*Pakistan Journal of Social Research*
ISSN 2710-3129 (P) 2710-3137 (O)
Vol. 4, No. 4, December 2022, pp. 1127-1150.
https://doi.org/10.52567/pjsr.v4i04.1273
www.pjsr.com.pk

# STRUCTURING THE ASSET INDEX, MEASURING THE INEQUALITIES AND INVESTIGATING THE FACTORS OF ASSET INEQUALITIES: AN EVIDENCE FROM PDHS DATA

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**ABSTRACT**
*The main aim of this research paper is to construct suitable, valid, reliable and socially realistic asset index at household level in Pakistan by using PDHS micro-data and to estimate the economic disparities in Pakistan by using Gini-coefficient and Palma-ratio. Further, this study has investigated the economic, demographic, cultural and social factors of asset inequality at household level in Pakistan by employing quantile regression analysis. This study elaborates the dimensional structure of the assets by presenting the results from Factor Analysis (Exploratory Factor Analysis) and Principal Component Analysis (Tetrachoric-PCA), and have applied Item Response Theory (IRT) and Classical Test Theory for reliability analysis of the index. The results show that Sindh and Baluchistan provinces are with higher asset inequalities comparing to Khyber Pakhtunkhwa and Punjab. Within Punjab, district Sialkot is outperformer with lowest asset inequalities, district DG khan is ranked at top with highest inequal distribution of assets. The districts Buner, Mirpur, Sohbatpur are with highest economic disparities within the provinces KP, Sindh and Balochistan respectively. Interestingly, the district rank ordering produced by both Gini coefficient and Palma Ratio are similar. The study revealed that the land ownership, the access to financial institutions, household size, and education of head of family have positive and significant impact on asset inequality. Study suggested policy recommendations is that efforts should be made to reduce the effects of inequality. This study also boost to policy makers to arrange public investment in socioeconomic development in economically lagging districts of Pakistan.*
**Keywords:** Asset Index, Inequality, Factor Analysis, Item Response Theory, Palma ratio, Gini-coefficient, Pakistan.
**JEL classification codes:** P36, O15, D63, D31

## 1. INTRODUCTION

On 25th September, 2015, all UN member states join-together at Sustainable Development Summit to implement the agenda for 2030. The SDG agenda includes a set of 17 goals, the goal 10 is specifically devoted, by 2030, end inequalities among and within the countries. Importantly, parliament of Pakistan has adopted the SDGs as a national development agenda. Pakistan's performance on socio-economic indicators is the worst in South Asia, approximately 60.19 percent population fall below (US $2 a day) poverty line (Economic Survey of Pakistan, 2013-14), Pakistan is ranked at 144 position out of 145 countries on the pedestal of Global Gender Gap index (World Economic Forum, 2018), is ranked at 133 out of 151 countries for Gender Inequality Index (HDR, 2017) and about 38 percent children are stunted (PDHS, 2018).

The income disparities in developing countries have increased since 1990, more than 75 percent of the world's population now lives in a household where income is more unequally distributed (UNESCO, 2016). To measure inequality there are various approaches. Inequality measurement has been

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an area of interest for economists and statisticians. The statistically techniques gives number about the inequalities but it is more important to know what measure or construct has been used to apply statistical analysis.

Income has long been used to measure living standards and household well-being. However, the quality of income data has been questioned because earnings are often highly variable for people working in informal labor markets or engaged in small businesses (Moser & Felton, 2007). In the absence of income data the expenditures are theoretically more suitable and empirically more consistent units to gauge of economic well-being. There are limitations linked to the expenditure data e.g., recalling the expenditures on particular items, trustable information on spendings etc. It is also difficult to estimate all the expenditures because different members of the household create the expenditures on various products, so counting them altogether is difficult. Some of the massive expenditures are made less often such as buying new house and/or vehicle. There is also always a debate on which expenditure is to be added in expenditure data and which should not? (Rutstein, Johnson, & Measure, 2004). Consumption data may not be suitable when the objective is to measure the household level living standards over long period of time (Gunnsteinsson et al, 2010). The expenditure and income methods, both, have some flaws, and are considered inappropriate methods to reflect the true picture of households' economic welbing.

There is need of a suitable, valid, reliable and socially realistic measures to gauge the household economic wellbeings that latter on may be used to gauge the inequalities with in the country or across the countries. The asset index may be appropriate method because of its suitability, charity, and data accuracy. Wittenberg (2017) suggests that the asset index is a reliable proxy to measure household long term income. The asset index was firstly introduced by Filmer & Pritchett (2001). The asset index has been presented by academic and researchers since 1998 (Filmer and Pritchett, 1998; Morris et al,2000; Sahn and Stifel, 2001). This method employs data of household assets such as durables and semi-durable goods to define the household well-being instead of using household's income or expenditure data. Howe et al, (2008) says that asset index better because its measurement is easier rather than a measurement of household expenditures and income data. The data about ownership of assets provides accuracy and validity (Sahn & Stifel, 2003). The assets are far better than income to identify the most deprived households and explaining poverty (Harttgen & Kalsen, 2012). To construct the asset index at household level this study has used Pakistan Demographic and health survey (2017-18) micro0data. This survey covers information of 30 assets that fall into different categories like, durable assets, housing conditions, non-durables and agricultural related assets. The housing conditions may include main material of floor, roof and walls. The durables may consist of motorcycle, pump, mobile phone, television, watch, rickshaw, radio, electricity, and cooking fuel, washing machine, air conditioner, sewing machine, car, refrigerator, computer, and boat, camera, chair, cabinet, and room cooler. Agricultural related assets consist of land, animal drawn cart, tractor, and animals.

The main objective of the study is to construct a valid and reliable asset index at household level in Pakistan by using PDHS (2017-18) micro data. To measure the asset inequality in Pakistan by employing Gini coefficient and Palma ratio. The paper is organized as follow. Section 2 provides literature review whereas section 3 presents Research methodology. While, section 4 cover the methodology and discussion of estimation results and section 5 concludes the paper.

## 2. LITERATURE REVIEW

### 2.1 Constructing the Asset Index

In the most economic and demographic analysis, the socioeconomic status or well-being of a household is an important element to measure. The asset-based approach is used to measure the well-being of the household which is an appropriate measure of household wealth. The framework of asset vulnerability is used for reviewing the metropolitan poverty decline approaches, they are concerned to asset ownerships because their intentions are to identifying what the poor have, rather than what they do not have? They included both tangible, reproductive, and intangible assets (Moser, 1998). The asset index was firstly introduced by (Filmer & Pritchett, 2001), by elaborating the wealth effects in the absence of data on expenditures. Further, they have tried to investigate the link between household-based wealth index and educational attainment of children. Furthermore, applied the PCA to derive weights for each of asset, and wealth proxy is used to construct the linear index from the asset ownership indicators. Houweling, Kunst,

and Mackenbach (2003) investigated health disparity between children in developing countries. They used Demographic and Health Survey for 10 developing countries. In their study, they used an asset index based on all assets of the household and health inequality measured by measles and under-5 mortality. The results indicate that the asset index is important for the relative position of the household.

Likewise, Naschold (2005) has investigated the threshold of asset poverty in Pakistan and Ethiopia. In this study, they used two households panel Pakistan Rural Household Survey (PRHS) and Ethiopian Rural Household Survey (ERHS). They measure asset index by using factor analysis and used parametric and non-parametric methods to detect asset poverty dynamics and asset thresholds in Pakistan and Ethiopia. Income has long been used to measure the household well-being. It has many limitations in both accuracy and measurement, in the developing countries (Moser & Felton, 2007). Caroline and Andrew (2007) investigated the construction of an asset index. In this study, they construct an asset index by using a polychoric principal component analysis. The household survey was undertaken in 1978, 1992 and 2004. They estimated the welfare and wealth of the developing countries by the asset index. Asset index to measure the household socioeconomic position, the index produces reasonable evaluation with household income and expenditure. In the asset index, the high scoring factors are washing machine, a telephone, a video recorder, and a refrigerator and these factors should be included in the future household socio-economic surveys. Some assets are related to new technologies such as mobile phones, palm computers, DVD players tend to play a major role in the construction of the asset index (Prakongsai (2006).

