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ISSUE OF INCOME INEQUALITY UNDER THE PERCEPTIVE OF MACROECONOMIC INSTABILITY:AN EMPIRICAL ANALYSIS OF PAKISTAN

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Abstract. This study has investigated the impact of macroeconomic instability on income inequality in Pakistan over the period of 1980 to 2015. A comprehensive macroeconomic instability index has been constructed by incorporating inflation rate, unemployment rate, trade deficit and budget deficit. Stationarity of data is checked with the help of the Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) and Dickey-Fuller Generalized Least Squares (DF-GLS) unit root tests. Autoregressive Distributed Lag (ARDL) model has been used for examining the co-integration among the variables of the model and Vector Error-Correction model has been used for short run dynamics of the model. The empirical results of the study confirm the existence of co-integration between macroeconomic instability and income inequality in Pakistan. The results of the study show that macroeconomic instability has a deep-rooted impact on income inequality in the case of Pakistan. Hence, for achieving the desired level of income distribution, Pakistan should make its macroeconomic environment stable.

Keywords: Macroeconomic instability, Income inequality, Pakistan, Co-integration

JEL Classification: C43, C51, C52, D63, F62

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I. INTRODUCTION

Better quality of life is the aim of all types of sciences. Following this objective, economists treat economics as a science. Smith (1784) mentions that no society can be happy and flourished if the greater part of its population is miserable and poor. Hartwell (1972) claims that the spirit of economics to study poverty. But a historical overview of economic thoughts shows that the nature of economic activities changed over the time. Bigsten (1983), Atkinson (1997) and Ferran (1997) place income distribution in the center of their thoughts when they claim that political economy should determine the laws and rules of income distribution. Thus, the fairer income distribution is the prime objective of economics, but this prime objective lost elsewhere as economic thoughts move forward. After Smith and Ricardo, the literature before 1950's shows that the objective of fair distribution of income is absent in economic theories and policies (Atkinson, 1997).

Generally, income inequality gives a concise picture of society that show who receives what. Following theoretical and empirical literature, functional distribution and personal distribution or size of income distribution are two main concepts of income distribution. The functional distribution reveals what the share of income is received by individual factor of production. Whereas the size of income distribution reveals that how many households get how much? The final results of the entire economic process are the distribution of income (Bigsten, 1983). From 1970's much concern of the developed world is the quality of life and harmful consequences of economic growth, such as the depletion of natural resources and pollution. But the developing world is still confused between relationship of economic growth and distribution of income. Moreover, developing countries are experiencing high rates of economic growth with increasing income inequality (Todaro, 1994).

How macroeconomic environment impacts income distribution? This is a critical topic of discussion among the economists and policymakers since the days of Kuznets. But after millennium development goals of United Nations reducing income discrepancies and macroeconomic instability are the main objectives of United Nations member countries. Macroeconomic instability is not only a natural policy target of governments, but it can also be viewed as an important factor affecting

income distribution. Moreover, there are number of normative and positive questions are associated with the relationship of macroeconomic instability and income distribution. So, uncovering the direction of this relationship gives much understanding to policymakers for targeted policy issues. Demery and Tony (1987) mention that rising inflation, deficit in balance of payment and budget deficit create distributional issues. Due to political pressure the rising government spending arises domestic demand, which has no concerns with employment and real output. Hence the ultimate impact of macroeconomic instability may create the distributional issues among different households and sectors. Lewis (1954) points out that rising overall national income may increase income inequality because that boom has minimal impact on overall employment and other socioeconomic structure of the economy. For last few decades the poverty rate declined at national and global level due to high economic growth in developing countries. However, income inequality also rises as the profits and wages of skilled labor to move upward in market-oriented and open economies. As the economies move towards for getting higher economic growth they have to face higher inflation, unemployment and income inequality. Blinder and Howard (1978) and Blank and Alan (1985) mention that there is a positive and significant relationship between inflation, unemployment and income inequality in the USA. Nolan (1987) studies those macroeconomic factors which have a very influential impact on income distribution. Pasinetti (1989) argues that it is the budget deficit, which decides the propensity to consume of wage and non-wage income.

The objective of this study is to find the impact of macroeconomic instability on income inequality in Pakistan. Income inequality is most studied topic in development economics but there are few studies how link macroeconomic factors with income inequality. The existing studies use inflation or GDP fluctuations as macroeconomic instability, but these two separate variables are not enough for representing the macroeconomic situation. So, this study uses a comprehensive macroeconomic instability index for measuring macroeconomic situation. There are a number of studies which focus on determinants of income inequality, but there is hardly any study which investigates the impact of macroeconomic instability on income inequality in the case of Pakistan, so this study is a healthy contribution to respective literature.

II. LITERATURE REVIEW

Historically, the basic objective of development economics is to improve the standard of living by reducing poverty. In the last few years, the economists are much worried about rising income inequality and income gap within and among nations. Some of the most prominent and important studies are presented here as a review of literature. Gibrat (1931) gives an empirical and theoretical framework for income distribution. This model has supposed that individual income is subject to random proportionate changes. Kalecki (1945) modifies the Gibrat (1931) original model and he claims that negative shocks in income worsen the level of income inequality. He mentions that the rising level of income inequality puts pressure on low income communities rather than high income communities. Rutherford (1955) expands Gibrat (1931) model by introducing birth and death rate considerations. He concludes that income inequality has greater impact on birth and death rate. There is a negative relationship between income and longevity of life, whereas death and birth rates have a positive relationship with income inequality. Atkinson (1970) establishes a theoretical background for social welfare function by using Lorenz Curve. Kakawani (1977) extents the model of Atkinson (1970) and finds the relationship between income distribution and macroeconomic variables. This model is also known as Generalized Lorenz Curves.

Jeetun (1978) examines the trends of economic growth and income inequality both rural and urban areas of Pakistan from 1963-64 to 1971-72. Coefficient of variation, Kuznets measures and GINI coefficient are used for measuring tendencies of income inequalities. The estimated results of the study show that income inequality by all measures deteriorates in selected time period. He concludes that the fruits of agricultural development and high output concentrated in a few hands of the urban aristocracy which widely disturb the income distribution in Pakistan.

