

MEASURING INEQUALITY OF OPPORTUNITY IN PAKISTAN: PARAMETRIC AND NON-PARAMETRIC ANALYSIS

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Abstract. The present study estimates inequality of opportunity for Pakistan by using parametric and non-parametric analysis. Pakistan Social and Living Standard Measurement Surveys of two time periods, 2005-06 and 2010-11, have been utilized. Father's education, mother's education, father's occupation, region of residence, and gender have been used as the circumstance variable while labour earnings and household income per capita are outcome variables. Three indices of Generalized Entropy measures have been utilized to estimate inequality of opportunity. Results depict that inequality of opportunity in labour earnings declines by 11 percentage points in Pakistan, during study period. The inequality of opportunity, for household income per capita, declines by 16 percentage points for Pakistan. Among all circumstances, gender is the highest contributor followed by region of residence, father's education, and father's occupation.

Keywords: Inequality of opportunity, Parametric analysis, Non-parametric analysis, Pakistan

JEL classification: D63, I31

I. INTRODUCTION

Since last two decades, a huge literature on the measurement of inequality has been emerged. Broadly, this literature can be classified into two types:

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measurement of inequality, and determinants/causes of inequality. Among the determinants/causes of inequality, the impact of economic development on inequality is the most debatable issue after the work done by Kuznets (1955). The inequality-growth relationship suggests several channels through which inequality can affect growth. Unobservable efforts (Mirrless, 1971), accumulation of saving (Galenson and Leibenstein, 1955), and size of investment projects (Barro, 2000) are amongst the important paths through which equality may enhance growth (Marrero and Rodríguez, 2012). Contrary, political instability (Alesina and Perotti, 1996), capital market imperfections (Banerjee and Newman, 1991), unproductive investment (Mason, 1988), and regional disparity (Sandilah and Yasin, 2011) are amongst main reasons of negative relation between inequality and economic growth. Depending upon the dominance of the above mentioned channels, the inequality can be negatively or positively affected by economic growth.

The impact of inequality on growth turns out to be ambiguous because several studies investigated the positive relation while some explores the negative (Marrero and Rodríguez, 2012). Studies highlighted that this might be due to usage to contradictory inequality indices (Knowles, 2001; Székely, 2003) or the inconsistent econometric methods (Forbes, 2000). This ambiguity can be due to the indistinct conceptual understanding of inequality (Marrero and Rodríguez, 2012). The policy makers and the government adopt several measures to remove inequality without the clear understanding of its dimensions. For the minimization of inequality it is very much essential to target the right path so that level playing field is provided for all individual. After the seminal work by Roemer (2000), it has been accepted that fraction of inequality is linked to the differences in circumstances and opportunities faced by individual (Hassine, 2009). Inequality of opportunity (IO) refers to that inequality that is due to circumstances, which are beyond the control of individual, and effort. The circumstances are those factors which an individual receives by the day of birth, *e.g.* family background, region of residence, father's education, race etc. The second factor effort, is entirely linked towards individual's choice, *e.g.* number of hours worked, occupational choice, migration etc. Consequently, the overall inequality is the result of heterogeneity in social origins and other factors such as effort (Marrero and Rodríguez, 2012). Coming to our starting point, whether inequality has positive or negative relation with growth, the two fractions of inequality have different effect on growth. The provision of equal circumstances contributes a larger portion in the enhancement of growth rather than effort, because circumstances play dual role. Firstly, circumstances directly minimize the outcome inequality. Secondly, also play a role

for the minimization of outcome inequality through effort (de Barros *et al.*, 2009). Hence, the success of policy interventions in alleviating inequalities and improving welfare depends upon their efficacy in compensating for the circumstance-based disadvantages and in expanding opportunities (Peragine, 2004; Ferreira and Gignoux, 2008).

Several studies estimated inequality of opportunity for different countries; I have not come across any study which does it for Pakistan. IO to be a useful for policy, we need to estimate of how much of total inequality is due to IO. Energies should aim to get rid of that part of inequality which is due to circumstances, which are beyond the control of an individual. Given this context, the present study estimated the inequality of opportunity for labour earnings and household income per capita in case of Pakistan. By using PSLM of two time periods, 2005-06 and 2010-11, study estimated IO by utilizing parametric and non-parametric techniques.

The rest of the study is organized as: section II discusses the studies relevant to inequality of opportunity, section III explains the parametric and non-parametric techniques to estimate IO. Section IV presents the results of parametric and non-parametric analysis and last section concludes the study and recommends certain policies to minimize IO in Pakistan.

II. REVIEW OF LITERATURE

There is immense literature available on this topic and several researchers estimated IO. Most of the studies are found in case of Brazil and EU countries. Marrero and Rodríguez (2012) have tested whether the effects of macroeconomic changes on income inequality depend on their influences on the total inequality constituents, *i.e.* inequality of opportunity (IO) and inequality of effort (IE). The research uses US data from PSID for a period of 1970-2009. A dynamic model was used to relate the components of inequality with macroeconomic factors as real GDP, inflation rates, outstanding consumer credits, public welfare and health care expenditures. The results revealed significant negative effect of real GDP and outstanding credits upon IO and IE, while positive significant effect of inflation only on IE, and welfare expenditures only on IO.