Howe, Hargreaves, and Huttly (2008) presented the construction of wealth indices for the measurement of socio-economic position in low-income countries. In this study, they measure the socio-economic position by wealth indices. Wealth index was constructed by using principal component analysis and multiple correspondence analysis. The results showed that the level of agreement between wealth indices and consumption expenditure not different. These are different when consumption equivalence scales were applied. Wai-Poi, Spilerman and Torche (2008) investigated the measurement and concepts with asset index to measure the economic well-being. They examined the construction and use of the household with asset index by using Indonesian data set to gauge the methods of asset index construction. They used Principal Component analysis, multiple correspondence analysis, principal factor analysis and dichotomous hierarchical ordered probit model for different combinations of the underlying asset indicators to weighting the variables. They used housing quality characteristics, water quality, assets and other indicators in asset index. Harttgen and Vollmer (2013) examined an asset index to simulate household income. In this most commonly survey data used for developing countries do not include income or expenditure data. They used principal component analysis to construct an asset index for each household. The following variables are used to construct an asset index, radio, TV, refrigerator, bike, floor material, type of wall material, type of toilet, type of drinking water and housing quality and they calculate the asset indices separately for each country. Wittenberg (2017) suggests that the asset index is a reliable proxy to measure income. The primary use of this index in this enormous literature is in generating wealth rankings, separating the "rich" from the "poor" as elements for more practical analysis.

Naveed, Gordon, Ullah, and Zhang (2021) scrutinized the construction of Asset index and also measure the economic disparities in Punjab by using MICS data. The basic objectives of this study were to construct the valid and reliable asset index at household level and also estimated the economic disparities in 36 districts of Punjab (Pakistan). They said asset index may be a better measure than current income or expenditure to gauge the long-term capacity for buying goods and services.

In this study, we have applied the Factor analysis (Exploratory) and Tetrachoric-PCA with oblique rotation that is more appropriate to identify the dimensional structure items when data is binary in nature. Further, we applied Alpha-test (also known as Classical Test Theory) and IRT models to ensure the reliability of the construct, asset index.

**2.2 Measuring the Inequalities**

To measure inequality there are various approaches. Inequality measurement has been an area of interest for economists and statisticians. In 1905, a revolutionary graphical measure of inequality known as Lorenz curve, proposed by Max Otto Lorenz. In 1912 Gini derived a parametric measure of disparity, which called Gini Coefficient (Idrees and Ahmed, 2017). Many studies used Gini coefficient, Atkinson,

Generalized Entropy measure and Palma Ratio for measuring inequality. The coefficient of Gini ranges between zero to one, zero presents state of perfect equality and one means perfect inequality (Phan, 2016). Palma Ratio is also used for measuring inequality. Since the Palma Ratio is defined as the incomes ratio between richest 10 percent and bottom 40 percent. In this paper we have applied Gini and Palma methods to measure asset inequalities across the various districts of Pakistan.

## 3. RESEARCH METHODOLOGY

### 3.1 Data and Sampling

This study has used micro-data from 2017-18 Pakistan Demographic and Health Survey. The sample size was 14,540 households.

### 3.2 Indices Measurement

This section is to explain the dimensional structure of assets and construction and reliable asset index for income inequality at household level. For the construction of asset index 30 assets are used, furthermore, factor analysis, tetrachoric PCA, classical test theory and item response theory are applied.

#### 3.2.1 Construction of Asset Index

Expenditure data or household income frequently used to measure current and long-term welfare of households and within country inequality (Harttgen & Vollmer, 2011). Filmer and Pritchett (2001) and Sahn and Stifel (2001) have offered one-dimensional index based on household assets and household characteristics as proxies for long-standing welfare to overwhelmed the issue missing income and expenditure data. The so-called 'asset index' sometime used in the literature on poverty and inequality analysis as a proxy for household income. Similarly, asset indices are also used to analyze determinants and changes in poverty. However, it has become common tool to overwhelm the problem of missing data on expenditure or income.

It has become popular to use an asset constructed from variables on asset ownership as measure of economic wellbeing, when data on income, wealth and consumption are not available in developing countries. A wide literature available in development studies and policies using such indices. The same index often used to measure household well-being such as wealth or living standard. Similarly, household wealth is a better indicator of income than current income. Data on income and wealth collected from some household surveys, but rarely information is available on household wealth. For these reasons, in developing countries researches explore some strategies for using asset index as proxy to measure wellbeing of households (Wai-Poi, Spilerman, & Torche, 2008). Wittenberg (2017) suggests that the asset index is a reliable proxy to measure income. The primary use of this index in this enormous literature is in generating wealth rankings, separating the "rich" from the "poor" as elements for more practical analysis. The asset index was firstly introduced by (Filmer & Pritchett, 2001). To use asset index there are some reasons, firstly, measuring household is easier rather than a measurement of household expenditure and income data. Secondly, in asset data, there is more accuracy and validity than expenditure or income data (Sahn & Stifel, 2003). Asset index would be a very useful tool for a national household survey rather than income or expenditure data because both are unreliable and difficult to be interviewed. Above all, the World Bank generally supports their researchers to utilize the asset index to measure socioeconomic position in middle and low income middle developing countries instead of household income and expenditure which is unreliable and invalid. In short, an asset index can be a better measure than expenditure or income method in gauging the long-term household well-being and it may be a good proxy for long-term or permanent income. One more reason that the asset index even permits to identify the most deprived households better than income (Harttgen & Kalsen, 2012).

We use following variables to construct asset index: type of roof material, type of wall material, type of floor material, telephone, radio, television, cooking range, sewing machine, refrigerator, washing machine, fan/ air cooler, water filter, donkey pump/turbine, air conditioner, watch, bicycle, motorcycle, anima-drawn cart, car, boat, tractor, computer, internet, house, land, animals and bank account capturing the housing quality.

#### 3.2.2 Measurement of Inequality

To measure inequality there are various approaches. Inequality measurement has been an area of interest for economists and statisticians. Pure statistical measures like mean deviation and range were used to measure income inequality till the end of eighteen century (Idrees and Ahmed, 2017). In early nineteenth

century, few specific measure are introduced. In 1905, a revolutionary graphical measure if inequality known as Lorenz curve, proposed by Max Otto Lorenz. In 1912 Gini derived a parametric measure of disparity, which called Gini Coefficient (Idrees and Ahmed, 2017). Many studies used Gini coefficient to measure the inequality. Atkinson, Generalized Entropy measure and Palma Ratio is also a method for measuring inequality. In this study, we used Gini-coefficient and Palma Ratio for measuring disparities.

**3.3 Asset Index Data**

Asset index is used as a proxy for income. Asset index is a measurement unit about household welfare which generally serves for differentiating household according to economic status. Asset index is computed through 30 different variables. All of these variables are in binary form (0 and 1). Where 0 means "no" and 1 means "yes". If "Yes" that means households have facility of such items otherwise "No" have no facility Household based asset index is aggregated index of household asset variables. All variables computed from Pakistan Demographic and health survey (PDHS 2017-18).

**3.4 Quantile Regression Analysis**

Ordinary Least Square Regression is one of the most frequently used statistical technique. Conversely, it is a parametric model and depend on the assumptions that are often not met. Quantile regression makes no assumption about the distribution of residuals. Quantile regression is an extension of linear regression model. It also let you discover different aspects of the association between the dependent variable and exploratory variables (Yu, Lu, and Stander, 2003).

For quantile regression, you're not limited to just finding the median, but you can compute any quantile (percentage) for a specific value in the structures variable. For example, if we were to find the $25^{th}$ quantile of the price of home that would mean that there is 25% chance the actual price of the house is below the prediction, while there is 75% chances that price is above.

Quantile regression is introduced by koenker and Bassett (1978), pursue to spread these ideas to the estimation of conditional quantile regression (Koenker and Hallock, 2001). Quantile divide the number of observations in a study into equally sized groups, such as quartiles means division into four groups, quintiles means division into five groups, deciles divided into 10 groups, and percentiles divided into 100 equal groups.

The basic equation of simple Linear Regression model is:

$$y_i = \beta_0 + \beta_1 x_i + \varepsilon_i \quad \ldots\ldots\ldots\ldots \quad (1)$$

Where $\varepsilon_i$ is normally distributed with mean zero, $\beta_1$ is the regression parameter, y is dependent variable and x is independent variable.

Quantile regression equation for the ($\tau$th) quantile is expressed as:

$$(Q_r)y_i = \beta_0(\tau) + \beta_1(\tau)x_i + e_i \quad \ldots\ldots\ldots\ldots \quad (2)$$

Where, $\beta$ is a vector of unknown parameters related with the quantile The quantile regression tests the regression coefficients at different points of the distribution of the dependent variable, in this study asset index is the dependent variable at household level in Pakistan.

**3.5 Model and Data**

The inequality factors are introduced in this part. The inequality falls into the following factors: economic factors, demographic factors, cultural and social factors. These factors will be measured at the household level in Pakistan by using micro data of PDHS (2017-18). The study will investigate the factors of inequality variables will help to generate basic model

$$AI_i = \beta_0 + \beta_1 OL_i + \beta_2 LS_i + \beta_3 AFI_i + \beta_4 Area_i + \beta_5 HS_i + \beta_6 LAN_i + \beta_7 EDU_i + \mu_i \quad (3)$$

In this model, i subscript represents different cross sectionals. In this study the dependent variable is asset index and independent variable is OL ownership of land which means household owns land. LS shows owns livestock means household has livestock. AFI stands for access to financial institutions, Area shows urbanization means household located in urban or rural. HS means size of household or family size which means how many members in the household, LAN means respondent's

native language. EDU stands for Education of household head. All data were computed by Pakistan demographic and health survey (2017-18).