Chaudhry (1982) investigates the impact of Green Revolution on income inequality in rural areas of Pakistan. On the basis of empirical results, it is concluded that Green Revolution reduces income inequality among large farms and small farms and among farms and non-farms rural population. The study recommends the necessity of Green Revolution in

developing countries like Pakistan. Knight and Sabot (1983) mention that human capital and income inequality has a very complex relationship in case of the dual economy. It is the wage compression, which decides investment in human capital. The upward rising wages reduce the risk on education as educated workers have high rate of expected return which lower income inequality. On the basis of estimated results, they conclude that there is negative relationship between education and income inequality.

Afridi et al., (1984) analyze the relationship between inflation and income inequality in the case of Pakistan. They evaluate the gap between rich and poor over the time. The results of the study show that inflation has a very influential role on income inequality in Pakistan. They conclude that inflation puts a negative impact on the purchasing power of poor and poor class suffer from inflation but the case is reverse for rich. Kruijk and Leewan (1985) examine different indices of income inequality and poverty in Pakistan with the help of decomposition techniques during 1970s. In this study standard deviation, coefficient of variation and GINI coefficient are used for measuring income inequality in Pakistan. The results of the study show that income inequality increases in both rural and urban areas of Pakistan during the selected time period. They conclude that remittances have a negative and significant impact of reducing inside and outside household income inequality in Pakistan. Collier et al., (1986) study the determinants of income inequality in the case of Tanzania based on household and a village survey of 1980. This survey covers 600 households from 120 villages of different region of Tanzania. Inequality is analyzed on the base of returns on those activities whom non-poor and poor are adopted for a living. The results of the study explain that government incentives to farmers, education, land reforms and health services reduce inequality among and within communities in Tanzania.

Ewijk (1991) develops a post-Keynesian model of economic growth. A dynamic process of demand and supply is needed for getting the maximum level of national output. In this process capitalists are actual borrowers, so interest income and government bonds are increased as workers get some part of the profits. He concludes that if the interest rate is higher than the share of workers the income distribution at the national level will remain same. Valentine (1993) claims that income inequality

increases as the assets of the rich population increase faster than the poor. The findings of the study explain that it is the financial liberalization and privatization, which increase the concentration of resources in few hands that worsen income inequality. These findings strengthen the arguments of Nurkse (1953) "the poor remains poor because they are poor". Kemal (1994) analyses the experience of structural adjustment program and its impact on income inequality and production efficiency in Pakistan. The empirical results of the study show that the structural adjustment program decreases production efficiency and leads an increasing trend in income inequality in Pakistan. The rural areas income inequality increased more than urban areas because reduced subsidies put negative impact on rural investors and employment. The study concludes that the structural adjustment program increases income inequality in Pakistan.

Alderson and Nielsen (1995) investigate the determinants of income inequality in the case of selected developing countries. They mention that a rising population is one of the main causes of rising income inequality in developing countries. If these countries increase labor force participation in the industrial sector the level of income inequality comes down. Sahn and Stifle (2003) finds the impact of urbanization on income inequality in the case of selected African countries. They find that living standard in rural areas lag behind and income inequality worsens living standard in rural areas as compare to urban areas. Barro and Lee (1993) investigate the relationship between school enrollment and income inequality for more than 100 countries based on five-year interval from 1960. The findings of the study show that higher school enrollment increase female labor force participation rate and reduce population growth rate. They find schooling and income distribution has positive relationship for selected countries.

Reardon and Taylor (1996) investigate the relationship of agro-climatic shocks on income inequality and poverty in Burkina Faso by using household farm data of three agro-ecological zones. They review the Foster-Greer-Thorbecke poverty index and Gini co-efficient after and before the drought seasons. The findings show that the poor have fewer opportunities for outside farm jobs and their income is greatly affected by the ups and downs of weather. The empirical results show that income inequality and poverty is on their highest level in droughts and vice versa. Ravallion (1997) tests the hypothesis of income inequality. The study

mentions that the reduction of poverty rate is less responsive to economic growth and reaches zero at high inequality. Two household surveys of 23 developing and developed countries are used for empirical analysis. The results of the study show that initial inequality depends upon the level of poverty, 1 percent increase in income reduces poverty by 4.3 percent in the case of developed countries and 0.6 percent in the case of developing countries. He concludes that for reducing income inequality a fast reduction in poverty is necessary, especially in case of developing countries. Adger (1999) analyzes income inequality for the coastal districts of Vietnam using a primary survey in 1995 and 1996. The study examines the causal relationship between poverty and income inequality. The results of the study show that wages level and remittances play important role in present income inequality in these districts. The results explain that wages level and remittances have a negative relationship with income inequality. He concludes that the concentration of wealth increases income inequality and the empirics also reveal that in these districts concentration of income is very high.

Gregorio and Lee (2002) investigate the relationship between education and income distribution for a panel of countries over the period of 1960 to 1990. The results of the study explain that higher educational attainments play significant role in fair income distribution. The results confirm that there is an inverted U-shaped relationship between education and income inequality. They suggest that government social spending plays an important role in equal income distribution. Okidi et al., (2003) study income inequality in the case of Uganda for rural sector by using household surveys data. The results explain that inequality in agriculture sector decreases from 1992 to 2000 because of remittances and education, the change in income of agriculture sector directly change the ownership of land. These conclusions strengthen the arguments of Adams Jr (1995) that income from nonagricultural sectors plays a key role in decreasing income inequality in rural areas. Bourguignon (2004) investigates the changes in income distribution in the case of Mexico by using simulation equations. The results of the study show that 3 percent growth in per capita income over the 10 year reduces poverty rates by 7 percent. But when income inequality reduction is the ultimate objective, then poverty is reduced more than twice in the case of Mexico.

Ravallion (2004) explains two main factors for poverty reduction at given rates of growth. First higher level of initial inequality gives less benefit to poor population because of poor infrastructure and social services. Second, the distribution of income becomes better with rising development because of tax reforms, demographic changes, trade regime changes and welfare policy reforms. Moreover, if the economic growth is favorable to rural sector this will reduce poverty at the national level. Karray (2005) discusses three ingredients of poverty, such as average income growth, responsiveness of poverty to growth and changes in income distribution with the help of cross country data. The results of the study reveal that 1 percent increase in average income reduces poverty rates by 70 percent in the short run and 90 percent in the long run. The responsiveness of poverty to income is minimal as compared to average income growth. He concludes that both average income growth and responsiveness of poverty to growth are necessary for fairer distribution of income.