Gamboa and Waltenberg (2012) used PISA data of 2006 and 2009 to detect the IO for educational achievement in six Latin American Countries using non-parametric approach. School type, gender, parental education and their combinations are taken as circumstance variables. Countries are ranked according to the degree of IO prevailing in them on the basis of decomposable inequality index. The unconditional inequalities based rankings showed

limited similarity with the conditional inequalities based rankings. Gross inequality is decomposed into opportunity and effort fraction. Overall, gender based IO was insignificant except for reading whereas school type based IO was highly significant. The index of IO ranged from below 1% to 27%, varying significantly across years, countries, subjects and circumstances. Bootstrap and alternative index are used to verify the results.

Marrero and Rodríguez (2012) explored the reasons for the inconclusive effects of income inequality on growth. They postulated one potential reason for this confusion to be the two contradictory components of income inequality, *i.e.* IO and IE. These components affect growth in opposite directions using means of min approach and hence, the direction of relationship remains subject to the direction of the dominant force. Separate analysis for IO and IE was taken up using the PSID database for 23 states of the US in 1980 and 1990. A negative relationship was observed between IO and growth, and a positive one between IE and growth.

Dabalen *et al.* (2015) conducted a study to inquire the IO among Egyptian Children in access to basic needs. It analyzed the degree of EO regarding basic services taking gender, birth place and family background as circumstance variables and health, access to basic services and income as outcome variables. Data for 2000 and 2008 were taken from Egypt Demographic and Health Survey (DHS) the Egypt Household Income, Expenditure and Consumption Survey (HIECS). Results for IO reveal that although reduced it is still significant in case of school enrollment and healthcare. IO is insignificant for malnutrition, safe drinking water availability, electricity, sanitation etc. The study thereby reveals that Egypt has attained significant progress with reference to the availability of and access to basic services for children and mothers, in some cases with a pro-poor overall effect.

Abras *et al.* (2013) endeavored to quantify the degree of IO in labour market for selected European and Central Asian (ECA) countries, to compare across ECA countries and with self-assessments and to compare ECA results with Latin American and Caribbean (LAC) countries. Decomposing inequalities into circumstance variables (gender, parental education, minority status etc.) and effort variables (education, age), Human Opportunity Index and Theil-L index were calculated using data from the Life in Transition Surveys (LiTS) 2006. The findings showed significant circumstance based IO in employment status for ECA region and high heterogeneity across countries. Significant positive correlation was observed between the Theil-L index and the self-perception of equality. The comparison suggested that ECA countries do much better than the LAC countries.

Dabalen *et al.* (2015) conducted a study on economic situation, especially IO in South Africa. HOI and Gini coefficients were used for measuring IO. After the global economic crisis, South Africa's economy has yet been unable to gain momentum. Industrial concentration, labour market rigidities, skill shortages and low savings and investment rates have created hindrance in potential growth. Growth has also been anti-poor leading the income Gini reach about 0.70 in 2008 and consumption Gini 0.63 in 2009 which makes South Africa one of the most unequal countries in the world. Significant inequality was observed in case of employment opportunities and income earnings. Circumstances such as ethnicity, location, gender, and family background proved to be the most important determinant of IO in basic needs, education, employment and income. The report suggested a special focus on human capital development esp. in younger generation along with social assistance.

Marrero and Rodríguez (2011) estimated the IE and IO for US by using the panel data from 1970-2007. The panel data income dynamics database (PSID) provides the data on parental education information over a long time period. Two circumstance variables like father's education and race with log of Theil index are used in this study. The study followed the decomposition technique of Björklund *et al.* (2011). Results found significant differences between the nonparametric and parametric approaches. Moreover, the degree of correlation between effort and circumstances which has significantly increased over the period 1970 and 2007 in the United States, explains between 5% and 20% of total IO. In addition, race is the main circumstance during the 1970s and 1980s, accounting for more than 50% of the direct IO, while parental education take the lead in the last two decades.

Ferreira *et al.* (2011) estimated lower bound estimator of the share of IO in total inequality in Turkey by using TDHS and HBS datasets of 2003-2004. Language, family background, ethnicity, place of birth, consumption expenditures, and income are variable used in the study. The study computed wealth index by following Roemer (2000) definition of advantage variable. This is computed as vector of assets and durable goods. Results found 26% IO of overall inequality imputed in consumption. Moreover, among one quarter and one third of the observed inequality between women in Turkey is due to unequal opportunities. The opportunity profile indicates that in rural areas of Eastern provinces opportunity deprivation is high in families headed by women with no formal education. This phenomenon is high in rural areas than urban.

