International Journal of Social Economics

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Article information:
To cite this document:
Permanent link to this document:
https://doi.org/10.1108/IJSE-07-2017-0278

Downloaded on: 07 August 2018, At: 04:51 (PT)
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Dynamics of unidimensional and multidimensional inequality in Pakistan
Evidence from regional and provincial level study

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Abstract
Purpose – The purpose of this paper is to measure the unidimensional and multidimensional inequality in the case of Pakistan and compare their results at the provincial as well as regional (urban and rural areas) level. The authors collected data from Pakistan Social and Living Standard Measurement and Household Integrated Economic Survey for fiscal years of 1998–1999 and 2013–2014.

Design/methodology/approach – The authors used Gini coefficient for unidimensional inequality and multidimensional indexing approach of Araar (2009) for multidimensional inequality.

Findings – The findings predicted that unidimensional inequality is relatively high in the urban area due to uneven dissemination of income, but multidimensional inequality is quite high in rural areas because of higher disparities among all dimensions. At the provincial level, Punjab has relatively high-income inequality followed by Sindh, KPK and Baluchistan.

Originality/value – This study is a pioneering effort to compare two time periods to explore unidimensional and multidimensional inequality in all provinces of Pakistan and their representative rural-urban regions by applying Araar and Duclos’s (2009) approach. Further, this study opens some new insights for policy makers.

Keywords Pakistan, Gini, Multidimensional inequality, Unidimensional inequality

Paper type Research paper

1. Introduction
The standard objective of the economic literature regarding inequality measure is to relate unidimensional indicators, such as income. People are different in income, education, health, and we must take into account several individual characteristics. On the other hand, in order to calculate the social state of an individual, more than one criterion often needs to be applied, since economic disparity does not arise from the distribution of income alone. Despite the appropriate distribution of income, living standard of the common man can never be improved through economic growth. As viewed by Kemal (2006), economic growth and proper income distribution are essential for economic development. Kuznets (1955) pronounced an inverted U curve, according to which, inequality rises because of higher
migration from agriculture sector to industrial sector at the initial stage of economic
development. But when an economy becomes stable, such income divergences decrease
gradually because the higher growth benefits the lower income groups.

During the second half of the twentieth century, Pakistan was faced with high poverty
and inequality rates despite higher economic growth and ranked 144th out of 178 countries
on the Human Development Index (HDI), says UNDP’s (2010) report. This ranking clearly
designates that benefits of higher economic growth had not been trickled down the society
because of the poor income distribution pattern as observed by Easterly (2003).

Historically, there has been growing trepidation on the predicament of inequality in
Pakistan. In the 1960s, Pakistan appeared to have good evolution in reducing income
inequality. Nevertheless, income inequality increased during the era of the 1970s, which
overturned in 1980s. In the decade of 1990s, inequality increased rapidly and then reversed
in 1996–1997. Owing to unequal distribution of income and weak government policy, such