### 3.6 Description of Variables

The summary of description of variables used to investigate the factors of asset inequality at household level in Pakistan. Where dependent variable is asset index which is household based, and independent variables are factors i.e. economic, demographic, cultural and social factors. All variables are extracted from PDHS (2017-18).

**Table 3.1 Description of variables**

| Factor | Variable Code | Variable | References |
|---|---|---|---|
| Dependent Variable | AI | Asset Index | (Sahn and Stifel, 2003); Filmer and Pritchett, 2001) and Booysen, et al. 2008; crespo, Simoes & Diogo, 2012) |
| Economic Factors | OL | Owns land | (Naschold, 2009 ; Wan & Zhou, 2004) |
| | LS | Owns livestock | (Ciamarra et al, 2011; Naschold, 2009) |
| | AFI | Access to financial institutions | (Michelson, Muniz & DeRosa, 2013) |
| Demographic factors | Area | Area | (Kinra,2015; Malik, Abdullah & Javed, 2019; Crespo, Simoes & Diogo, 2012) |
| | HS | Household Size | (Malik 1996; Malik, Abdullah & Javed, 2019; Naschold, 2009; Muszynska & Wedrowska, 2018; Kumar & Mahadevan, 2011) |
| Cultural Factors | LAN | Language | (Kinra, 2015) |
| Social factors | EDU | Education | (Muszynska & Wedrowska, 2018; Manna & Regoli, 2012; Kinra, 2015; Naschold, 2009; Kumar & Mahadevan, 2011) |

#### 3.6.1 Description

Description of variables are stated as follows:

**(A) Asset Index**

Asset index is used as a proxy for income. Asset index is a measurement unit about household welfare which generally serves for differentiating household according to economic status. Asset index is computed through 30 different variables. All of these variables are in binary form (0 and 1). Where 0 means “no” and 1 means “yes”. If “Yes” that means households have facility of such items otherwise “No” have no facility Household based asset index is aggregated index of household asset variables. All variables computed from Pakistan Demographic and health survey (PDHS 2017-18).

**(B) Ownership of Land:** Ownership of land means household owns agricultural land. This variable is also in binary form, 1 if household owns agricultural land and 0 otherwise.

**(C) Owns Livestock:** Owns livestock means household has any livestock, farm animals or poultry. 1 if household owns livestock and 0 otherwise. Data collected from PDHS (2017-18).

**(D) Access to Financial Institutions:** Financial institutions means household has any access to bank accounts or financial institutions. The variable is in binary form. 1 if household have access to financial institutions and 0 otherwise.

**(E) Area:** Area shows the urbanization means where household located demographically. 1 if household located in urban area and 0 if rural.

**(F) Household Size:** Household size means how many number of members in each household. Data are collected from PDHS 2017-18.

**(G) Language :** Language means respondents native language of household. 1if household native language is Urdu, 2 Saraiki, 3 Punjabi and 4 other languages. It ranges from 1 to 4.

(**H) Education of head**: Education means that household head completed either highest, secondary or middle education. 1 if the household head or family is no education, 2 if primary, 3 middle and 4 secondary or higher education.

## 4. RESULTS AND DISCUSSION

### 4.1 Step by Step Results of Asset Index

This study provides results of Exploratory Factor Analysis (EFA) with Promax oblique rotation and Tetrachoric Principal Component Analysis (PCA) with oblique rotation. For the construction of a reliable asset index, 30 assets are used but after applying EFA and Tetrachoric 21 items are selected. After EFA and Tetrachoric PCA, we have applied Classical Test Theory and Item Response Theory (IRT) for the construction and reliability of the asset index.

**Table 4.1: Loadings of EFA and Tetrachoric PCA**

| **Exploratory Factor Analysis** | | | **Tetrachoric PCA with oblique rotation** | | | |
|---|---|---|---|---|---|---|
| **Factors** | **Variables** | **Factor** | **Alpha** | **Sr.no** | **Assets** | **Factor1** |
| Factor 1 | Wall | 0.70 | 0.87 | 1 | Refrigerator | 0.89 |
| | Washing | 0.70 | | 2 | Washing | 0.86 |
| | Floor | 0.69 | | 3 | Internet | -0.84 |
| | Refrigerator | 0.68 | | 4 | Cabinet | 0.82 |
| | Television | 0.63 | | 5 | Computer | 0.79 |
| | Roof | 0.63 | | 6 | CF | 0.79 |
| | Cabinet | 0.62 | | 7 | AC | 0.79 |
| | CF | -0.57 | | 8 | Wall | 0.76 |
| | Chair | 0.56 | | 9 | Camera | 0.75 |
| | Electricity | 0.54 | | 10 | Television | 0.75 |
| | SM | 0.50 | | 11 | Chair | 0.71 |
| | Mobile | 0.40 | | 12 | Floor | 0.71 |
| | Pump | 0.42 | | 13 | Bank | 0.68 |
| Factor 2 | RC | 0.40 | 0.78 | 14 | Electricity | 0.66 |
| | Internet | -0.73 | | 15 | RC | 0.65 |
| | Computer | 0.69 | | 16 | Roof | 0.65 |
| | AC | 0.67 | | 17 | Cars | -0.63 |
| | Car | -0.63 | | 18 | SM | 0.60 |
| | Telephone | 0.60 | | 19 | Pump | 0.56 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | Camera | 0.60 | | 20 | Telephone | 0.54 |
| | Bank | 0.46 | | 21 | Mobile | 0.51 |
| Factor 3 | Land | 0.78 | 0.54 | 22 | Watch | 0.38 |
| | Animals | 0.69 | | 23 | Motorcycle | 0.34 |
| Factor 4 | Motorcycle | 0.59 | 0.39 | 24 | Animals | 0.31 |
| | ADC | 0.48 | | 25 | Tractor | 0.06 |
| | Tractor | 0.43 | | 26 | Land | -0.09 |
| Factor 5 | Radio | 0.61 | 0.20 | 27 | ADC | -0.23 |
| | Watch | 0.58 | | 28 | Boat | 0.14 |
| Factor 6 | Boat | 0.73 | 0.08 | 29 | Radio | 0.01 |
| | Rickshaw | 0.64 | | 30 | Rickshaw | -0.02 |

In table 1, we applied exploratory factor analysis with Promax rotation and Tetrachoric PCA with oblique rotation. The Exploratory factor analysis is a data reduction technique and tetrachoric PCA is used because assets are in binary form. We have used 30 assets for analysis and 21 assets are selected after applying both factor analysis and tetrachoric PCA. The cut-off value in factor analysis is ≥0.4, the factors are formed based on the Cronbach alpha test and for tetrachoric, the cut off value is ≥0.4. In tetrachoric PCA, assets are selected having a value greater than or equal to 0.4. In Exploratory factor analysis and Tetrachoric PCA same items are selected. We applied Cronbach alpha to check reliability and internal consistency first two factors are formed. When we drop nine variables the internal consistency improved from 0.79 to 0.84 which is good indication of the asset index.

**4.2 Item Response Theory**

In this study, we have applied IRT for the selection of assets for the reliability of asset index construction. IRT has three types of models, 1 parameter Logistic (1PL), 2 parameter Logistic (2PL) and 3 parameter logistic (3PL), but in this study, we have applied two-parameter logistic (2pl). This model measures both difficulty and discrimination.