Hammond and Thompson (2006) use regional data of the labor market in US for investigating the determinants of income inequality between metropolitan and non-metropolitan areas. The results of this study show that education and entertainment attract the residents of non-metropolitan to move to metropolitan areas and this increase inequality between these areas. Moreover, they mention that social infrastructure and employment opportunities at no-metropolitan areas decrease income inequality in the US. Gao and Cao (2006) study the income inequality between rural and urban China by using Holt-Winter non-seasonal exponential smoothing model. They conclude that income inequality between rural and urban areas increases due to slow income growth in rural areas. Sicular et al., (2006) investigate the factors responsible for the income gap between rural-urban China by using household surveys data of 1995 and 2002. For investigating the income inequality of various population groups in rural-urban China they use Oaxaca-Blinder method of Decomposition. The results of their study to describe that level of education is one of the main factors which is responsible for rural-urban household's income gap in the case of China.

Awan (2007) examines the main factors responsible for income inequality in the case of Pakistan by using integrated households survey data. He concludes that education level has significant impact on income

inequality in the case of Pakistan. He further explains that the starting point of educated and uneducated individuals is same but as experience of educated person increases level of inequality is also increased. Smith (2007) analyzes the determinants of income distribution in case of the Soviet Union by using households and demographic surveys. The empirical results of this study show that human capital determines the national and regional income distribution in case of the Soviet Union. He finds that a well-educated, married middle age man has good health and high income as compare to primary education earner of the same age. The results show that the income gap is huge between occupational employed man and self-employed man and he finds self-employed persons are better in case of the Soviet Union. The Center for Rural Pennsylvania (2007) finds statistically significant differences between rural and urban middle-income households demographically, economically and educationally. Afonso et al., (2008) finds that public spending for redistribution and level of education plays significant role in fair distribution. They conclude that it is the efficiency of public spending, which plays an influential role in income distribution. Li and Xu (2008) analyze the income disparities within the provinces and among the provinces in case of China over the period of 1978 to 2005. The results of this study show that within provinces income disparity is 70 percent more than the regional income disparity in the case of China. They conclude that the process of urbanization and rural-urban labor migration is reducing the income disparities among the process, although it has minor impact in case of regional disparity.

Aikaeli (2010) investigates the income disparities in the case of Tanzania by using household survey data of 2005. The results of the study show that education of rural household plays an important role in reducing income disparity between rural and urban population. Moreover, he concludes that globalization is playing a significant role in reducing income inequality at the national level in the case of Tanzania. Leyaro and Morrissey (2010) investigate the relationship between characteristics of household like size of household, location of household, employment, age and education by using household budget survey data of 1991/92, 2000/01 and 2007 in the case of Tanzania. The results of the study show that level of skill in rural and urban sector becoming a major cause of inequality in Tanzania. Orewan and Lyanbe (2010) study factors

responsible for low income and food calories for rural-urban Nigeria with the help of cross sectional survey by using Ordinary Least Squares (OLS). They conclude that age, education level, household size and sex have significant impact on income inequality between urban and rural Nigeria. Farooq (2010) investigates the impact of education on income inequality in Pakistan by using 2004/05 PSLM survey data. The results of this study show that gender, income inequality is becoming one of the main causes of overall income inequality. Moreover, the results show that income inequality is less in rural areas as compare to urban areas and education has a favorable impact on fairer income distribution in case of Pakistan.

Asad and Ahmad (2011) analyze the relation between economic growth and consumption inequality in the case of Pakistan by using HIES. They use different measures of inequality, including Theil index, Declies Dispersion Ratio, Atkinsion, Mean log deviation, Gini-coefficient and Coefficient of variation for consumption inequality in Pakistan. The results of this study reveal that the poorest 20 percent and 60 percent middle income population, consumption is attached with 20 percent richest populations. As the richest 20 percent increase consumption, the level of income inequality comes down in case of Pakistan. Cheema (2012) investigates the relationship among poverty, income inequality and economic growth in case of Pakistan by using eight household income and expenditure surveys between 1992-93 and 2007-08. The estimated results of the study show that economic growth and income inequality play significant role in reducing poverty in Pakistan. But the absolute magnitude of net growth on poverty is smaller than the gross growth and some effects of growth on poverty offset by rising income inequality. He suggests that for reducing poverty the government should focus on growth by keeping in view better situations for income distribution.

III. THEORETICAL BACKGROUND

Inequality is multidimensional phenomena and following the last six decades, there are number of hypothesizes have been developed for explaining the magnitude of income distribution among nations. Pareto (1897) to Gibrat (1931), Kalecki (1945), Rutherford (1955), Metcalf (1969), Singh and Maddala (1976) and Bourguignon (2003) investigate

the income distribution by using different functional forms. The ceremonial work of Kuznets (1955) establishes relationship between income inequality and stages of development. According to this hypothesis in the initial stages of economic development income inequality increases, but when industrialization increases income inequality comes down. The Kuznets hypothesis has strong theoretical and empirical roots. This hypothesis suggests that after starting from a particular point of time there is inverted U-shaped relationship between per capita income and degree of income inequality (Shafik, 1994; Grossman and Krueger, 1995; Moomaw and Unruh, 1997; McConnell, 1997; Rothman, 1998; De Bruyn et al., 1998 and Suri and Chapman, 1998).

The study of the economic determinants of the distribution of income and its welfare implications remains an empirical issue in case of developing countries. Because in developing countries the macroeconomic variables like aggregate income is showing upward trend with the rising level of income inequality (Fofack and Zeufak, 1999). Anand and Kanbur (1993) highlight the two main problems with Kuznets hypothesis, first by using cross-section data there is no inverted U-shaped relationship between income inequality and economic development (Halkos and Tzeremes, 2011). Second, Kuznets model has some theoretical misspecification as sectoral inequalities and sectoral means of production change over time, so overall inequality may increase or may decrease. Bourguignon and Morrisson (1998) mention that the process of inverted U-shaped of Kuznets is complex. Moreover, rural-urban migration and income differences have endogenous properties. The income distribution under competitive labor market is decided by distribution of factor ownership and factor endowments. But in real life perfect competition is absent and relative labor productivity decides the income distribution among factors of production. This creates inequality in income distribution, so inverted U-shaped is hardly exists. Lewis (1954), Kaldor (1957) gives theoretical background for measuring income inequality as well as explaining its determinants among different sectors of the economy. Alesina and Perotti (1996) empirically investigate the relationship among social-political instability and income inequality. So, following the empirical model of Alesina and Perotti (1996) the model of this study becomes as:

$$GINI_t = f(SSE_t, MII_t, \mathrm{PCI}_t, URB_t, FLF_t) \quad (1)$$

$GINI =$ Income inequality (Gini)