Inequality is a worldwide discussed issue; different researchers have different
viewpoints and use different techniques and methods to estimate it. Kruijk (1986) assessed
the incidence of inequality in Pakistan along with the provinces and their urban-rural
regions. Similarly, Jafri and Khattak (1995) estimated Gini coefficient using household
income data and concluded that income inequality in urban areas is higher than rural
areas. Mujahid (1978) explored the methodological issues related to the measurement of
poverty and income inequalities. Afridi et al. (1984) scrutinized that high inflation rate
increased income inequality between haves and have-nots. Similarly, Saboor (2004)
estimated inequality by applying Gini coefficient, Theil coefficient, coefficient of variation,
Atkinson index and standard deviation of log income. Kakwani (1977) explored the idea of
the generalized Lorenz curve for studying the relationship between different economic
variables. Furthermore, Mahmood and Tahir (1984) showed a declining trend in income
inequality for both rural and urban areas for the period of 1970–1971. Iqbal (1988) used
inequality measure in calculating income elasticity and predicted that households
consume more than 50 percent of their income on food items including beverage and
tobacco. The expenditure elasticity coefficient for most of the commodities have a value
close to unity and greater than unity. Sen (1974) argued that income inequality can be
measured in two comprehensive classes. First explains statistical dispersion and second
explores the normative of income inequality. Knowles (2005) assessed the negative effect
of higher inequality on growth. White and Anderson (2001) claimed that lower income
inequality is more helpful in reducing poverty as compared to economic growth.
McCulloch et al. (2000) scrutinized the trend of inequality in Zambia by applying Gini
coefficient, Theil index, entropy measures, standard deviation of log of income and
coefficient of variance. Naseem (1973) predicted that the concentration of income and
expenditure in urban areas is higher than that in the rural areas and has been getting
worse over the time. Moreover, Khandkar (1973) concluded that income inequality is
greater in urban areas than in the rural areas and it declined in rural areas and increased
high-income inequality leads to low economic growth. Their evidence suggested that the
poor in developing countries do share in the gains from rising aggregated affluence and in
the losses from aggregated constriction.

Previously, inequality is discussed as a unidimensional phenomenon and only income
expenditure is used to explore it. But, with the passage of time, researchers comprehended
that given measures could not draught the true picture of economy because income
expenditure inequality has very little role in reducing poverty and improving growth.
Therefore, such measure is deliberated in multidimensional perspective for discussing
inequality effects in a wider sense on the economy.
While Araar and Duclos (2009) compared multidimensional and unidimensional inequality and concluded that rural and semi-urban areas are harshly affected by multidimensional inequality, income inequality is more prominent in urban areas. Lugo (2004) estimated the trend of multidimensional inequality in Argentina and concluded that despite the deteriorated effect of monetary inequality and income distribution, multidimensional inequality showed a declining trend over the period of time. Jorda et al. (2013) had shown a declining trend of multidimensional inequality in a worldwide context. Rohde and Guest (2013) examined multidimensional inequality in the USA in a racial context from 1990 to 2007 by using health, education and income as basic dimensions and concluded that over the period of time inequalities show an increasing trend. Similarly, Ahmad et al. (1989) used the Lorenz curve for Pakistan, rural and urban sectors as well as the four provinces for the period of 1979 and 1984–1985. This study found that the Gini coefficient for both income and expenditure has deteriorated over the time. Later on, Alkire and Foster (2011) used FGT measure to calculate multidimensional poverty and concluded that a poor person can never rise out of poverty by increasing the level of a non-deprived achievement, while a non-poor person will never become poor as a result of a decrease in the level of a deprived achievement. Similarly, Donni et al. (2015) analyzed inequality of opportunity on disparities between social types by making a comparison between different approaches. They predicted that the estimation of latent class models does not hinge on time variation and therefore does not require panel data.

Multidimensional inequality measures sophisticate the magnitude of inequality in an economy more broadly as compared to unidimensional estimates because such measure draught the extent of the problem in a wider sense. Consequently, the current study was planned to compare the situation in Pakistan by applying Araar and Duclos’s (2009) approach for multidimensional inequality and Gini coefficient for unidimensional inequality. The study analyzes the situation of unidimensional and multidimensional inequality in Pakistan along with four provinces and representative rural-urban regions. The study reports the research gap that no one has done any comparative study on inequality in multidimensional perspective in Pakistan along with the provinces and representative regions by using current estimation method and dimensions. Therefore, the current study has done best effort to bridge up the research gap by using a socioeconomic set of dimensions and employing newly developed methodology.

On the basis of a strong literature review, current study selected three basic dimensions like education, health and living standard for the assessment of the extent of multidimensional inequality and per capita consumption expenditure are used for the estimation of unidimensional inequality. The novelty of this study is that it estimates the comparative study in Pakistan for the first time by using current methodology.