Singh (2011a) conducted a study to determine the severity of IO among the children in access to Primary education in India. He used Inequality of Opportunity Index and Human Opportunity Index for this purpose using the National Family Health Survey (NFHS) data of 1992-93 and 2005-06. The study estimates the impacts of caste, tribes, religion, gender, residence, wealth quintiles, parental education and number of siblings on the completion of 5th grade on time. He found high IO in India varying, especially by geography. IO decreased from 1992-93 to 2005-06 but varying significantly across geography. This made him suggest for regional policy revisions along with those at national level. On individual circumstances, he found parental education be a strong determinant of children's access to primary education thereby suggesting the provision of adult literacy programmes.

Singh (2011b) focused the within households gender based IO in academic skills among India children using Mathematics and Reading test scores. Household fixed effects linear probability models are used on data of 1010 households having exactly one male – one female child in the age 8-11 years. The results provided an evidence of the disadvantaged position of the female child as compared to the male child along with significant GB intra-household IO in academic skills. The differential in educational expenditures is also estimated which represents much lower expenses carried out in female education than male.

Hermann and Horn (2011) conducted a study to analyze the determinants and effects of institutional structures on IO, the effects of the early subject selection in Hungary and the reasons of their evolution. IO is taken as the effect of socioeconomic backgrounds of students on their performances. For the general case, research was conducted on selected educational institutes of 29 OECD countries. The results suggested that the number of school types and their earlier selection significantly increase IO. For Hungary the early age selective tracks are highly beneficial for rich families and lead to an increase in IO. He then determined three major factors responsible for the evolution of pre-subject selection system of education in Hungary, *i.e.* historical conditions, decentralization and democracy.

Hoyos and Narayan (2011) measured IO among children with the help of decomposition method applied upon HOI to analyze the extent to which gender contributes to inequality in children's access to the basic minimum opportunities. DHS data for 47 countries are used for a period of 2003-2010. Opportunities selected are polio immunization, measles immunization and

school attendance among 6-11 years old children and 12-15 years old separately. Circumstance variables include gender, location, wealth quintile and gender of the household head. IO, on average and across countries, is higher in school attendance than immunization. Moreover, IO due to gender proved to be much lesser than due to household factors. However, in some countries gender still has a significant influence on child's access to certain services. The correlations among IO in the same sector are higher than those in different sectors.

In contrast to stochastic dominance criteria and traditional inequality indices used for comparing and measuring IO, Yalonzky (2009) suggested an additional method to assess IO with two indices, of dissimilarity across distributions, based on traditional homogeneity test of multinomial distributions. The study aims at estimating the variability in inequality of educational opportunity in Peru from elder to younger groups of adults using 16,515 households from Peruvian National Household Survey, ENAHO 2001. IO is calculated for the education attainment level and the quality of education (school type); both separately and jointly. IO decreased monotonically for the school type from elder to younger groups. IO for educational level and joint outcome showed signs of decrease but not monotonic.

Checchi and Peragine (2010) estimated the IO in earnings by using the data of two Italian regions, south and north. The study decomposed inequality into ethically offensive and ethically accepted part. South region has stronger effect than north with reference to IO. South region has low income per capita and high income inequality. Moreover, higher inequality was in south region schools. By using the sample of 15 years old students the study found that parental education as main determinant in the level of individual achievements.

Singh (2012b) used Indian Human Development Survey of 2004-05 to estimate the IO in India. The study used place of birth, parental education, religion, parental occupation, and caste as circumstance variables. Result indicates that, in case of urban India, parental education is most important contributor to consumption expenditure inequality. Caste and place of birth is important contributor to consumption inequality in case of rural India. The circumstance contributes to 16%-25% in consumption expenditure inequality in case of urban while contributes 20%-23% in rural India.

Ferreira *et al.* (2011) used three datasets in order to estimate IO in Turkey. The study used TDHS dataset of 2003 and estimate IO. IO of consumption is estimated by using HBS. Results found place of birth and

father's education as main circumstances of IO. Moreover, the women born in rural areas are most deprived than urban women. Controlling other circumstances, the mother with no-formal education accounts for largest share in the variance of IO.

Jusot *et al.* (2013) inquire the extent to which the differential circumstances contribute in overall inequality. The research proposed a method of quantification of the contribution of IO and IE to overall health inequality by using Logit and Multinomial Probit Models. French Health, Health Care and Insurance Survey (ESPS survey) data on 6074 individuals for the year 2006 were used for three sets of variables, *i.e.* circumstance, effort and demographic characteristics. The estimated share of inequality due to circumstances (upto 46%) turned out to be much larger than due to effort (at most 8%). The estimated contribution differed very little from the self-assessed contribution.

Milanovic (2009) is of the view that income depends largely upon two major factors, *i.e.* the country of residence and the income class of parents within that country; disregarding migration. Using database World Income Distribution (WID) for data of 120 countries for the year 2002, the research suggested that at least 80% of the variation in the income of the world population of about six billions can be attributed to the afore mentioned factors. Such heavy impact of circumstances suggests limited role of luck or effort in the improvement of income level. Results showed that having one grade higher income class of parents, on average, is equivalent to living in an eleven percent richer country.