$SSE =$ Level of education (Secondary school enrollment rate)

$MII =$ Macroeconomic instability (Macroeconomic Instability Index)

$PCI =$ Per capita income

$URB =$ Availability of food (Food production index)

$FLF =$ Female labor force participation rate

$t =$ time period

For finding the responsiveness of dependent variable to independent variables, the equation can be written in the following form:

$$GINI_t = \alpha_2 SSE_t^{\beta_{10}} MII_t^{\beta_{11}} Y_t^{\beta_{12}} URB_t^{\beta_{13}} FLF_t^{\beta_{14}} e^{t+u_{2t}} \quad (2)$$

Where

e is the base of natural logarithms and u is the white noise error term

Taking the natural log of both sides of the equation (2)

$$\ln GINI_t = \alpha_2 + \beta_{10} \ln SSE_t + \beta_{11} \ln MII_t + \beta_{12} \ln PCI_t + \beta_{13} \ln URB_t + \beta_{14} \ln FLF_t + u_{2t} \quad (3)$$

MACROECONOMIC INSTABILITY INDEX (MII)

After Keynesian macroeconomics become a compulsory part of economic theory which mainly discusses fluctuations in overall business activities, determinants of interest rate, inflation and exchange rate following the fiscal and monetary policies at national level. So macroeconomic instability becomes the central of concern of policymakers, but measuring the macroeconomic instability still needs some theoretical discussion. Simply, everything going wrong with the above variables is called macroeconomic instability. Few economists have tried to define the precise conditions for macroeconomic instability, but they do not have a theoretical underpinning for precise policy implications. Fischer (1991), Shigoka (1994), Ramey and Ramey (1994), Drugeon and Wignolle (1996), Caballero (2007) have used inflation as a proxy for macroeconomic instability. Ocampo (2005) presents a concept

of macroeconomic stability by involving price stability, fiscal policies and good working of real economies, public debt that is payable by government and private as well as public sector balance sheets. Ali (2015), Ali and Rehman (2015) and Ali and Bibi (2016) uses inflation rate, unemployment rate, budget deficit and trade deficit for measuring macroeconomic instability in Pakistan. Following the methodology of Ali (2015), Ali and Rehman (2015) and Ali and Bibi (2016) this study uses variables like inflation rate (Inf), unemployment rate (UN), the trade deficit (TD) and the budget deficit (BD) for measuring macroeconomic instability in the case of Pakistan. Equal weight is given to each variable following the standard deviation of that variable. The data for all the variables is collected from various issues of Economic Survey of Pakistan and World Development Indicators maintained by World Bank databases.

IV. ECONOMETRIC METHODOLOGY

The use of econometric tools on macroeconomic models is one of the most important aspects within the quantitative economic analysis. In most of macroeconomic data, the involvement of time trend makes the time series data non-stationary and the regression results of this data may be spurious. Nelson and Plosser (1982) mention that mostly time series data of macroeconomic variables have a unit root problem. They conclude that the existence or non-existence of unit root helps to check the authenticity of the data generating process. In the literature, several unit root tests are available for checking the stationarity of the time series data. This study uses Augmented Dickey-Fuller (ADF) unit root test (1981), Phillips Perron (PP) unit root test (1988) and Dickey-Fuller Generalized Least Squares (DF-GLS) unit root test (Elliott et al., 1996).

Dickey and Fuller (1981) propose the Augmented Dickey-Fuller (ADF). The general forms of the ADF can be written as:

$$\Delta X_t = \delta X_{t-1} + \sum_{j=1}^{q} \varphi_j \Delta X_{t-j} + e_{1t} \tag{4}$$

$$\Delta X_t = \alpha + \delta X_{t-1} + \sum_{j=1}^{q} \varphi_j \Delta X_{t-j} + e_{2t} \tag{5}$$

$$\Delta X_t = \alpha + \beta t + \delta X_{t-1} + \sum_{j=1}^{q} \varphi_j \Delta X_{t-j} + e_{3t} \tag{6}$$

Applying OLS and computing τ statistic of the estimated coefficient of X_{t-1} and comparing it with the Dickey Fuller (1981) critical τ values, if the calculated value of τ statistic is greater than the critical value then the data is stationary. On the other hand, if vice-versa the series is non-stationary.

Phillips and Perron (1988) present unit root and PP test is viewed as DF test that made robust to serial correlation with the help of Newey-West (1987) heteroskedasticity and autocorrelation consistent covariance matrix estimator. PP has two main advantages over ADF. The first PP test has strong power to predict the heteroskedasticity and serial correlation in the error term. Second, the user does not need to specify the lag length of test regression. The PP test has following procedure:

$$y_i = \alpha + \beta y_{i-1} + \mu_i \tag{7}$$

Where we include the time trend and exclude the constant term. In this way Z_ρ and Z_τ are two statistic calculated as:

$$Z_\rho = n(\hat{\rho}_n - 1) - \frac{1}{2}\frac{n^2\hat{\sigma}^2}{s_n^2}\left(\hat{\lambda}^2 - \hat{\gamma}_{0,n}\right) \tag{8}$$

$$Z_\tau = \sqrt{\frac{\hat{\gamma}_{0,n}}{\hat{\lambda}^2}}\frac{\hat{\rho}_n - 1}{\hat{\sigma}} - \frac{1}{2}\left(\hat{\lambda}^2 - \hat{\gamma}_{0,n}\right)\frac{1}{\hat{\lambda}_n}\frac{n\hat{\sigma}}{s_n} \tag{9}$$

$$\hat{\gamma}_\rho = \frac{1}{n}\sum_{i=j+1}^{n} \hat{\varepsilon}_i \hat{\varepsilon}_{i-j} \tag{10}$$

$$\hat{\gamma}_n^2 = \hat{\gamma}_{0,n} + 2\sum_{j=1}^{q}\left(1 - \frac{j}{q+1}\right)\hat{\gamma}_{j,n} \tag{11}$$

$$s_n^2 = \frac{1}{n-k}\sum_{i=1}^{n}\hat{\varepsilon}_i^2 \tag{12}$$

where ε_i error term of OLS, k represents the number of covariates, q represent number of lags, $\hat{\gamma}_n^2$ and $\hat{\sigma}$ is standard error of $\hat{\rho}$. In eq. (10) When $j=0$ this represents the variance of the error terms and when $j>0$ this represents the covariance lies between two error term. In eq. (11) when covariances are zero or –ve the auto correlation between the residuals $\hat{\gamma}_{i,n}$ is zero for $j>0$. Then the second term of the eq. (10) disappears and $\hat{\gamma}_n^2 = \hat{\gamma}_{0,n}$ and they can be replaced with each other.