2. Data collection and methodology explanation

To assess unidimensional and multidimensional inequality in Pakistan, this research collects well-defined data on abundant household indicators from Pakistan Social and Living Standard Measurement and Household Integrated Economic Survey[1]. This study uses two sets of data, such as 1998–1999 and 2013–2014, and compares the results of both periods. We compare the empirical results of inequality in Pakistan along with the provinces and their representative regions (urban and rural). The dimensions along with representative sub-dimensions are given in Table I. We take the Gini coefficient to estimate unidimensional inequality also known as income or consumption inequality. Similarly, the sub-dimensions of education, health and housing services are used to estimate multidimensional inequality to compare different provinces and rural-urban areas as well. All sub-dimensions are aggregated through indexing approach to make a single composite dimension. Furthermore, equal weight is assigned to each dimension to make analysis simple.
2.1 Unidimensional inequality

The Gini coefficient is extensively used measure to estimate inequality in unidimensional perspective. Such measure is defined as the ratio of the area between the Lorenz curve and the line of equality to the area of triangle. Such a measure ranges from 0 to 1 and specified as Gini coefficient range $0 \leq G \leq 1$ (Asad and Ahmad, 2011). Mathematically, such measure is described as follows:

\[
G \text{inicoefficient} = 1 - \sum_{i=0}^{n-1} (F_{i+1} - F_i) (\phi_{i+1} + \phi_i),
\]

where $F_i$ is the cumulative share of population and $\phi_i$ is the cumulative share of consumption.

2.2 Multidimensional inequality

For the first time, Hicks (1997) estimated the multidimensional inequality through inequality-adjusted HDI or welfare index which is written as follows:

\[
W_H = \mu_1 (1 - G),
\]

where $\mu_1$ is the arithmetic mean across each dimension and $G$ is the Gini coefficient of each dimension. This index is very simple and provides results without involving aversion parameters $\alpha$ and substitution parameter $\beta$. Therefore, the welfare index could not predict the actual situation of well-being in the economy. For getting appropriate results, the current study used more modified index proposed by Abdelkrim Araar (2009). The Araar (2009) proposed multidimensional inequality index (MDI) which measures the inequality among the individual taking $K$ number of dimensions. The general form of the index is as follows:

\[
I = \sum_{i=1}^{k} \phi_k [\lambda_i l_k + (1 - \lambda_k)C_k],
\]
where $\phi_k$ is the weight assigned to $k$ dimension, $I_k$ and $C_k$ are the relative and absolute measure of Gini and concentration indices of $k$ dimensions, respectively. The normative parameter $\lambda_k$ is the sensitivity index between different dimensions which take values $0–1$. If the value of $\lambda_k$ is 0, it shows that dimensions of well-being are perfect substitutes. But if value of $\lambda_k$ is 1, it reflects that dimension of well-being is the perfect complement.

3. Results and discussion

Table II shows unidimensional inequality at the national and provincial level of Pakistan along with their representative regions (rural and urban). Given results illustrate that income inequality in Pakistan and its provinces (Punjab, Sindh, KPK and Baluchistan) were 45, 46, 45 and 41 percent in 1998–1999, respectively, while these estimates reduced to 31, 32, 29, 27 and 25 percent in 2013–2014, respectively. These coefficients of unidimensional inequality predicted a major decline in income inequality in Pakistan and its provinces as well. Similarly, estimates of income inequality in the urban region of Punjab, Sindh, KPK, Baluchistan and Pakistan were 50, 47, 46, 40 and 48 percent in 1998–1999, while these measures declined further and reached to 34, 30, 35, 33 and 34 percent in 2013–2014, respectively. Moreover, estimated measures of the rural region of Pakistan along with its provinces were 39, 38, 38, 40 and 41 percent in 1998–1999 which declined to 25, 27, 21, 22 and 20 percent in 2013–2014, respectively.