Lefranc *et al.* (2009) examined the relationship between Inequality of Income and Inequality of Opportunity to acquire income, for international comparison across countries and also to inquire the impact of the equality of opportunity on the inequality of outcome. Data for male household heads aged 25-40 (25-50 in West Germany) for nine developed countries were used for this research. Circumstance variable or social origin is measured by the parental education and occupation. For the same of nine developed countries, inequalities were the highest in US and Italy while lowest in the Scandinavian Countries. Strong differences in the degree of EO across countries were observed along with a strong correlation between inequality of outcomes and inequality of opportunity.

Dias (2009) uses two alternative approaches to measure IO in health sector of India by using NCDS cohort member parental background. Results of structural and reduced form indicate that exposure to financial difficulties during childhood, parental social status, and mother's education is significant

circumstances. The study explores that focus should be given to IO rather than inequality of outcome.

Ferreira and Gignoux (2008) estimated the opportunity inequality in consumption expenditure and income by using parametric and non-parametric approaches. The study used the data of six Latin American countries: Brazil, Central America, Colombia, Ecuador and Peru. Race, gender, family background, and place of birth are the circumstance variables. Results indicate 24%-50% consumption inequality in Latin American countries. IO is more in Central America and Brazil than other countries. Moreover, ethnic origin and place of birth are most important determinant of IO than outcome of poverty. This phenomenon is greater in Peru, Guatemala and Brazil than other countries.

Bourguignou *et al.* (2007) decompose the female and male earning distribution in Brazil to find the IO. By using PNAD data from 1996 the study finds that parental education is the most important circumstance which affects earnings. Moreover, race and place of birth are the secondary circumstances that affect earnings. Results indicate a substantial share of inequality in Brazil and lower bound share of IO is 20%. Results of Theil index show that total inequality within gender group is more than 5%. Family background, the most important circumstance variable, contributes 55%-75% to IO.

Roemer (2006) measured economic development on the basis of the degree of equalization of opportunity that the society has been able to achieve regarding income acquisition. GNP per capita is used to measure economic development as a social concept while parental education is used as a circumstance variable. The IO is measured for a number of developing countries as well as developed countries separately terms of Gini coefficient. In highly developed economies, IO was found to be less than 10% of total inequality especially in welfare states where it was less than 1%, while for developing economies it varied between 15% and 30%.

Lefranc *et al.* (2009) consider three main determinants of outcome namely effort, circumstance and luck. Considering these determinants, a model of equality of opportunity (EO) was formulated; testable even with incomplete information on effort and circumstances. Luck, encompassing the non-responsibility factors affecting outcomes, was even-handed to satisfy the equality of opportunity. Following Davidson and Duclos (2000), non-parametric tests of stochastic dominance were used for the analysis of EO for income acquisition for France using household data "Budget des Familles" (BdF) over 1979-2000. The results show that the intensity of IO tends to

decrease overtime and the risk of social lotteries also appears similar for different social groups.

Cogneau and Gignoux (2005) studied the effects of variations in educational opportunities on labour market inequalities in the highly inegalitarian society of Brazil. Using Roemer's (2000) approach on data from four editions of the PNAD survey for over two decades (1976-96), the increase in overall inequalities and in IO for 40-49 years old males' earnings were analyzed. Semi-parametric decompositions of the effects of schooling expansion, changes in the structure of earnings and in the intergenerational educational mobility are designed and implemented. The results showed little variations in earnings inequalities over the period, reaching the highest in 1980s due to hyperinflation. Both overall and specific earning inequalities increased specifically due to differences in distribution of education, reducing sharply post-World War II. Moreover, a fall in returns to education from 1988-96 resulted in equalizing labour market opportunities. Changes in educational mobility, however, did not affect earnings inequalities significantly, whereas, in equalizing opportunities in future, they are expected to play a prominent role.

III. DATA AND METHODOLOGY

The debate of IO has established the immense attention among the policy makers, researchers, and academia. Usually, it has been measured by the outcome and family background, but has no universal definition. Sociologists measured it as the relationship among child's outcome and family background, parental status, etc.

MEASUREMENT OF INEQUALITY OF OPPORTUNITY

To develop the empirical foundation of the IO let's consider z , as the individual's outcome, *i.e.* income, access to education or other social services etc. This outcome has certain determinants, under control and beyond the control. The determinants which are beyond the control of the individual are also called circumstances. Let's consider a , the circumstances. The other determinants, which are under the control of individual, are called choice or effort. Let's consider b , the effort variables and u as a factor of luck or other random factor. Consider μ , the function which relates the relationship among outcome and its determinants.

$$\text{Hence, } z = \mu(a, b, u) \quad (1)$$

According to Roemer (2000), circumstances are economically exogenous, meaning these are beyond the control of individual. Efforts may

be endogenous to circumstance, meaning circumstances can affect effort. For example, region of residence or father’s education is beyond the control of individual, one cannot change these factors. But circumstances can affect one’s occupational or educational choice etc. We can write this fact as:

$$z = \mu [a, b(a, v), u] \tag{2}$$

Equation (2) states that outcome is the function of circumstances, effort, and luck while effort is again the function of circumstances and random term v . According to equality of opportunity requires that $F(z | a) = F(z)$. This expression implies three conditions:

- (a) The circumstances have no causal direct impact on outcome $\frac{\partial_{\mu}(a,b,u)}{\partial_a} = 0, \forall a$.
- (b) Effort is independently distributed from all circumstances: $G(b | a) = G(b), \forall b, \forall a$.
- (c) Luck or random term is independent of circumstances: $H(u | a) = H(u)$.