**Figure-4.1: Item Characteristics Curve**

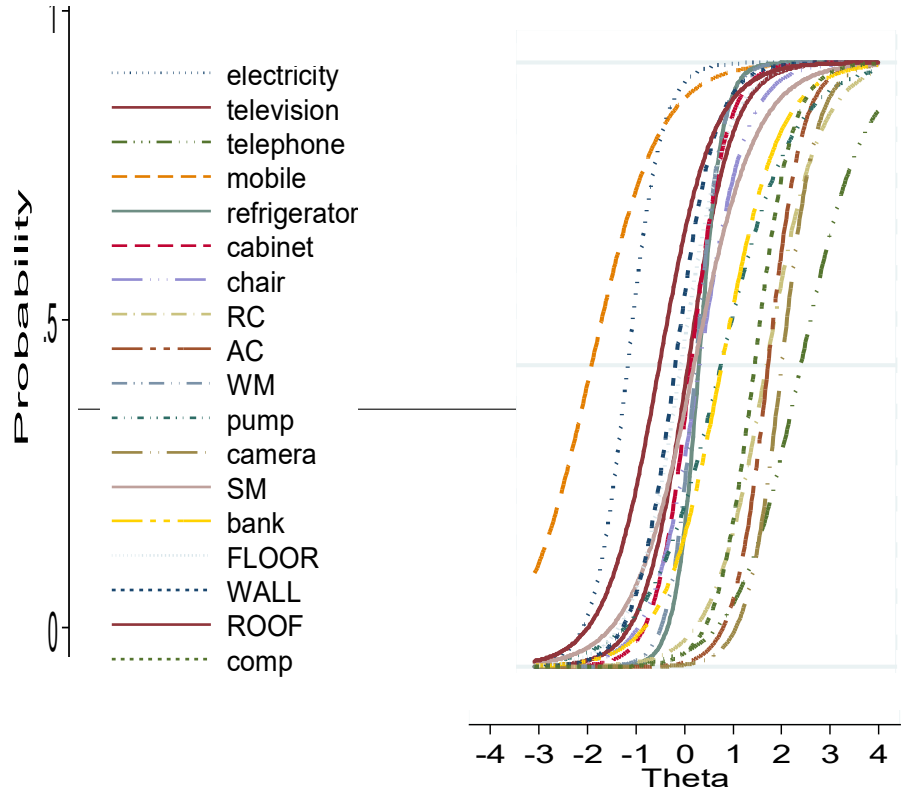


Figure 4.1 shows the 2-parameter logistic results for 30 assets. The table below shows values of difficulty, discrimination and correlation range. The difficulty range is greater than or equal three to less than or equal three (≥3 or ≤3) and discrimination ranges from -1 to +1. The correlation column is obtained from the discrimination criteria and drop all items below 0.4. The results suggested that the same 21 items are selected and dropped the same items in the analysis.

**Table 4.2: IRT results for 30 indicators of Asset index**

| | | IRT Results[=] | | |
|---|---|---|---|---|
| **Sr.no.** | **Item Name** | **Difficulty** | **Discrimination** | **Correlation** |
| 1. | Radio | -134.20 | -0.15 | -0.08 |
| 2. | Rickshaw | -171.2 | -0.22 | -0.12 |
| 3. | Animals | -22.05 | -0.18 | -0.09 |
| 4. | Land | -0.35 | -1.49 | -0.07 |
| 5. | Cooking Fuel | 0.29 | 1.91 | 0.54 |
| 6. | Bank | 2.25 | 1.14 | 0.63 |
| 7. | Electricity | 1.83 | 2.50 | 0.80 |
| 8. | Car | -1.53 | 1.57 | 0.65 |
| 9. | Air | 1.42 | 2.65 | 0.82 |
| 10. | Wall | 0.72 | 2.23 | 0.77 |
| 11. | Floor | 0.59 | 1.88 | 0.71 |
| 12. | Computer | -1.09 | 2.55 | 0.81 |
| 13. | Internet | -1.10 | 3.17 | 0.86 |
| 14. | Television | 0.42 | 1.94 | 0.73 |
| 15. | Sewing | 0.29 | 1.31 | 0.58 |
| 16. | Washing | 0.25 | 3.2 | 0.86 |
| 17. | Refrigerator | 0.18 | 3.50 | 0.88 |
| 18. | Watch | 0.74 | -0.68 | -0.35 |
| 19. | Telephone | -2.13 | 1.44 | 0.62 |
| 20. | Motorcycle | -0.24 | -0.71 | -0.36 |
| 21. | Roof | 1.10 | 1.58 | 0.65 |
| 22. | Pump | -1.15 | 2.34 | 0.53 |
| 23. | Mobile | 2.63 | 1.30 | 0.68 |
| 24. | Cabinet | 0.36 | 2.42 | 0.80 |
| 25. | Chair | 0.16 | 1.74 | 0.69 |
| 26. | Room Cooler | -1.44 | 1.52 | 0.64 |
| 27. | Camera | -1.80 | 2.35 | 0.79 |
| 28. | ADC | 6.60 | 0.46 | 0.24 |
| 29. | Boat | 20.84 | -0.31 | -0.16 |
| 30. | Tractor | -22.05 | -0.16 | 0.09 |

**4.3 Economic Inequalities in Pakistan**

In this section, the results of asset inequality across the districts of Pakistan and provinces of Pakistan by applying Gini Coefficient and Palma ratio.

[=] IRT 2pl is applied, sorted by difficulty, discrimination, and run the transformation: $\{a|\sqrt{(3.29 + \text{a2}}\}$ for correlation range -1 to +1 and exclusion rule for difficulty is ≥ 3 or ≤ -3 & for correlation is ≤0.4.

**Table 4.3: Asset Inequality of Provinces: Palma Ratio and Gini Coefficient**

| Provinces | Bottom 40% | Middle 50% | Top 10% | Palma Ratio | Gini Coefficient |
|---|---|---|---|---|---|
| Sindh | 18.1 | 62.9 | 20.8 | 1.149 | 0.301 |
| Baluchistan | 18.3 | 60.6 | 20.8 | 1.136 | 0.300 |
| Khyber Pakhtunkhwa | 23.5 | 59.2 | 17.2 | 0.731 | 0.235 |
| Punjab | 25.5 | 58.04 | 16.4 | 0.64 | 0.209 |

Source: (Author's Owns Calculation)

The above table shows that Gini coefficient and Palma ratio provinces wise. The Gini is high in Sindh i.e. 0.301, Baluchistan has value 0.300, Khyber Pakhtunkhwa has 0.235 Gini and Punjab has lowest value i.e. 0.209. The components of Palma Ratio shows that bottom 40% has18% shares of assets and top 10% has 20% shares of asset in Sindh, while Baluchistan has also same shares of assets 18% and 20%. In KP bottom 40% has 23.5% and richest top 10% has 17.2% shares of income or asset. In Punjab, 25% share of asset has poorest bottom 40% and richest top 10 % has 16.4% shares of asset.

**Table 4.4: Asset Inequality in Punjab: Gini Coefficient and Palma Ratio**

| Serial No. | Districts | Bottom 40% | Middle 50% | Top 10% | Palma Ratio | Gini Coefficient |
|---|---|---|---|---|---|---|
| 1 | DG Khan | 15 | 60 | 23 | 1.533 | 0.362 |
| 2 | Rajanpur | 13.3 | 59.06 | 18.6 | 1.34 | 0.271 |
| 3 | Lodhran | 14.3 | 62 | 21.6 | 1.51 | 0.268 |
| 4 | Bhakkar | 19.4 | 58.1 | 20.5 | 1.05 | 0.262 |
| 5 | Layyah | 16.9 | 59.3 | 23.7 | 1.40 | 0.259 |
| 6 | Muzaffarghar | 17.9 | 63.1 | 18.9 | 1.05 | 0.25 |
| 7 | Pakpattan | 23.5 | 58.6 | 17.7 | 0.753 | 0.241 |
| 8 | RY khan | 23.7 | 53.1 | 23.1 | 0.975 | 0.239 |
| 9 | Bahawalnagar | 23.8 | 58.7 | 17.4 | 0.933 | 0.231 |
| 10 | Bahawalpur | 24.4 | 57.7 | 17.7 | 0.826 | 0.229 |
| 11 | Attock | 24.0 | 59.4 | 16.4 | 0.985 | 0.225 |
| 12 | Okara | 24.1 | 56.9 | 18.9 | 0.984 | 0.225 |
| 13 | Khushab | 29.3 | 56.3 | 14.2 | 0.985 | 0.217 |
| 14 | Khanewal | 27.1 | 57.4 | 15.4 | 0.68 | 0.209 |
| 15 | Toba Tek Singh | 27 | 56.4 | 16.4 | 0.607 | 0.207 |
| 16 | Multan | 22.5 | 59.2 | 18.1 | 0.804 | 0.195 |
| 17 | Sahiwal | 27.7 | 56.6 | 15.5 | 0.60 | 0.191 |
| 18 | Vehari | 27.8 | 57.2 | 16.1 | 0.95 | 0.191 |
| 19 | Mianwali | 25 | 58.4 | 16.4 | 0.90 | 0.185 |
| 20 | Sheikhpura | 31.02 | 54.7 | 14.1 | 0.89 | 0.181 |
| 21 | Jhang | 31.1 | 55.2 | 12.8 | 0.88 | 0.178 |
| 22 | Kasur | 25.8 | 57.8 | 16.7 | 0.647 | 0.177 |
| 23 | Hafizabad | 25.5 | 58.2 | 16.1 | 0.631 | 0.176 |
| 24 | Nankna Sahib | 28.3 | 57.4 | 14.2 | 0.802 | 0.175 |
| 25 | Rawalpindi | 24.9 | 58.4 | 16.5 | 0.663 | 0.167 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 26 | Sargodha | 32.2 | 53.9 | 13.8 | 0.78 | 0.158 |
| 27 | Chiniot | 25.3 | 59.1 | 15.4 | 0.610 | 0.155 |
| 28 | Chakwal | 28.1 | 56.2 | 15.6 | 0.555 | 0.154 |
| 29 | Faisalabad | 27 | 56 | 15 | 0.556 | 0.152 |
| 30 | Narowal | 23.7 | 60.2 | 16.0 | 0.677 | 0.147 |
| 31 | Gujrat | 31.1 | 56 | 12.8 | 0.412 | 0.147 |
| 32 | Lahore | 29.5 | 60.1 | 17.8 | 0.59 | 0.146 |
| 33 | Mandi bahu din | 26.3 | 58.5 | 15.1 | 0.574 | 0.143 |
| 34 | Jhelum | 29.3 | 56.2 | 14.3 | 0.489 | 0.134 |
| 35 | Gujranwala | 29.7 | 55.6 | 14.7 | 0.495 | 0.122 |
| 36 | Sialkot | 30.2 | 54.7 | 15 | 0.497 | 0.121 |