If $\hat{\gamma}_n^2 - \hat{\gamma}_{0,n} = 0$ the in the second term of the eq. (9) disappear.

$$Z_\tau = \sqrt{\frac{\hat{\gamma}_{0,n}}{\hat{\lambda}^2}}\frac{\hat{\rho}_n - 1}{\hat{\sigma}}$$

and $\frac{\hat{\gamma}_{0,n}}{\hat{\lambda}^2} = 1$ then its reduce form is as

$$Z_\tau = \frac{\hat{\rho}_n - 1}{\hat{\sigma}} \tag{13}$$

Hence there is no autocorrelation or unit root problem between the error terms. In this way of applying this procedure on all variables, we can easily find their respective orders of integration of all variables.

Elliott et al., (1996) propose modifying DF test statistic by using Generalized Least Squares (GLS) approach. They claim that the modified DF test has best explanatory power for small sample size data as compared to simple DF and ADF. Moreover, DF-GLS unit root test has improved predicting power when an unknown mean or trend is present. DF-GLS test has following process:

Let

$$z_t = (1, t) \tag{14}$$

In case of y_t time series,

$$\left[y_1, (1-\alpha L) y_2, ..., (1-\alpha L) y_T \right] \tag{15}$$

$$\left[z_1, (1-\alpha L) z_2, ..., (1-\alpha L) z_T \right] \tag{16}$$

regress eq. (15) on eq. (16) and get

$\tilde{\beta}_{GLS}$

where $\alpha = 1 + \bar{c} / T, \mu_0 = 0$ and $\bar{c} = -13.5$ for without trend statistic. Without trend $y = \tilde{y}_t - z_t' \tilde{\beta}_{GLS}$ and then regress ADF with no time trend and intercept. The t-statistic of $\tilde{y}_{t-1}$ is DF GLS statistic. For demeaned case, t is omitted from z_t and $\bar{c} = -7.0$

AUTOREGRESSIVE DISTRIBUTIVE LAG (ARDL) APPROACH TO CO-INTEGRATION

In literature, a number of cointegration tests for macroeconomic analysis are available. Most famous and traditional cointegration tests are the residual based Engle-Granger (1987) test, Maximum Likelihood based on Johansen (1991/1992) and Johansen-Juselius (1990) tests. One thing is common in these tests that they require same order of integration for their analysis. These cointegration tests become invalid and inefficient when the variables of the model have different level of integration.

The ARDL bound testing approach presented by Pesaran and Pesaran (1997), Pesaran and Shin (1999), and Pesaran et al., (2001) has numerous advantages over traditional methods of cointegration. Firstly, ARDL can be applied regardless of the order of integration. Secondly, ARDL bounds testing approach to cointegration can be used for small sample size (Mah, 2000). Thirdly, this approach allows to take a sufficient number of lags for capturing the data generating process in a general to specific modeling framework (Laurenceson et al., 2003). Lastly, ARDL gives efficient and valid detailed information about the structural breaks in the data. This technique is based on Unrestricted Vector Error Correction Model (UVECM) which has better properties for short and long-run equilibrium as compared to traditional techniques (Pattichis, 1999). Pesaran and Shin (1997) and later on Pesaran et al. (2001) mention that under certain environment long-run correlation among macroeconomic variables can be found with the help of the Autoregressive Distributive Lag Model (ARDL). After lag order selection for ARDL procedure, simply OLS can be used for identification

and estimation. Valid estimates and inferences can be drawn through the presence of unique long-run alliance that is crucial for cointegration.

$$\Delta \ln Y_t = \beta_1 + \beta_2 t + \beta_3 \ln Y_{t-1} + \beta_4 \ln X_{t-1} + \beta_5 \ln Z_{t-1} + ... + \sum_{h=1}^{p} \beta_h \Delta \ln Y_{t-h} + \sum_{j=0}^{p} \gamma_j \Delta \ln X_{t-j} + \sum_{k=0}^{p} \phi_k \Delta \ln Z_{t-k} + ... + u_{it} \quad (17)$$

If there exits long-run cointegration relationship among the variables, then for the finding short-run relationship the study uses the Vector Error Correction Model (VECM). The VECM is explained as under:

$$\Delta \ln Y_{it} = \beta_1 + \beta_2 t + \sum_{h=1}^{p} \beta_h \Delta \ln Y_{it-h} + \sum_{j=0}^{p} \gamma_j \Delta \ln X_{t-j} + \sum_{k=0}^{p} \phi_k \Delta \ln Z_{it-k} + \omega ECT_{t-1} + u_t \quad (18)$$

V. EMPIRICAL RESULTS AND DISCUSSIONS

The Table 1 presents descriptive statistic for reviewing the temporal properties of the data. We have analyzed the variables of the model with the help of its Mean, Median, Maximum, Minimum, Standard Deviation, Skewness, Kurtosis, Jarque-Bera and Probability values. Skewness and Kurtosis help to overview the volatilities among the variables of the model and descriptive statistic also explain the normality of the variables. The table-1 reports the descriptive statistic of all variables, including income inequality, secondary school enrollment, macroeconomic instability, per capita income, urbanization and female labor force participation. The estimated descriptive statistic reveals that income inequality and per capita income are negatively skewed whereas secondary school enrollment, macroeconomic instability, urbanization and female labor force participation are positively skewed. The estimated descriptive statistic shows that all variables of the model have positive Kurtosis values. The estimated results of Skewness and Kurtosis indicate that all variables are different from zero and are normally distributed. The calculated values of the Jarque-Bera specify that all variables have finite covariance and zero mean, this also confirms that all variables of the model are normally distributed.