For the measurement of IO, we have to measure the extent to which $F(z | a) \neq F(z)$. This study is following the complementary approach as used by Ferreira and Gignoux (2008). The scalar indices of IO are constructed through the partitioning the population by categories of circumstances. Consider a , vector of circumstance variable. $\{z_i^k\}$ is the division of the distribution such that $a_i^k = a^k \Leftrightarrow i \in k, k = 1, \dots, K$. $\{z_i^k\}$ is the division of the population into K groups. It shows that in vector a all the members have identical circumstances. We are basically interested to measure the IO in this partition through a scalar measure $\theta: \{z_i^k\} \rightarrow \mathfrak{R}_+$.

In case of between-group inequality, stochastic independence implies that:

$$F(z | a) = F(z) \Rightarrow IB[\{z_i^k\}] = 0 \tag{3}$$

$IB[\{z_i^k\}]$ shows the between group inequality. It follows two natural candidates for $\theta: \{z_i^k\} \rightarrow \mathfrak{R}_+$ would be indices of the form, absolute and relative:

$$\theta: [\{z_i^k\}] = IB[\{z_i^k\}] \tag{4}$$

$$\text{or } \theta: \left\{ \left\{ z_i^k \right\} \right\} = \frac{IB \left[\left\{ z_i^k \right\} \right]}{I \left[F(z) \right]} \quad (5)$$

Equation (4) shows the measurement of IO as absolute level. It measures the IO between groups whose members have same circumstances. Equation (5) is the measurement of IO as relative to overall inequality in the population. From this equation we can map $\theta: \left\{ z_i^k \right\} \rightarrow [0,1]$ for any index I().

CALCULATING RELATIVE- θ MEASURES IN PRACTICE

The literature on inequality measurement suggests that the best-known family of additively decomposable measures is the generalized entropy class, which includes the mean log deviation E(0) and the Theil entropy index E(1). There are three main reasons for different estimates of inequality for $\left\{ z_i^k \right\}$.

- (i) The specific inequality index I() used in the decomposition. From literature it is proved that different measures, Generalized Entropy, Atkinson etc, show different results.
- (ii) The path of the decomposition. It is divided into further two concepts, a smooth distribution $\left\{ sm_i^k \right\}$ and a standardized distribution $\left\{ sd_i^k \right\}$. In smooth distribution we simply replace $\left\{ z_i^k \right\}$ with group-specific mean $\left\{ sm_i^k \right\}$. Conversely, in standardized distribution we replace $\left\{ z_i^k \right\}$ with $\left\{ z_i^k \right\} \frac{sm}{sm^k}$, where sm shows the value of grand mean.
- (iii) The decomposition procedure, *i.e.* whether it is estimated parametrically or non-parametrically (Ferreira and Gignoux, 2008).

Smooth distribution eliminates all with-in group inequality by structuring $\theta_d = \frac{I \left(\left\{ sm_i^k \right\} \right)}{I \left(\left\{ z_i^k \right\} \right)}$. It summarized the between group inequality directly. θ_d is the ratio of smoothed distribution inequality to the original distribution inequality. The residual approach measures the between-group inequality by using $\theta_\gamma = 1 - \frac{I \left(\left\{ sm_i^k \right\} \right)}{I \left(\left\{ z_i^k \right\} \right)}$. This straightforward, non-parametric

decomposition is very similar to Checchi and Peragine (2005), who proposed either to re-weight the distributions of outcome in order to equalize the means of different circumstances groups (in a “types approach”) or to re-

weight the means of the individuals who can be considered as having exerted the same efforts (in a “tranches approach”) (Ferreira and Gignoux, 2008). By following Foster and Shneyerov (2000), the study utilizes the path independent decomposition of inequality. They are of view that when the set of inequality indices under consideration is restricted to those that use the arithmetic mean as the reference income, and that satisfy the Pigou-Dalton transfer axiom, this class reduces to a single inequality measure, the mean log deviation, or $E(0)$ (as cited in Ferreira and Gignoux, 2008). The study of Ferreira and Gignoux (2008) also proves that θ_d and θ_γ give same results by using $E(0)$.

If the sample is large enough relative to the number of cells, one can estimate equation (5). As the number of cells increases it lessens cell size which leads towards a problem of data insufficiency. If this happens we can face a problem for non-parametric estimation. To minimize this issue some studies go for parametric estimates of inequality which are the alternative of θ_d and θ_γ .