We find that income inequality in Punjab is fairly high as compared to all other provinces because of high population, low employment rate, technological advancement and unequal distribution of income. Similarly, estimates of the urban region of all provinces also indicate high-income inequality due to unequal distribution of wages among heterogeneous labor force. Kemal (2006) stated that higher productivity due to technological advancement causes higher inequality in urban areas because such advancement declines the employment rate in urban areas. All results of rural-urban areas and Pakistan along with representative province represent a declining trend over the period of time.

The findings of multidimensional inequality are reported in Table III. We examined well-being inequality index to measure multidimensional inequality at national and provincial level along with rural and urban areas for the period of 1998–1999 and 2013–2014. The estimated results indicate that when normative parameter $\lambda$ is 0, average multidimensional inequality in Pakistan along with its provinces (Punjab, Sindh, KPK and Baluchistan) were 28, 23, 27, 26 and 34 percent in 1998–1999, while these measures declined

<table>
<thead>
<tr>
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<th></th>
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<tbody>
<tr>
<td>Punjab</td>
<td>6,381</td>
<td>43.05</td>
<td>0.46</td>
<td>7,597</td>
<td>42.23</td>
<td>0.32</td>
</tr>
<tr>
<td>Urban</td>
<td>2,590</td>
<td>46.27</td>
<td>0.50</td>
<td>3,150</td>
<td>50.52</td>
<td>0.34</td>
</tr>
<tr>
<td>Rural</td>
<td>3,791</td>
<td>41.10</td>
<td>0.38</td>
<td>4,447</td>
<td>37.83</td>
<td>0.27</td>
</tr>
<tr>
<td>Sindh</td>
<td>3,712</td>
<td>25.04</td>
<td>0.45</td>
<td>5,211</td>
<td>28.96</td>
<td>0.29</td>
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<tr>
<td>Urban</td>
<td>1,536</td>
<td>27.44</td>
<td>0.47</td>
<td>1,374</td>
<td>22.04</td>
<td>0.30</td>
</tr>
<tr>
<td>Rural</td>
<td>2,176</td>
<td>23.59</td>
<td>0.38</td>
<td>3,837</td>
<td>32.64</td>
<td>0.21</td>
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<tr>
<td>KPK</td>
<td>2,711</td>
<td>18.29</td>
<td>0.43</td>
<td>3,522</td>
<td>19.57</td>
<td>0.27</td>
</tr>
<tr>
<td>Urban</td>
<td>859</td>
<td>15.34</td>
<td>0.46</td>
<td>1,301</td>
<td>20.87</td>
<td>0.35</td>
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<tr>
<td>Rural</td>
<td>1,852</td>
<td>20.08</td>
<td>0.40</td>
<td>2,221</td>
<td>18.90</td>
<td>0.22</td>
</tr>
<tr>
<td>Baluchistan</td>
<td>2,016</td>
<td>13.60</td>
<td>0.41</td>
<td>1,659</td>
<td>9.22</td>
<td>0.25</td>
</tr>
<tr>
<td>Urban</td>
<td>612</td>
<td>10.93</td>
<td>0.40</td>
<td>409</td>
<td>6.56</td>
<td>0.33</td>
</tr>
<tr>
<td>Rural</td>
<td>1,404</td>
<td>15.22</td>
<td>0.41</td>
<td>1,250</td>
<td>10.63</td>
<td>0.20</td>
</tr>
<tr>
<td>Pakistan</td>
<td>14,820</td>
<td>100</td>
<td>0.45</td>
<td>17,989</td>
<td>100</td>
<td>0.31</td>
</tr>
<tr>
<td>Urban</td>
<td>5,597</td>
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<td>0.48</td>
<td>6,234</td>
<td>100</td>
<td>0.34</td>
</tr>
<tr>
<td>Rural</td>
<td>9,223</td>
<td>100</td>
<td>0.39</td>
<td>11,755</td>
<td>100</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Table II. Estimation of unidimensional inequality

Unidimensional and multidimensional inequality
to 22, 19, 22, 21 and 26 percent in 2013–2014, respectively. Similarly, multidimensional inequality in rural areas of Pakistan and its respective provinces were 0.27, 0.21, 0.26, 0.25 and 0.30 in 1998–1999, whereas these statistics decreased to 0.21, 0.19, 0.21, 0.22 and 0.26 in 2013–2014, respectively. Furthermore, multidimensional inequality in urban areas of Pakistan and its provinces were 0.23, 0.18, 0.23, 0.23 and 0.26 in 1998–1999 and it decreased to 0.16, 0.15, 0.14, 0.17 and 0.20 in 2013–2014, respectively.