The lower part of the Table 1 reports the correlation matrix among the variables of the model. The results indicate that income inequality has negative and significant correlation with secondary school enrollment, per capita income, urbanization and female labor force participation in Pakistan. The results show that income inequality has positive and insignificant correlation with macroeconomic instability. The results highlight that secondary school enrollment has positive and significant correlation with per capita income, urbanization and female labor force participation. Macroeconomic instability has positive but insignificant correlation with per capita income. Macroeconomic instability has positive and significant correlation with urbanization and female labor force participation. The results indicate that urbanization has positive and significant correlation with per capita income and female labor force participation. The results highlight that there is a positive and significant correlation between urbanization and female labor force participation. Overall estimated results reveal that all variables of the model have positive correlation with each other and most of them are significant.

Normally, time series data have unit root or non-stationary problem which makes regression results spurious. Moreover, for investigating the co-integration among the variables stationarity is necessary and sufficient condition. There are a number of unit root tests available, but we choose Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) and Dickey-Fuller Generalized Least Square (DF-GLS) tests because of their unique properties. The results of unit root tests are presented in table-2. The estimated results of ADF and PP show that income inequality is not stationary at level, but it is stationary at a level when we use DF-GLS. The results reveal that secondary school enrollment, per capita income, urbanization and female labor force participation are not stationary at level by using ADF, PP and DF-GLS. But estimated results of ADF, PP and DF-GLS show that macroeconomic instability is stationary at level. The results of ADF, PP and DF-GLS at first difference show that income inequality, secondary school enrollment, macroeconomic instability, per capita income, urbanization and female labor force participation are stationary. The overall results show that this model has a mixed order of integration which is a suitable condition for applying ARDL co-integration approach.

TABLE 1

Descriptive Statistic

	LGINI	LSSE	LMII	LPCI	LURB	LFLP
Mean	-1.049254	4.167707	-0.825534	28.78773	-1.134345	2.728138
Median	-1.000579	4.095627	-0.846751	28.86288	-1.139023	2.681022
Maximum	-0.891598	4.553279	-0.199087	29.43359	-0.984541	3.148882
Minimum	-1.290257	3.859275	-1.189510	28.03135	-1.258878	2.424803
Std. Dev.	0.127478	0.223079	0.222306	0.416547	0.081619	0.229740
Skewness	-0.418739	0.436339	0.569019	-0.264150	0.244844	0.491562
Kurtosis	1.921113	1.806800	3.204553	1.961256	1.902801	1.954337
Jarque-Bera	2.564882	3.004778	1.838336	1.867372	1.985005	2.832420
Probability	0.277360	0.222598	0.398851	0.393102	0.370648	0.242632
Sum	-34.62539	137.5343	-27.24261	949.9950	-37.43338	90.02854
Sum Sq. Dev.	0.520022	1.592460	1.581439	5.552361	0.213175	1.688968
Observations	33	33	33	33	33	33
LGINI	1.0000					
LSSE	-0.6704 (-5.031)***	1.0000				
LMII	0.14839 0.835	0.3257 (1.918)*	1.0000			
LPCI	-0.5173 (-3.366)***	0.4532 (17.564)***	0.2661 1.5372	1.0000		
LURB	-0.5682 (-3.844)***	0.5851 (31.988)***	0.3365 (1.989)*	0.9820 (29.012)***	1.0000	
LFLP	-0.5967 (-4.141)***	0.6750 (24.910)***	0.3673 (2.199)**	0.9321 (14.339)***	0.9726 (23.307)***	1.0000

Note: The asterisks ***, ** and * denote the significant at %1, 5% and 10% levels, respectively

TABLE 2

Unit Root Tests

Variables	ADF	PP	DF-GLS
LGINI	-2.052709	-1.433104	-2.044728**
LSSE	0.302891	0.556579	1.216241
LMII	-2.953044**	-3.033310**	-2.862015***
LPCI	-1.914221	-1.980072	0.186805
LURB	1.607850	2.883489	0.315554
LFLP	0.328981	0.864679	0.776305
At First Difference			
ΔLGINI	-3.973495***	-2.990615**	-4.045170***
ΔLSSE	-6.710352***	-6.710352***	-6.785395***
ΔLMII	-7.902321***	-8.348556***	-7.547342***
ΔLPCI	-5.063244***	-5.126295***	-4.920152***
ΔLURB	-5.584114***	-5.584011***	-5.387767***
ΔLFLP	-5.450431***	-5.457515***	-5.314809***

Note: The asterisks ***, ** and * denote the significant at %1, 5% and 10% levels, respectively. The figure in the parenthesis is the optimal lag structure for ADF and DF-GLS tests, bandwidth for the PP unit root test is determined by the Schwarz Bayesian Criterion.

The Table 3 reports the results of lag order selection criterions for variables of the model. On the basis of sequential modified LR test statistic (LR), Final prediction error (FPE), Akaike information criterion (AIC), Schwarz information criterion (SC) and Hannan-Quinn information criterion (HQ) optimal lag length is selected. The results of the Table 3 reveal that all criterions allow optimal lag length 2, except Schwarz information criterion. Thus, following the sequential modified LR test statistic, Final prediction error, Akaike information criterion and Hannan-Quinn information criterion lag length 2 is used for the variables of the model.

TABLE 3

Unit Root Tests VAR Lag Order Selection Criteria LGINI, LSSE, LMII, LPCI, LURB, LFLP Time Period: 1980-2015

Lag	LogL	LR	FPE	AIC	SC	HQ
0	247.1290	NA	7.06e-15	-15.55671	-15.27916	-15.46623
1	419.9893	267.6547	1.08e-18	-24.38641	-22.44358*	-23.75309
2	474.5191	63.32494*	4.35e-19*	-25.58188*	-21.97378	-24.40573*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table 4 reports the results of the ARDL co-integration of income inequality, secondary school enrollment, macroeconomic instability, per capita income, urbanization and female labor force participation. For testing the null hypothesis of no co-integration among the variables of the model W-statistic and F-statistic are used. The results show that calculated F-statistic (22.3205) is greater than the upper bound (4.5401) value of Pesaran et al., (2001) at 5 percent and the calculated W-statistic (133.9231) is greater than the upper bound (27.2404) value of Pesaran et al., (2001) at 5 percent. So alternative hypothesis is accepted and null hypothesis of no co-integration is rejected. This confirms that income inequality, secondary school enrollment, macroeconomic instability, per capita income, urbanization and female labor force participation have co-integrational relationship in case of Pakistan.