Source: (Author's Owns Calculation)

The above table shows the results of asset inequality in Punjab districts of Pakistan. The results depicts that DG khan, Rajanpur, Lodhran and Bhakkar has highest disparities and the Gini Coefficients are 0.36, 0.27, 0.26 and 0.26 respectively. The results of Palma ratio showed that DG khan has highest inequality where the bottom 40% has only 15% share of income or asset and top 10% has 23% share of asset. The lowest inequality is in Jhelum, Gujranwala and Sialkot. In Gujranwala, bottom 40% has 29% shares of asset and top 10% has 14% shares of asset.

**Table 4.5: Asset Inequality in Sindh: Gini Coefficient and Palma Ratio**

| Sr# | Districts | Bottom 40% | Middle 50% | Top 10% | Palma Ratio | Gini Coefficient |
|---|---|---|---|---|---|---|
| 1 | Mirpur | 18.3 | 59.06 | 20.5 | 1.12 | 0.404 |
| 2 | Sanghar | 14.3 | 62 | 21.6 | 1.51 | 0.4 |
| 3 | Shaheed Benzirabad | 19.4 | 58.1 | 20.5 | 1.05 | 0.36 |
| 4 | Badin | 16.9 | 59.3 | 23.7 | 1.40 | 0.359 |
| 5 | Sujawal | 13.9 | 67 | 18.9 | 1.35 | 0.348 |
| 6 | Sukkur | 17.9 | 63.1 | 18.9 | 1.05 | 0.334 |
| 7 | Thatta | 20.7 | 58.02 | 1.25 | 0.60 | 0.314 |
| 8 | Tando all | 24.03 | 57.7 | 18.2 | 0.75 | 0.308 |
| 9 | Kambar shadadkot | 21.2 | 55.3 | 13.5 | 0.63 | 0.306 |
| 10 | Khairpur | 31.8 | 54.5 | 13.6 | 0.599 | 0.303 |
| 11 | Umerkot | 26.9 | 57.3 | 15.7 | 0.589 | 0.303 |
| 12 | Hyderabad | 19.6 | 60.8 | 19.4 | 0.98 | 0.3 |
| 13 | Matiari | 14.1 | 61.9 | 23.9 | 1.69 | 0.299 |
| 14 | Tharparka | 19.1 | 59.6 | 21.1 | 1.104 | 0.291 |
| 15 | Larkana | 19.3 | 60.3 | 20.2 | 1.04 | 0.29 |
| 16 | Ghotki | 22.6 | 55.9 | 21.4 | 0.94 | 0.281 |
| 17 | Jacobabad | 24.05 | 52.2 | 23.7 | 0.98 | 0.263 |
| 18 | Naushahro | 16.4 | 56.2 | 27.8 | 1.69 | 0.258 |
| 19 | TM khan | 24.1 | 50.5 | 23.5 | 0.97 | 0.242 |
| 20 | Dadu | 26.4 | 52.7 | 20.8 | 0.78 | 0.237 |
| 21 | Korangi | 20.1 | 60.6 | 19.2 | 0.95 | 0.209 |
| 22 | Jamshoro | 26.01 | 57.5 | 16.3 | 0.62 | 0.206 |
| 23 | Karachi West | 28.9 | 66.5 | 17.6 | 0.60 | 0.188 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 24 | Shikarpur | 30.7 | 58.3 | 18.5 | 0.602 | 0.179 |
| 25 | Karachi Milar | 30.6 | 54.5 | 14.8 | 0.48 | 0.166 |
| 26 | Karachi South | 29.6 | 55.1 | 15.2 | 0.457 | 0.163 |
| 27 | Karachi central | 30.9 | 55.4 | 13.5 | 0.436 | 0.154 |
| 28 | Kashmore | 30.0 | 61.3 | 12.5 | 0.416 | 0.144 |
| 29 | Karachi east | 30.1 | 55.5 | 12.2 | 0.405 | 0.122 |

Source: (Author's Owns Calculation)

The above table shows the results of asset inequality in Sindh districts of Pakistan. The results of Palma ratio showed that Mirpurkhas has highest inequality where the bottom 40% has only 18% share of income or asset and top 10% has 20% share of asset. The lowest inequality is in Karachi south, Milar, Karachi central, kashmore and Karachi east. In Karachi, bottom 40% has 30% shares of asset and top 10% has 14% shares of asset. The Gini coefficient has displays that Mirpur, Sanghar and Badin has highest degree of inequality.

**Table 4.6: Asset Inequality of Khyber Pakhtunkhwa: Gini Coefficient and Palma Ratio**

| Sr# | Districts | Bottom 40% | Middle 50% | Top 10% | Palma Ratio | Gini Coefficient |
|---|---|---|---|---|---|---|
| 1 | Buner | 17.3 | 58.3 | 23.7 | 1.25 | 0.333 |
| 2 | Bannu | 18.9 | 59.1 | 13.5 | 1.06 | 0.312 |
| 3 | Lower Dir | 21 | 58.2 | 18.9 | 1.06 | 0.303 |
| 4 | Batagram | 18.5 | 60.9 | 18.3 | 0.98 | 0.299 |
| 5 | Hangu | 19.7 | 57.2 | 18.9 | 0.95 | 0.296 |
| 6 | D. I khan | 17.7 | 56.6 | 14.9 | 0.84 | 0.279 |
| 7 | Upper Dir | 16.5 | 52.9 | 13.5 | 0.81 | 0.277 |
| 8 | Chitral | 20.7 | 60.5 | 18.2 | 0.90 | 0.247 |
| 9 | Lakki marwat | 20.6 | 61.4 | 21.5 | 0.98 | 0.245 |
| 10 | Mardan | 19.3 | 55.5 | 13.6 | 0.704 | 0.242 |
| 11 | Swat | 18.3 | 58.6 | 15.7 | 0.70 | 0.236 |
| 12 | Nowshera | 16.7 | 57.1 | 19.4 | 0.66 | 0.222 |
| 13 | Charsadda | 32.2 | 53.9 | 13.8 | 0.78 | 0.22 |
| 14 | Mansehra | 25.3 | 59.1 | 15.4 | 0.610 | 0.216 |
| 15 | Abbottabad | 28.1 | 56.2 | 15.6 | 0.555 | 0.202 |
| 16 | Peshawar | 27 | 56 | 15 | 0.556 | 0.2 |
| 17 | Malakand | 23.7 | 60.2 | 16.0 | 0.677 | 0.199 |
| 18 | Tank | 31.1 | 56 | 12.8 | 0.412 | 0.191 |
| 19 | Kohat | 29.5 | 60.1 | 17.8 | 0.59 | 0.177 |
| 20 | Haripur | 26.3 | 58.5 | 15.1 | 0.574 | 0.174 |
| 21 | Karak | 29.3 | 56.2 | 14.3 | 0.489 | 0.172 |
| 22 | Shangla | 29.7 | 55.6 | 14.7 | 0.495 | 0.172 |
| 23 | Tor Ghar | 30.1 | 55.5 | 12.2 | 0.405 | 0.17 |
| 24 | Swabi | 30.2 | 54.7 | 15 | 0.497 | 0.167 |

Source: (Authors owns Calculations)

The above table shows the results of asset inequality in KP districts of Pakistan. The results of Palma ratio showed that Buner has highest inequality where the bottom 40% has only 17% share of

income or asset and top 10% has 23% share of asset. The results of Gini Coefficient explains that Buner, Lower Dir, Upper Dir and Banu has utmost asset disparity. The lowest level of asset disparity in these districts of KP i.e. Shangla, Tor Ghar and Swabi.