To construct the parametric estimates of inequality, consider a parametrically standardized distribution $\tilde{z}_i \cdot \tilde{z}_i$ corresponds to $F(z, a)$, which is that distribution which we got after replacing z_i with $\tilde{z}_i = f[\bar{a}, b(\bar{a}, v_i), u_i]$. The \bar{a} explains that by giving each and every individual the same circumstance variables, it eliminates any inequality between groups that are associated with circumstances.

After the estimation of equation (2) we can find out the values of \tilde{z}_i , simply by replacing the individual circumstance values in equation (2) with sample average for each circumstance variable. By following Bourguignon *et al.* (2007) we used a log-linear/linear specification model:

$$\ln z = a\alpha + b\beta + \mu \quad (6)$$

$$b = Wa + v$$

$\ln z = a(\alpha + W\beta) + v\beta + \mu$ is the reduced form of equation (6) which can be estimated through OLS as

$$\ln z = a\varphi + \varepsilon \quad (7)$$

The parametrically standardized distribution can be estimated by $\tilde{z}_i = \exp[\bar{a}_i\hat{\varphi} + \hat{\varepsilon}_i]$. To obtain parametrically standardized distribution (\hat{p}_i) we simply replace z_i with $\hat{p}_i = f[a, b(a)]$. In case of reduced-form framework the parametrically smoothed distribution is estimated by

$\hat{p}_i = \exp[a_i \hat{\phi}]$. Therefore, the alternative of $\theta_\gamma^n = 1 - \frac{I(\{sm_i^k\})}{I(\{z_i^k\})}$ is $\theta_\gamma^p = 1 - \frac{I(\{\hat{z}_i\})}{I(\{z_i^k\})}$ and the alternative of $\theta_d^n = \frac{I(\{sm_i^k\})}{I(\{z_i^k\})}$ is $\theta_d^p = \frac{I(\{\hat{z}_i\})}{I(\{z_i^k\})}$.

DATA DESCRIPTION

The study used Pakistan Social and Living Standard Measurement Survey (PSLM) of two time periods, 2005-06 and 2010-11. The PSLM is nationally/provincially represented survey. The PSLM collect the data on 15 indicators in which most important indicators are: income and consumption, employment, savings, education, household assets, and social indicators etc. Planning Commission of Pakistan also used PSLM for the analysis of poverty and inequality by Planning Commission of Pakistan. The sampling frame of PSLM consists on 200-250 households. By adopting two-stage stratified random sampling, households are selected after dividing the each city/town into certain enumeration blocks. The enumeration block is divided into three income categories; low, middle and high. The PSLM 2005-06 consists of 5204 enumeration block and interviewed 74420 households. Households within sample Primary Sampling Units (PSUs) have been taken as Secondary Sampling Units. 16 and 12 households from each PSUs have been selected, from urban and rural respectively. The PSLM 2010-11 target 77488 households from 5413 sample PSUs which includes 2280 urban and 3133 rural areas.

The study restricted the sample to individual aged 30-49 because this age group has highest proportion of employed persons. As mentioned above, PSLM contains information about set of circumstances. Father's education, mother's education, and father's occupation are three variables related to family background. Region of residence is also used as circumstance. In the analysis of labour earnings the gender is also used as one of the circumstance variable. Father's and mother's education are categorized into three dummies; no education, primary education, and secondary and above education. Father's occupation is divided into two categories; agricultural and non-agricultural. Region of residence is divided into two categories, rural and urban. Moreover, gender is divided into two categories, male and female. The study used two outcome variables, *i.e.* labour earnings and household income per capita. Labour earnings is the individual earnings without including other income sources while household income per capita includes income from all sources divided by the family size. Both are measured on monthly basis in domestic currency.

IV. RESULTS AND DISCUSSION

INEQUALITY IN EARNINGS OPPORTUNITY

Personal income is the key determinant of person's access to private goods, self-esteem and social status (Ferreira and Gignoux, 2011). The personal income is affected by the effort of individual and also from the exogenous circumstances (which are beyond the control of individual). As cited in Lefranc *et al.* (2009), Roemer's (1998) concept of equality of opportunity for earnings would require that the distribution of earnings conditional on any circumstance variable be identical to the marginal distribution – *i.e.* that there should be no difference across the earnings distributions estimated for particular population subgroups defined according to their circumstances. The study used three indices of Generalized Entropy measures to estimate overall earning inequality by utilizing two datasets of PSLM 2005-06 and 2010-11. E(0) is the mean log deviation, E(1) is the Theil Index and E(2) is half of the square of the coefficient of variation. The estimates of E(0) depicts that during 2005-06, the inequality of opportunity in labour earnings is 50% in Pakistan. During 2010-11, the IO reduces by 11 percentage points and is recorded 37% (Table 1).