TABLE 4

ARDL Bounds Testing Approach Dependent Variable LGINI
ARDL (1,0,1,0,1,1)

Critical Value	F-Statistics 22.3205		W-statistic 133.9231	
	Lower Bound	Upper Bound	Lower Bound	Upper Bound
95%	3.0902	4.5401	18.5411	27.2404
90%	2.5740	3.8197	15.4442	22.9185

ARDL bounds have approved co-integration among the variables of the model. Now we can investigate the long run relationship by using income inequality as dependent variable and secondary school enrollment, macroeconomic instability, per capita income, urbanization and female labor force participation as independent variables. The table-5 reports the long run results of the model. The results reveal that secondary school enrollment has negative and significant impact on income inequality. The estimates explain that 1 percent increase in secondary school enrollment in Pakistan decrease income inequality by (-1.6751) percent and this relationship is significant at 1 percent. These results also support the finding of (Gregorio and Lee, 2002; Hammond and Thompson, 2006; Smith, 2007 and Awan, 2007). These studies claim that level of education decide the level of income among individuals. The results show that macroeconomic instability has a positive and significant relationship with income inequality. The calculated results show that 1 percent increase in macroeconomic instability, increase income inequality in Pakistan by (.29877) percent and this relationship has 1 percent level of significance. Afridi et al., (1984) and Asad and Ahmad (2011) use inflation and economic growth as determinants of income inequality. These studies conclude that macroeconomic situations decide the level of income distribution among factors of production. The results show there is a positive and significant relationship between per capita income and income inequality. The results highlight that 1 percent increase in per capita income increase income inequality in Pakistan by (.36743) percent and this relationship is significant at 1 percent. Gibrat (1931) and Kalecki (1945) also find a positive relationship with income inequality and per capita income. The coefficient of urbanization shows that there is a positive, but insignificant relationship between urbanization and income inequality. The estimates of female labor force participation show that female labor force participation has a positive and insignificant relationship with income inequality. Secondary school

enrollment in Pakistan has negative influence on income inequality in Pakistan whereas macroeconomic instability in Pakistan becomes source to increase income inequality in Pakistan. The empirical results confirm that per capita income becoming a big source of income inequality and redistribution of per capita income reduces income inequality in Pakistan. The overall long run results show that for reducing income inequality, Pakistan should increase secondary school enrollment and reduce macroeconomic instability.

TABLE 5

Estimated Long Run Coefficients using the ARDL Approach
ARDL (1,0,1,0,1,1) Dependent variable is LGINI
Time Period 1981-2015

Regressor	Co-efficients	Standard-Error	T-Ratio (Prob)
LSSE	-1.6751	.15670	-10.6897[.000]
LMII	.29877	.029215	10.2266[.000]
LPCI	.36743	.078943	4.6544[.000]
LURB	1.0316	.76010	1.3572[.194]
LFLP	.17827	.12912	1.3806[.186]
C	-3.7383	3.5524	-1.0523[.308]

After finding the long run relationship among the variables of the model, now we can find the short run dynamic by using Vector Error-Correction Model. The short run relationship among the variables of the model is presented in table-6. The short run results show that secondary school enrollment has negative and significant relationship with income inequality in Pakistan. The estimates show a 1 percent increase in secondary school enrollment reduce income inequality in Pakistan by (-1.2949) percent. These results also support the finding of (Gregorio and Lee, 2002; Hammond and Thompson, 2006; Smith, 2007 and Awan, 2007). These studies claim that level of education decide the level of income among individuals. The coefficient of macroeconomic instability shows that there is positive and increasing relationship between macroeconomic instability and income inequality in Pakistan. The results

show a 1 percent increase in macroeconomic instability increase income inequality by (. 098034). Afridi et al., (1984) and Asad and Ahmad (2011) conclude that macroeconomic situations decide the level of income distribution among factors of production. The estimated results show that there is positive and significant short run relationship between per capita income and income inequality in Pakistan. The short run coefficient of urbanization shows 1 percent increase in urbanization (2.1658) percent rise is occurring in income inequality in Pakistan. The results show that there is a negative, but insignificant relationship between female labor force participation and income inequality in Pakistan. The short run dynamic shows that secondary school enrollment and macroeconomic instability are more fruitful for reducing income inequality in Pakistan. The negative and significant coefficient (-.97206) of ECM is theoretically correct. The negative and significant value of ECM shows the speed of adjustment from short run to long run equilibrium. The estimates of ECM reveal that short run needs one and half year to converge in the long run equilibrium. Moreover, short run deviations in the last period are corrected by (97.206) percent in future in case of Pakistan.

TABLE 6

Error Correction Representation for the Selected ARDL Model
ARDL (1,0,1,0,1,1) Dependent variable is dLGINI
Time Period 1981-2015

Regressor	Co-efficients	Standard-Error	T-Ratio (Prob)
dLSSE	-1.2949	.14789	-8.7559[.000]
dLMII	.098034	.021968	4.4625[.000]
dLPCI	.35717	.074744	4.7785[.000]
dLURB	2.1658	.93673	2.3120[.032]
dLFLP	-.090876	.10166	-.89393[.382]
ECM(-1)	-.97206	.087432	-11.1179[.000]

R-Squared	.94742	R-Bar-Squared	.90141
S.E. of Regression	.017562	F-Stat. F(10,20)	28.8289[.000]
Mean of Dependent Variable	-.0043217	S.D. of Dependent Variable	.055931
Residual Sum of Squares	.0049346	Equation Log-likelihood	91.5676
Akaike Info. Criterion	76.5676	Schwarz Bayesian Criterion	65.8127
DW-statistic	1.6721		

The diagnostic tests are used for finding serial correlation, functional form, normality and Heteroscedasticity among the variables of the model. The results of diagnostic tests are presented in Table 7. The results of the Lagrange multiplier test of residual serial correlation show that there is no serial correlation between the variables of the model. Ramsey's RESET test using the square of the fitted values show that the model has correct functional form. Normality based on Skewness and Kurtosis explains that the time series data of all variables are normally distributed. The results show that there is no heteroscedasticity in data.