**Table 4.7: Asset Inequality of Baluchistan: Palma Ratio and Gini Coefficient**

| S# | Districts | Bottom 40% | Middle 50% | Top 10% | Palma Ratio | Gini Coefficient |
|---|---|---|---|---|---|---|
| 1 | Sohbatpur | 17.3 | 58.3 | 23.7 | 1.25 | 0.382 |
| 2 | Khuzdar | 13.5 | 59.1 | 18.9 | 1.4 | 0.381 |
| 3 | Nasirabad | 18.9 | 58.2 | 21 | 1.06 | 0.343 |
| 4 | Lasbela | 18.2 | 57.7 | 20.2 | 1.10 | 0.329 |
| 5 | Mastung | 16.9 | 57.2 | 19.7 | 1.16 | 0.313 |
| 6 | Gwadar | 15.9 | 60.9 | 23.3 | 1.46 | 0.31 |
| 7 | Killa Saifullah | 16.6 | 52.4 | 28.8 | 1.1 | 0.292 |
| 8 | Lehri | 17.4 | 60.7 | 21.8 | 1.25 | 0.287 |
| 9 | Loralai | 16.4 | 54.4 | 29.4 | 1.12 | 0.285 |
| 10 | Awaran | 14.8 | 56 | 29.1 | 1.9 | 0.279 |
| 11 | Jhal Magsi | 18.3 | 57.5 | 24.1 | 1.31 | 0.275 |
| 12 | Kalat | 16.4 | 58.4 | 20.7 | 1.26 | 0.256 |
| 13 | Zhob | 20.5 | 54.7 | 18.3 | 0.89 | 0.252 |
| 14 | Kachhi | 22.3 | 58.7 | 18.9 | 0.85 | 0.238 |
| 15 | Kharan | 20.5 | 54.7 | 18.3 | 0.89 | 0.231 |
| 16 | Jafarabad | 23.9 | 54.4 | 21.6 | 0.90 | 0.215 |
| 17 | Kohlu | 17.7 | 59.9 | 22.3 | 0.79 | 0.18 |
| 18 | Pishin | 26.9 | 57.1 | 15.9 | 0.72 | 0.174 |
| 19 | Sherani | 24.9 | 58.4 | 16.5 | 0.663 | 0.166 |
| 20 | Killa Abdullah | 32.2 | 53.9 | 13.8 | 0.78 | 0.162 |
| 21 | Sibi | 25.3 | 59.1 | 15.4 | 0.60 | 0.15 |
| 22 | Dera Bugti | 23.7 | 60.2 | 16.0 | 0.677 | 0.149 |
| 23 | Quetta | 27 | 56 | 15 | 0.556 | 0.123 |
| 24 | Kech (Turbat) | 28.1 | 56.2 | 15.6 | 0.555 | 0.116 |
| 25 | Washuk | 31.1 | 56 | 12.8 | 0.412 | 0.111 |

**Source: (Authors owns calculations)**

The above table shows the results of asset inequality in Baluchistan districts of Pakistan. The results of Palma ratio shows that Sohbatpur has highest inequality where the bottom 40% has only 17% share of income or asset and top 10% has 23% share of asset. Khuzdar has also highest inequality, the share of asset 13% in bottom 40% while richest top 10% has 18% shares of assets. The lowest inequality in Quetta, kech and Washuk. In Quetta, bottom 40% has 27% shares of asset and top 10% has 15% shares of asset. The Gini coefficient has displays that Sohbatpur, Khuzdar, Awaran, and Mastung has highest degree of inequality.

**4.4 OLS results (Gini by top 10% and bottom 40%)**

| VARIABLES | (1) Model 1 |
|---|---|
| Top10 | 0.247 |
| | (0.185) |

| | |
|---|---|
| Bottom40 | -0.336** |
| | (0.149) |
| Constant | 0.263*** |
| | (0.0618) |
| Observations | 143 |
| R-squared | 0.103 |

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The above table represents the results of Gini Coefficient top 10% and bottom 40%, it is the components of the Palma ratio. The positive sign for the top 10% shows that an increase in the share of the income would rise in inequality. The negative sign for bottom 40% show that increase in the share of bottom 40% of income will decline the overall inequality.

**4.5 Province-wise distribution of Household-based Asset Index in Pakistan**

The table 4.8 shows the results of asset index at district level in Pakistan.

| **Table: 4.8. Province-wise distribution of Household-based Asset Index in Pakistan** | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Punjab** | | | **Sindh** | | | **KP** | | | **Baluchistan** | | |
| **Sr.no.** | **District** | **Asset Index** | **Sr.no.** | **District** | **Asset Index** | **Sr.no.** | **District** | **Asset Index** | **Sr.no.** | **District** | **Asset Index** |
| 1. | Rajanpur | 0.24 | 1. | Tharparkar | 0.21 | 1. | Tor ghar | 0.26 | 1. | Dera Bugti | 0.25 |
| 2. | DG khan | 0.39 | 2. | Dadu | 0.28 | 2. | Upper dir | 0.33 | 2. | Gwadar | 0.27 |
| 3. | Lodhran | 0.42 | 3. | Jacobabad | 0.29 | 3. | Hangu | 0.37 | 3. | Jafarabad | 0.27 |
| 4. | Layyah | 0.45 | 4. | Sanghar | 0.30 | 4. | Lower dir | 0.42 | 4. | Jhal magsi | 0.27 |
| 5. | Pakpattan | 0.47 | 5. | Mirpurkhas | 0.32 | 5. | Chitral | 0.43 | 5. | Kachhi | 0.30 |
| 6. | Attock | 0.47 | 6. | Badin | 0.33 | 6. | Batagram | 0.45 | 6. | Kalat | 0.34 |
| 7. | RY khan | 0.47 | 7. | T. Muhammad khan | 0.34 | 7. | Lakki Murwat | 0.47 | 7. | Kech | 0.38 |
| 8. | Okara | 0.47 | 8. | Thatta | 0.34 | 8. | Buner | 0.47 | 8. | Kharan | 0.39 |
| 9. | Muzaffargh | 0.48 | 9. | Q. shahdadkot | 0.35 | 9. | Swat | 0.49 | 9. | Khuzdar | 0.40 |
| 10. | Bahawalnagar | 0.49 | 10. | Sujawal | 0.36 | 10. | Shangla | 0.50 | 10. | Killa abad | 0.41 |
| 11. | Vehari | 0.50 | 11. | Matiari | 0.37 | 11. | DI khan | 0.50 | 11. | Killa sai | 0.42 |
| 12. | Khanewal | 0.51 | 12. | Ghotki | 0.38 | 12. | Charsadda | 0.50 | 12. | Kohlu | 0.42 |
| 13. | Nankana S. | 0.51 | 13. | Umerkot | 0.40 | 13. | Mansehra | 0.51 | 13. | Lasbela | 0.44 |
| 14. | Bahawalpur | 0.52 | 14. | Shaheed Benzairabad | 0.41 | 14. | Mardan | 0.51 | 14. | Lehri | 0.46 |
| 15. | Mianwali | 0.54 | 15. | Hyderabad | 0.41 | 15. | Swabi | 0.53 | 15. | Loralai | 0.46 |
| 16. | Bhakkar | 0.54 | 16. | Larkana | 0.42 | 16. | Abbottabad | 0.54 | 16. | Mastung | 0.46 |
| 17. | Chakwal | 0.54 | 17. | Khairpur | 0.43 | 17. | Peshawar | 0.55 | 17. | Nasirabad | 0.47 |
| 18. | Narowal | 0.54 | 18. | Tando Allahyar | 0.45 | 18. | Malakand | 0.56 | 18. | Pishin | 0.48 |
| 19. | Khushab | 0.55 | 19. | Naushahro | 0.45 | 19. | Nowshera | 0.57 | 19. | Awaran | 0.51 |
| 20. | Kasur | 0.55 | 20. | Sukkur | 0.46 | 20. | Haripur | 0.58 | 20. | Quetta | 0.51 |
| 21. | Chiniot | 0.55 | 21. | Jamshoro | 0.50 | 21. | Bannu | 0.58 | 21. | Sherani | 0.52 |
| 22. | Sahiwal | 0.56 | 22. | Karachi Middle | 0.52 | 22. | Karak | 0.58 | 22. | Sibi | 0.56 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 23. | Multan | 0.56 | 23. | Kashmore | 0.54 | 23. | Kohat | 0.59 | 23. | Sohbatpur | 0.58 |
| 24. | Sargodha | 0.56 | 24. | Karachi west | 0.54 | 24. | Tank | 0.59 | 24. | Washuk | 0.59 |
| 25. | Hafiz Abad | 0.56 | 25. | Karachi South | 0.56 | | | | 25. | Zhob | 0.59 |
| 26. | Sialkot | 0.57 | 26. | Shikarpur | 0.59 | | | | | | |
| 27. | M. bahaudin | 0.58 | 27. | Korangi | 0.59 | | | | | | |
| 28. | Jhang | 0.59 | 28. | Karachi central | 0.61 | | | | | | |
| 29. | Rawalpindi | 0.60 | 29. | Karachi East | 0.63 | | | | | | |
| 30. | Sheikhupura | 0.60 | | | | | | | | | |
| 31. | Jhelum | 0.61 | | | | | | | | | |
| 32. | Gujranwala | 0.61 | | | | | | | | | |
| 33. | Faisalabad | 0.62 | | | | | | | | | |
| 34. | Gujrat | 0.63 | | | | | | | | | |
| 35. | TT singh | 0.64 | | | | | | | | | |
| 36. | Lahore | 0.67 | | | | | | | | | |