TABLE 1

Inequality of Opportunity Indices for Labour Earning (Total Inequality)

	PSLM 2005-06			PSLM 2010-11		
	E(0)	E(1)	E(2)	E(0)	E(1)	E(2)
Total Inequality	0.5047	0.5000	1.1966	0.3779	0.3944	0.8585

Table 2 explain the non-parametric estimates defined by θ_d^N and θ_γ^N . The estimates of E(0) show the observed share of opportunity in earnings inequality. For both years we have the value of E(0) is $\theta_d^N = \theta_\gamma^N$, which satisfy the path axiom of independence. During 2005-06, the differences in observed opportunity are 34% of total labour earnings inequality. In 2010-11 the observed opportunity decreased by 10 percentage points.

The parametric decompositions which are θ_γ^p and θ_γ^l provide the estimates of E(0), E(1) and E(2) for identical circumstances for each individual. The circumstances are gender, region of residence, father's

education, mother's education, and father's occupation. The parameter θ_γ^p shows that systematic share of opportunity is 31% of total inequality in labour earnings, during 2005-06. During 2010-11, systematic share of opportunity decreased by 10 percentage points. While considering the year 2005-06 the highest share in IO is associated with gender, it contributes 11% to total inequality. Region of residence is the second highest contributor this year. A converse picture is seen in year 2010-11, θ_γ^l is highest in case of father's education which means that father's education is associated with 8% of total inequality. During this year the contribution of gender is 6% to total inequality.

TABLE 2
Inequality of Opportunity Indices for Labour Earning
(Non-Parametric Estimates)

Non-Parametric Estimates	PSLM 2005-06			PSLM 2010-11		
	E(0)	E(1)	E(2)	E(0)	E(1)	E(2)
θ_d^N	0.3486	0.2679	0.1218	0.2487	0.1884	0.0783
θ_γ^N	0.3486	0.2064	-0.1908	0.2487	0.1722	0.2125

TABLE 3
Inequality of Opportunity Indices for Labour Earning (Parametric Estimates)

Parametric Estimates	PSLM 2005-06			PSLM 2010-11		
	E(0)	E(1)	E(2)	E(0)	E(1)	E(2)
θ_γ^p	0.3137	0.0995	-0.8081	0.2183	0.1066	0.0472
θ_γ^l						
Gender	0.1195	-0.2325	-2.6478	0.0699	-0.0837	-0.2659
Region of residence	0.0756	0.0874	0.1216	0.0521	-0.0623	-0.1589
Father's Education	0.0627	0.0539	0.0433	0.0830	0.0660	0.1075
Mother's Education	0.0252	-0.0007	0.0599	0.0216	-0.0108	-0.0104
Father's Occupation	0.0028	0.0037	-0.0006	0.0009	-0.0004	-0.0024

TABLE 4

Reduced-Form OLS Regression of Earnings on Observed Circumstances

Variables	PSLM 2005-06	PSLM 2010-11
Constant	8.5253 (0.0328)***	9.327 (0.0127)***
Female	-1.7543 (0.0356)***	-1.3953 (0.0202)***
Region of residence	-0.4146 (0.0205)***	-0.3799 (0.0084)***
Father Agricultural worker	0.0864 (0.0292)***	-0.0769 (0.0107)***
Father Primary Education	0.0749 (0.0427)***	0.0574 (0.2069)***
Father Secondary Education	0.3822 (0.0205)***	0.0350 (0.0077)***
Mother Primary Education	0.1532 (0.0203)	-0.3351 (0.1540)***
Mother Secondary Education	0.9859 (0.1078)***	0.9323 (0.0497)***
R-Square	0.4777	0.3537
F-Statistic	623.88	1611.08
Observations	10544	50608

Standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

In order to find out the impact of circumstances on IO, the study utilized the reduced-form OLS method. For both years, the results are significant and their relationship with dependent variable is according to expectations. As in case of gender, female has less opportunity than male. This result is also consistent with the norms and social stigma of Pakistani society in which female have less opportunity than male. According to *Global Gender Gap Report 2013*, Pakistan is the second worst country in gender equality. (Out of 136 countries, Pakistan is at 135th number and the global gender gap index is 0.546. Pakistan is facing worst conditions regarding gender gap index since 2006. In 2006 Pakistan was at 115th position and making a huge jump in 2007 reached at 128th position.) The region of residence is also considered as important circumstance, especially in developing and poor countries. The individuals whose region of residence is rural areas have less opportunity than those belong to urban areas. This result is also consistent with several

regional and international studies, which include Casari *et al.* (2011), Zhu and Luo (2010), and King and Bigotta (2009).

INEQUALITY OF OPPORTUNITY FOR HOUSEHOLD WELFARE

This section estimated the IO for Pakistan and its four provinces by using household per capita income. The previous analysis was on labour earnings while this part used household per capita income to measure household welfare. Consumption expenditure per capita and household hold income per capita are better proxies to measure household welfare. Household income includes the income from all sources, of all family members. Due to non-availability of data expenditure, the household per capita income is still the better measure of household welfare. In PSLM 2005-06 and 2010-11, we have the data of house hold per capita income. Rest of our analysis is based on household per capita income. The estimates of E(0) depicts that during 2005-06, IO indices for income is 50% in Pakistan. During 2010-11, the IO reduces by 16 percentage points and is recorded as 34% (Table 5).