TABLE 7

Diagnostic Tests

Test Statistics	LM-Version	F-Version
A-Serial Correlation CHSQ(1)	1.3867[.239]*F(1,15)*	.70240[.415]*
B-Functional Form CHSQ(1)	1.5212[.217]*F(1,15)*	.77406[.393]*
C-Normality CHSQ(2)	1.3313[.514]*	Not- applicable
D-Heteroscedasticity CHSQ(1)	.79430[.373]*F(1,29)*	.76260[.390]*

A: Lagrange multiplier test of residual serial correlation
B: Ramsey's RESET test using the square of the fitted values
C: Based on a test of Skewness and kurtosis of residuals
D: Based on the regression of squared residuals on squared fitted values

The stability of model enables us to see either the estimated model shifts or not over the selected time period. Hansen (1996) mentions that misspecification of model may provide biased results that influence the explanatory power of the results. The Cumulative Sum (CUSUM) and the Cumulative Sum of the Squares (CUSUM sq) tests are used for examining the stability of short run and long run coefficients of the model (Brown, Durbin and Evans, 1975). The results of Cumulative Sum (CUSUM) and the Cumulative Sum of the Squares (CUSUM sq) tests are reported in figure-1 and figure-2. The figures show that Cumulative Sum (CUSUM) and the Cumulative Sum of the Squares (CUSUM sq) are between the two critical lines and does not go outside the critical boundaries. The figures of Cumulative Sum (CUSUM) and the Cumulative Sum of the Squares (CUSUM sq) confirm that the selected model is correctly specified.

Figure 1

Plot of Cumulative Sum of Recursive Residuals

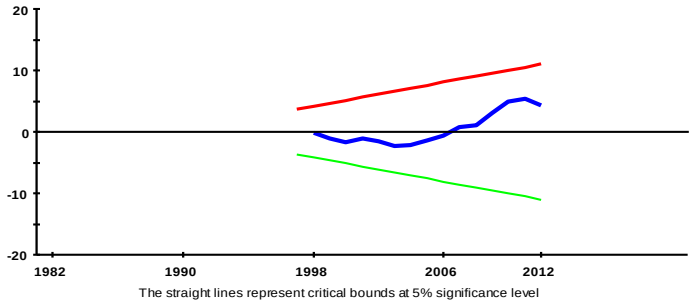
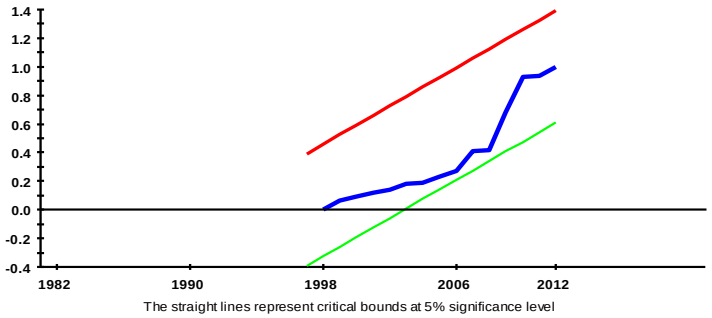


Figure 2

Plot of Cumulative Sum of Squares of Recursive Residuals



VI. CONCLUSION AND POLICY IMPLICATIONS

The conclusions are drawn on the basis of empirical results and discussions. Some recommendations and policy implications are presented here. The main objective of this study is to examine the impact of macroeconomic instability on income inequality in Pakistan over the period of 1980 to 2015. For reviewing the macroeconomic situation, a comprehensive macroeconomic instability index is constructed in case of Pakistan. This study uses inflation rate, unemployment rate, trade deficit and budget deficit for the construction of macroeconomic instability index for Pakistan. Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) and Dickey-Fuller Generalized Least Squares (DF-GLS) unit root

tests are used for checking stationarity of the data. Autoregressive Distributed Lag (ARDL) model has been used for examining the co-integration among the variables of the models and Vector Error-Correction model is used for short run dynamics of the models. In this study macroeconomic instability, secondary education, per capita income, urbanization and female labor force participation rate are used as explanatory variables when GINI is dependent variable. The results of unit root tests show that there is a mixed order of integration among the variables of the model. The long run results of the model show that secondary school education has a negative and significant impact on income inequality. The long run estimates show that there is a positive and significant relationship between macroeconomic instability and income inequality. Per capita income has a positive and significant impact on income inequality. But urbanization and female labor force participation have positive and insignificant long run relationship with income inequality. The short run dynamic shows that secondary school education has negative and significant relationship with income inequality. The short run coefficients reveal that macroeconomic instability, per capita income and urbanization have a positive and significant impact on income inequality. Whereas in short female labor force participation has negative, but insignificant impact on income inequality. The estimates of ECM reveal that short run needs one and half year to converge in the long run equilibrium. Moreover, short run deviations in the last period are corrected by (97.206) percent in the next period. On the basis of estimated results one can easily understand that macroeconomic instability boosting the evil of income inequality in the case of Pakistan.

On the basis of empirical results there are certain valuable policy suggestions for developing like Pakistan to overcome increasing income inequality. The results show that there is a positive and significant relationship between macroeconomic instability and income inequality in Pakistan. So, the government should require structural changes in its fiscal and monetary policies to reduce income inequality in Pakistan. For reducing the gap between rich and poor, the government should increase the share of direct taxes. The tax direct taxes have a dual impact on the economy. First, the share of direct taxes increases the welfare to the poor segment of the society on the other hand government would be able to

collect more revenues for budget. In this way, government can increase the development expenditures for enhancing equal income distribution. The major part of the labor force is uneducated and unskilled so by providing better education and working skills to labor the level of income inequality can be reduced. The level of urbanization should be increased as an urban sector has more employment opportunities for increasing social progress. As more than 60 percent population of Pakistan is residing in rural areas and these rural areas have less female labor force participation. So, by increasing female labor force participation in Pakistan income inequality can be reduced. Progress and prosperity is impossible without the reduction in unemployment. There are two major elements which can reduce the unemployment, use of labor intensive methods of production and adoption of self-reliance policy. Modern technological training facilities should be provided to labor. In this way unemployed people will get a chance to enhance their skills and become able to earn more reasonable income.

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