The above table shows the results of asset index at district level in Pakistan. In Punjab, the results depicts that DG khan, Rajanpur, Lodhran and Bhakkar has lowest asset index. The highest asset index is in Lahore, Jhelum, Gujranwala and Sialkot. In Sindh, the results showed that Mirpurkhas, Badin and Sanghar has lowest asset index. The highest asset index is in Karachi east and Karachi central. In KPK, The results of asset index that Buner, Lower Dir and Upper Dir has lowest asset. The highest level of asset index in these districts of KP i.e. Shangla and Swabi. In Baluchistan, Sohbatpur and Khuzdar has a lowest asset index. The highest asset index is in Quetta, kech and Washuk.

**4.6 Descriptive Statistics**

The most used methodology is that which starts with some descriptive statistics of these variables from the Pakistan Demographic and Health Survey (2017-18).

**Table 4.9: Descriptive Statistics**

| Variables | Observation | Mean | Std.dev | Min | Max |
|---|---|---|---|---|---|
| Asset index | 14,540 | 0.446 | 0.197 | 0 | 1 |
| Land | 14,538 | 0.321 | 0.466 | 0 | 1 |
| Livestock | 14,536 | 0.442 | 0.496 | 0 | 1 |
| Access to financial institutions | 14,535 | 0.407 | 0.491 | 0 | 1 |
| Area | 14,540 | 0.500 | 0.500 | 0 | 1 |
| Household size | 14,540 | 6.937 | 3.624 | 1 | 44 |
| Language | 14,540 | 3.583 | 0.655 | 1 | 4 |
| Education | 14,536 | 2.263 | 1.165 | 1 | 4 |

The above table explained the descriptive statistics of inequality at household level in Pakistan and its mean and standard deviation. The minimum and maximum value of asset index status fulfils the boundaries in the response which are 0 and 1. The consequences showed that mean value of asset index is 0.446 and standard deviation is 0.197 stated the deviancy of response from its mean.

The minimum and maximum value of ownership of agricultural land fulfill boundaries in the responses which were (0, 1) respectively, that presented how much values were spread out. The values showed a mean value of land is 0.321, standard deviation 0.466 stated the deviancy of responses from its mean.

The minimum and maximum value of ownership of livestock fulfill boundaries in the responses which were (0, 1) respectively, that presented how much values were spread out. The significances showed a mean value of livestock is 0.442, standard deviation 0.496 stated the deviancy of responses from its mean.

The descriptive statistics of access to financial institutions its mean and standard deviation. The minimum and maximum value of access to financial institutions fulfil boundaries in the responses which are (0, 1) respectively, that presented how much values are spread out. The consequences showed a mean value of financial institutions 0.407, standard deviation 0.491 stated the deviancy of responses from its mean.

The descriptive statistics of area its mean and standard deviation. The minimum and maximum value of area fulfil boundaries in the responses which are (0, 1) respectively, that

presented how much values are spread out. The consequences showed a mean value of area 0.500, standard deviation 0.500 stated the deviancy of responses from its mean.

The descriptive statistics of household size its mean and standard deviation. The minimum and maximum value of household size fulfil boundaries in the responses which are (1, 44) respectively, that presented how much values are spread out. The magnitudes showed a mean value of children 6.93 standard deviation 3.62 stated the deviancy of responses from its mean.

The descriptive statistics of respondents native language its mean and standard deviation. The minimum and maximum value of respondent's native language fulfil boundaries in the responses which are (1, 4) respectively, that presented how much values are spread out. The consequences showed a mean value of language 3.583, standard deviation 0.655 stated the deviancy of responses from its mean.

Education of household mean and its deviancy from mean. The minimum and maximum value of education fulfill boundaries in the responses which were (1, 4) respectively, that presented how much values were spread out. The consequences showed a mean value of education 2.263 and standard deviation 1.165 stated the deviancy of responses from its mean.

**4.7 Quantile Regression Analysis**

The table represents the results of ordinary least square, quantile regression and inter quantile regression. The dependent variable is Asset index and independent variables are factors of inequality.

**Table-4.10: Results of quantile regression**

| Asset Index | OLS | Quantile(0.25) | Quantile(0.50) | Quantile(0.75) | Inter-quantile regression |
|---|---|---|---|---|---|
| Land | 0.3223*** | 0.0340*** | 0.0344*** | 0.0346*** | 0.0060 |
| Yes | (0.000) | (0.000) | (0.000) | (0.000) | (0.893) |
| Livestock | 0.4156*** | 0.0340** | 0.0440*** | 0.0492*** | 0.0151** |
| | (0.000) | (0.024) | (0.000) | (0.000) | (0.004) |
| AFI | 0.1600*** | 0.1553*** | 0.1639*** | 0.1589*** | 0.0336 |
| Yes | (0.000) | (0.000) | (0.000) | (0.000) | (0.555) |
| Area | 0.0849*** | 0.1060*** | 0.0895*** | 0.0732*** | -0.0328*** |
| Urban | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| | 0.0037*** | 0.0037*** | 0.0041*** | 0.0041*** | 0.0037 |
| Household size | (0.000) | (0.000) | (0.000) | (0.000) | (0.567) |
| | -0.059*** | -0.066*** | -0.0592*** | -0.0492*** | 0.0170*** |
| Lang | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| Edu: Primary | 0.0377*** | 0.0378*** | 0.0399*** | 0.0405*** | 0.0027 |
| | (0.000) | (0.000) | (0.000) | (0.000) | (0.212) |
| Edu: | 0.075*** | 0.075*** | 0.077*** | 0.743*** | -0.00171 |
| Secondary | (0.000) | (0.000) | (0.000) | (0.000) | (0.752) |
| | 0.113*** | 0.113*** | 0.1205*** | 0.123*** | 0.1033** |
| Edu: higher | (0.000) | (0.000) | (0.000) | (0.000) | (0.055) |
| | 0.4480*** | 0.3674*** | 0.4338*** | 0.5052*** | 0.1377*** |
| Constant | (0.000) | (0.000) | (0.000) | (0.000) | (0.000) |
| **Observations** | 14,527 | 14,527 | 14,527 | 14,527 | 14,527 |
| **R2/Pseudo R2-66** | 0.5433 | 0.3462 | 0.3399 | 0.3214 | 0.3214, 0.3462 |

Note: ***, ** denote statistically significant at 1% and 5% levels respectively parenthesis shows probability

The table 4.10 presents the result of ordinary least square (OLS) regression, quantile regression and interquartile range regression. Where column 1 shows the variables, column 2 shows the results of ordinary least square regression (OLS), and column 3,4 and 5 display the results of quantile regression. In last, column 6 shows the results of Interquartile range regression that explains the significant difference between the coefficients of quantile 0.25 and 0.75. The last two rows of the qua shows observations for each model and coefficients of determination respectively. R2 for OLS and Pseudo R2 for quantile regression.

The results showed that the effect of agricultural land has a positive sign for 0.25, 0.50 and 0.75 quantiles, thus indicating that agricultural land has positive and significant effect on inequality. While, interquartile range regression has positive and not significantly impact on inequality. Ownership of agricultural land is important, it implies that increasing agricultural land reduces the total wealth of household (Ward, 2014). Land is the only factor which equalizing the inequality. This is clear as land is to be a more abundant in less developed areas and those who are poor are largely related with farming. Many households are unwilling to give up land because it acts as safety for livelihood in case of political or economic crisis. In Pakistan, the importance of land determining the income or asset disparities is not surprising because land itself is unequal distributed. Nevertheless, it is ownership of land rather than access to land, which matters most for income or asset disparities (Naschold, 2015). The results are consistent with pervious literature (Ward, 2015; Naschold, 2015; Wan & Zou, 2004).