TABLE 5

Inequality of Opportunity Indices for Income
(Total Inequality)

	PSLM 2005-06			PSLM 2010-11		
	E(0)	E(1)	E(2)	E(0)	E(1)	E(2)
Total Inequality	0.5047	0.4493	1.3164	0.3485	0.4422	1.8241

TABLE 6

Inequality of Opportunity Indices for Income
(Non-Parametric Estimates)

Non-Parametric Estimates	PSLM 2005-06			PSLM 2010-11		
	E(0)	E(1)	E(2)	E(0)	E(1)	E(2)
θ_d^N	0.3485	0.2088	0.0795	0.1585	0.1279	0.0329
θ_γ^N	0.3485	0.2941	0.4712	0.1585	0.1869	0.3699

During 2005-06, the differences in observed opportunity are 34% of total income inequality for the year 2005-06. In 2010-11 the observed opportunity decreased by 19 percentage points.

TABLE 7

Inequality of Opportunity Indices for Income (Parametric Estimates)

Parametric Estimates	PSLM 2005-06			PSLM 2010-11		
	E(0)	E(1)	E(2)	E(0)	E(1)	E(2)
θ_{γ}^p	0.2295	0.2581	0.4019	0.1495	0.1636	0.3141
θ_{γ}^l						
Region of residence	0.1615	0.1787	0.2745	0.1148	0.1299	0.2807
Father's Education	0.0509	0.0494	0.0473	0.0263	0.0219	0.0274
Mother's Education	0.0215	0.0318	0.0973	0.0155	0.0141	-0.012
Father's Occupation	0.0367	0.0296	0.0351	0.1136	0.0087	0.2364

TABLE 8

Reduced-Form OLS Regression of Income on Observed Circumstances

Variables	PSLM 2005-06	PSLM 2010-11
Constant	6.8413 (0.0309)***	7.6884 (0.0109)***
Region of residence	-0.4993 (0.0185)***	-0.4387 (0.0131)***
Father Agricultural worker	0.3008 (0.0266)***	0.1282 (0.0109)***
Father Primary Education	-0.0196 (0.0373)	-0.0828 (0.0198)***
Father Secondary Education	0.2807 (0.0193)***	0.2144 (0.0078)***
Mother Primary Education	-0.0908 (0.0934)	0.0122 (0.1006)
Mother Secondary Education	0.3821 (0.0740)***	0.5648 (0.0311)***
R-Square	0.1928	0.1331
F-Statistic	256.81	896.58
Observations	10598	51250

The parameter θ_{γ}^p shows that the systematic share of opportunity is 22% of total inequality in household income, during 2005-06. During 2010-11, the systematic share of opportunity decreased by 8 percentage points. The highest share in IO is associated with region of residence followed by father's education during 2005-06. In 2010-11, the θ_{γ}^I is highest in case of region of residence followed by father's occupation.

Results of OLS depicts that the individuals whose region of residences is rural areas have less opportunity than those belongs to urban areas (*see* Table 8).

V. CONCLUSION AND POLICY IMPLICATIONS

The study utilized two datasets of PSLM of 2005-06 and 2010-11 and by using the entropy measures the study estimated the inequality of opportunity for Pakistan. Due to non-availability of data on household expenditures, the study used household per capita income as a proxy of household welfare. Region of residence, gender, father's education, father's occupation, and mother's education are used as the circumstance variable in the analysis. Furthermore, the study also estimated the parametric (observed opportunity) and non-parametric (systematic share of opportunity) part of inequality of opportunity. The non-parametric part of inequality investigates the share of circumstances in overall inequality.

In the analysis of labour earnings, the gender is almost the highest contributor to overall earnings inequality. This result is consistent with the norms and social stigma of Pakistani society in which female have less opportunity than male. According to *Global Gender Gap Report 2013*, Pakistan is the second worst country in gender equality. The second most important result of our study is about the regional disparity. The region of residence is the second highest contributor to overall inequality, for labour earnings and household welfare analysis. The results of OLS also confirm this result and conclude that individual belonging to rural area is deprived than individual belonging to urban area. Due to the differences in circumstances, between rural and urban areas, individuals migrate to urban areas (Mujahid, 1975; Siddiqi, 2004; Ikramullah *et al.*, 2011; Miheretu, 2011; McCatty, 2004).

The study includes father's education, mother's education, and father's occupation as the other circumstance variables, which capture the role of family background. Parental education is considered as one of the most important circumstance. Children from highly educated parents benefit of

rich cultural environments in the home and become highly educated adults (Carneiro *et al.*, 2006). Hence, the results can help shape the policy debate in Pakistan in several directions; the IO in Pakistan compels us to think carefully how to spend current resources equitably, and on size fits all intervention will not be effective for equal opportunities.

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