizing macroeconomic instability through appropriate demand management policies in the short run and supply side policies in the long run. In this regard, the governments of the respective countries should ensure the possibilities of increasing foreign direct investment through providing incentives to the investors. Furthermore, an increase in expenditures on health may be helpful in reducing income inequalities in these countries.

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