The results showed that the impact of livestock on disparity is positively and significantly correlated for lower, median and upper quantile. Livestock is a multidimensional source of income. The livestock were found to be helpful in reducing overall disparities (Ciamarra et al, 2011). Livestock are important and considered a symbol of wealth and measure of assets owned. It owned by both low and high income households. Livestock income was more essential for the poor, and hence tended to decrease disparity. Unequal holdings of livestock are another source of the level of income disparity (Naschold, 2015). The results are similar with previous studies (Ciamarra et al., 2011; Naschold, 2015).

There is positive and significant relationship between access to financial institutions and inequality for upper, median and lower quantiles at household level. Low income people hesitate for using financial institutions, however, even its free for poor to use financial institutions, still income inequality increases the money and pay interest, lower the amount. Interest is paid on savings deposits, low income people have high marginal propensity to consume leads to lower savings and consequences in contrast with high income group. The banks or formal finance institutions are interested to provide financial facilities to rich people but poor people has less opportunities to get credit facility or financial facility which cause inequality (Michelson, Muniz & DeRosa, 2013).

The above results shows that area has positive and significant association with inequality for 0.25, 0.50, and 0.75 quantiles with p value (0.000). In generally inequality may be more noticeable in urban areas as compared to rural areas. Urban areas are more advanced with diversity of sectors demanding technical knowhow and skills. Overall disparity inclines to greater in urban areas as compared to rural areas. Urban residency may have also a balancing effect or positive impact on disparity. This sign generally dependent of the accessibility of the market size, employment and the general development level and not only its distribution level (Okatch et al, 2013). Urban areas residents tend to rise the household productivity and generating income. Commonly, household livings in urban areas are more visible to many opportunities which are income generating than rural areas. Residing in rural areas has the inclination of reducing the welfare of the households (Afful, Nunoo & Arthur-Biney, 2019). The results are consistent with pervious literature (Kinara, 2015; Malik, Abdullah & Javed, 2019; Crespo, Simoes & Diogo, 2012).

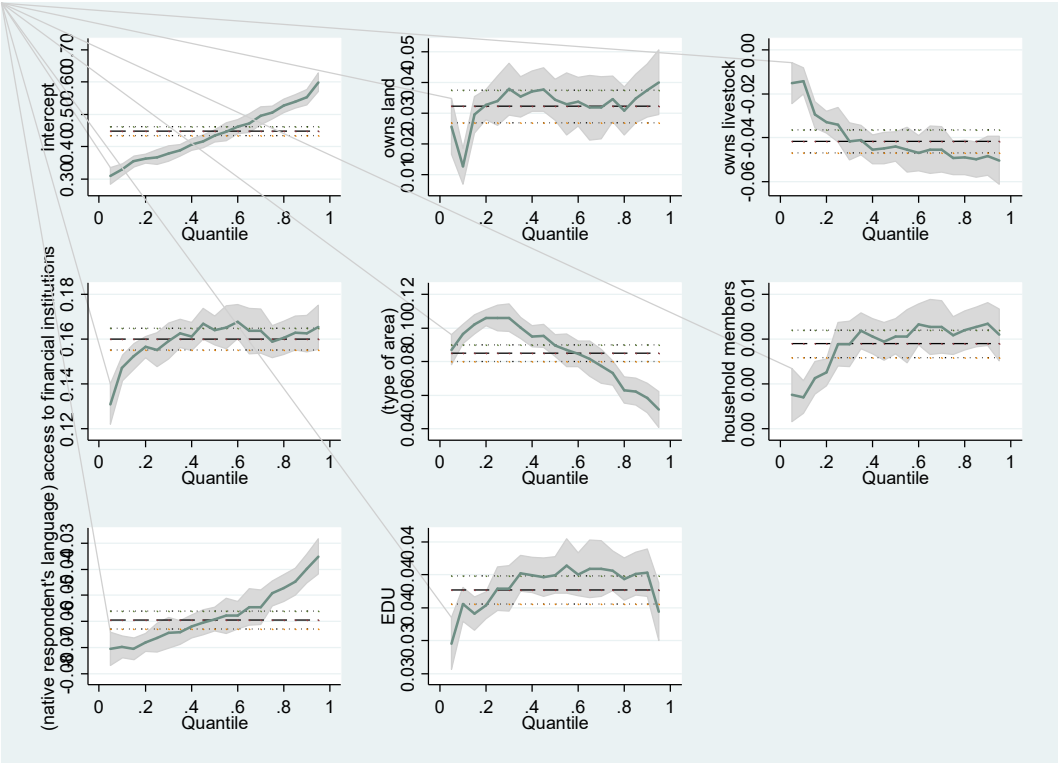
There is positive and significant relationship between household size and inequality. The association between the number of household member and inequality is opposite to the association between the number of children and disparities. Higher the inactive population in the household, the lower the wealth of the household. It is true that the number of inactive individuals in the family increases the burden on the household, in that case, the resources which spent on the family members are spent in attaining more assets for the family, which would increase the disparity (Afful, Nunoo & Arthur-Biney,

2019). More the people in the household increases, the more members contribute resources towards the group of income. The results are similar with previous studies ( Kumar & Mahadevan, 2011; Muszynska & Wedrowska, 2018)

Language is used as a proxy variable for determining cultural factor. There is negative and significant relationship between language and inequality (kinra, 2015).

Education is found to have a positive and significant association with inequality. The level of education of members of household can be another possible deriver of income disparity. It is believed that inequality is based on differences in human capital which is related to individual's experiences and education. Education affects the member of household more skills and productivity which ultimately increases the income of household (Muszynska & Wedrowska, 2018). This finding also consistent, more educated person more knowledge, thus leading to greater income. Individuals with greater level of education are more likely to hold jobs that involve accomplishment more difficult task and that have better career perspectives. They are also more proficient in job searching (Arrow, 1997). Education has long been considered a multi-purpose policy tool with the main goals this connection is obtained by the fact that education provides the skills that can be utilized in the labor market. Worker with these skills get higher salaries. If more people become educated the income gap reduces, and disparity also decreases. But this is not always the same case (Okatch et al, 2013). Many researchers argue that increasing education attainment could actually lead to higher, not decline, earnings disparities (Pereira and Martins, 2004). This could be a result of poorly designed or outdated education system, where students are provided with skills in largely supply and yet there is less demand for those skills in the labor market (Okatch et al, 2013). Many studies found that there is positive relationship between education and income inequality (Mankiw et al, 1992). The results are consistent with pervious literature (Okatch et al, 2013; Kumar & Mahadevan, 2011; Muszynska & Wedrowska, 2018).

**Figure -4.2: Coefficients for Each Regressor by Quantiles**




Source: Author's Own Calculation

The above figure provides a visualization of the differences in the coefficients across the quantiles with the bootstrapped confidence intervals. It also includes the ordinary least square estimates, which are constant across all quantiles, and their confidence interval.

From this figure, we can see that the ordinary least square coefficients fall within the confidence interval of the quantile regression coefficients. This implies that our quantile regression results are not statistically different from the ordinary least square (OLS) results.

## 5. CONCLUSION

The main objective of this study is to construct reliable and valid asset index at household level in Pakistan by using Demographic and Health Survey (2017-18) micro data. This study gives details of the results from Exploratory Factor Analysis (EFA), Tetrachoric Principal Component Analysis (PCA) to explain dimensional structure of assets. We have applied Item Response Theory (IRT) and Classical Test Theory for reliability of the asset index. Based on dimensional structure of assets and reliability analysis, out of 30, only 21 assets have been selected for the construction of asset index. This research has used binary response variable of household regarding asset ownership (i.e. yes or no).

This research study has calculate the Gini Coefficient and Palma ratio to measure asset inequalities in Pakistan The results show that Sindh and Baluchistan provinces have higher asset inequality comparing to Khyber Pakhtunkhwa and Punjab. Within Punjab, Sialkot is ranked at top in equality while DG khan is ranked at bottom in asset distribution. Within Khyber Pakhtunkhwa, Buner is ranked at top while Swabi is ranked at bottom on asset inequality. In Sindh, Mirpur has highest degree of inequality while in Karachi district of Sindh has lowest disparity. In Baluchistan, Sohbatpur has high level of asset disparity while, Washuk has lowest asset inequality. Interestingly, the district rank ordering produced by both Gini coefficient and Palma Ratio are similar.

Policy recommendations is that efforts should be made to reduce the effects of inequality. Evaluation the performance of the institutions is more important than just formulating policies. This research study boost to policy makers to arrange public investment in socioeconomic development in economically lagging districts of Pakistan. The policy makers and government to organize and coordinate expenditures on social development projects to attain equitable and balanced development. The government of Pakistan and decision makers aimed at reducing disparities and enhancing equal distribution of income among all districts and provinces of Pakistan. There is need to properly monitor the relevant intuitions to be transparent in their operations and become performance oriented.

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