In the same way at every measure of $\lambda$ like 0.1, 0.5, 0.9 and 1, multidimensional inequality shows a declining trend over the period of time in Pakistan along with the provinces and their representative regions (urban and rural). This is a result of different policy reforms taken by the Government of Pakistan, especially in the field of education and health such as Millennium Development Goal (World Bank, 2003) and National Health Policy (2009). Moreover, we concluded that Punjab has less multidimensional inequality as compare to other provinces. These findings are consistent with the findings of Ahmad et al. (1989).

Similarly, these measures significantly decline due to an improvement in living standards of the households over the period of time in both rural and urban areas. Furthermore, Punjab has lower multidimensional inequality followed by KPK, Sindh and Baluchistan. It is because of a large portion of Punjab’s budget and the government’s attention toward its development. Moreover, Punjab Government initiatives for improving education and health sector through Punjab Education Endowment Fund and Punjab Health Sector Reforms Program improved the current situation which leads to decrease in multidimensional inequality in Punjab. Similarly, multidimensional inequality in rural areas of Pakistan and respective provinces is high compared to urban areas. It is because of discrepancies in well-being indicators like health, education and housing services in rural areas.

By following Araar’s (2009) methodology, this study also predicts a relative contribution of different dimensions in multidimensional index at $\lambda = 0.5$. However, the dimensional contribution of other measures of $\lambda$ ($\lambda$ is equal to 0, 0.1, 0.9 and 1) is shown in Figure A2. Figure 1 explains the relative contribution of each dimension in multidimensional inequality for Pakistan, its provinces and representative region, when $\lambda$ is 0.5. Our estimated measures vibrantly pronounce a large contribution of education to multidimensional inequality in overall Pakistan along with the provinces (Punjab, Sindh, KPK and Baluchistan) and its representative regions (urban and rural) for the period of 1998–1999. The result of decomposition of MDI expresses that education is more correlated with monetary indicators...
of well-being. Furthermore, the contribution of health is more than housing services in Pakistan, its provinces and representative regime. This indicates that the government must provide all facilities for minimizing the disparities between such dimensions of well-being.

Figure 2 shows the relative contribution of each dimension to multidimensional inequality in Pakistan along with provincial measures and representative regions (urban and rural) over the period of 2013–2014, when $\lambda$ is 0.5. The results of given figure clearly show that still there is a large contribution of education to multidimensional inequality in overall Pakistan along with provinces and representative regions (urban and rural) in 2013–2014. Furthermore, the contribution of health is more than housing services which noticeably indicates that...
government must provide all facilities for minimizing the incongruences between well-being. Estimated measures of the current study more generally explain that the contribution of all dimensions to multidimensional inequality is more stable in 2013–2014 as compared to 1998–1999, because given the contribution significantly declined multidimensional inequality in Pakistan along with the province and representative divisions from 1998–1999 to 2013–2014.

The contribution of education is more than services and health because education has a close relation to monetary indicators of well-being and increase in education, improve the living standard of people, which leads to widening the gap between lower income group having the lowest level of education and higher income group having a significantly higher education such difference causes increase in inequality. Similarly, health also has more importance in the measurement of multidimensional and has the second highest contribution to current measurement. The high contribution of health indicates that in urban area households are enjoying more facilities and easy access to the health care center as compared to their rural counterpart, such thing leads to higher multidimensional inequality in rural areas and also widen the contribution of health in a given sector.

4. Conclusion and policy recommendations

The aim of this research is to compare unidimensional and multidimensional inequality in the case of Pakistan, its provinces and different region as well. As a matter of fact, we have confirmed significance of inequality as a unidimensional and multidimensional phenomenon. Briefly, we do not consider inequality as unequal distribution of material resources, but as an unequal access to educational opportunities or to health services. When we compare the result of unidimensional inequality for different provinces, we noted that Punjab has high-income inequality because of high population, low employment rate, technological advancement and unequal distribution of income in this province, followed by Sindh, KPK and Baluchistan in both time periods. Correspondingly, we found high-income inequality in the urban region of all provinces because of heterogeneous labor force during both estimated periods. However, income inequality in rural areas is low because of homogeneity of the labor. The low-income inequality in rural areas reflects that most of the labor force is employed in the agriculture sector so that their incomes are closed to each other. Moreover, with the passage of time, income inequality declines because of trickle-down effect which shifts the benefits from high income to lower income over the time. Likewise, multidimensional inequality also shows a declining trend over the period of time. However, due to a large share in the budget and advancement in infrastructure, Punjab has lower multidimensional inequality as compared to others. Moreover, in the case of multidimensional inequalities, rural areas of all provinces are most affected because of higher disparities in basic dimensions like health, housing services and education.

The discussed unidimensional and multidimensional inequality issue is very important for the growth of Pakistan because it helps to understand the gap between income, health, education and housing facilities with respect to time. In the last few decades, migration of the people from rural region to urban region has increased which caused to decline in employment opportunity in urban areas and created higher income inequality. This situation is clearly addressed that government should invest more in urban areas to increase employment opportunities. On the other hand, the government should control suitable wage rate to fill the gap between rural and urban income inequality through fiscal policy. To control high-income inequality in Punjab, the government should increase development in other provinces which will help to control national migration toward Punjab. To reduce multidimensional inequality, government and non-profit organizations (NGOs) should pay attention to rural areas and provide them funding to improve their educational and health facilities. Further, the policy makers should redesign budget by increasing share of
education, health and development in rural areas. By concluding, the government should implement different taxes in urban areas. It will reduce income inequality and increase tax revenue as well. The collected tax revenue should be spending on rural areas due to lack of basic facilities like, education, health, house and less development.

This study is limited to regional and provincial comparison. This was because of the limited scope of this study. To present a clear picture of inequality to government, researchers can also estimate the different types of inequality across the different occupational group in Pakistan. The income inequality between different occupational growth will also help policy makers to understand the current situation of income inequality with respect to an employment level. It will help policy makers to design their income and sale taxes policies for different regions. However, this study presents some interesting evidence and discussion points that could be used by researchers to conduct similar studies in other regions of the world.

Note

References


Further reading

Unidimensional and multidimensional inequality

Figure A1. Lorenz curve of Pakistan, provinces and regions in 1998–1999 and 2013–2014
### Figure A2.
Relative contribution of dimensions in MDI for years 1998–1999 and 2013–2014 at different measure of $\bar{z}$

<table>
<thead>
<tr>
<th></th>
<th>Education</th>
<th>Health</th>
<th>Services</th>
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<tr>
<td>1998 Urban</td>
<td>100</td>
<td>120</td>
<td>60</td>
</tr>
<tr>
<td>1998 Rural</td>
<td>80</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>1999 Urban</td>
<td>100</td>
<td>80</td>
<td>40</td>
</tr>
<tr>
<td>1999 Rural</td>
<td>80</td>
<td>60</td>
<td>40</td>
</tr>
<tr>
<td>2013 Urban</td>
<td>100</td>
<td>100</td>
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</tr>
<tr>
<td>2013 Rural</td>
<td>100</td>
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</tr>
<tr>
<td>2014 Urban</td>
<td>100</td>
<td>100</td>
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<tr>
<td>2014 Rural</td>
<td>100</td>
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