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RURAL INFRASTRUCTURAL DEVELOPMENT AND ITS ROLE IN POVERTY REDUCTION: Evidence from Pakistan

Ishtiaq AHMAD,* Ali AZAM,* and Babar AZIZ**

Abstract

This study aims not only to find out status of rural infrastructural development in Pakistan but also to investigate role of infrastructure in rural poverty reduction. Twin detached analyses have been utilized on two different secondary datasets based on temporally contemporary surveys. Firstly, with the help of 'Pakistan 2008 MOUZA Statistics', a comprehensive and composite index of principal infrastructural variables accessible to rural communities has been constructed while assigning higher weights to lower variances. Secondly, logit estimation is applied to 8480 observations of 'HIES (2005-06)' relating to rural households to explore hypothesized positive role of infrastructure in poverty reduction. The analysis not only points out a poor status of rural infrastructural development in Pakistan but also highlights its positive but secondary role in poverty eradication of rural areas.

I. Introduction

Even growth is necessary state but could not be termed as sufficient to achieve the goal of development. Enhanced growth with increasing inequality has nothing to serve the economies for developmental route because on account of inequality resources are captured by the elite who then serve their own interests and not serve the nation as a whole. This phenomenon is apparent picture of developing countries like Pakistan where even growth targets have been achieved time and again in the decades of 1960s, 1980s and 2000s, but indicators of social sector development show Pakistan economy in lower quartile of the globe. Pakistan also attempts to follow Millennium Development Goals of World Bank but even then in 2015 its rank is 147th out of 188 countries which is a sorrow state of affairs for a country to be known as an atomic power. To achieve developmental targets, poverty is still the main hurdle and issue of Pakistan economy. Developing countries are stumbled in a vicious circle of poverty. Inherited problem itself is the cause. On this account most of the research engrossed this topic in developing countries. In Pakistan even poverty has substantially been reduced during 1960 to 2005 but still the struggle

* Assistant Professor, Department of Economics, Islamia University of Bahawalpur, **Department of Economics, NUR International University, Lahore, Pakistan.

could not be considered as mitigating because economy is observed to be prone against economic shocks e.g., oil price increase after 2008 leaving Pakistan with poverty level of about 33 per cent [Arif and Farooq (2011)]. Cost of basic needs approach shows national poverty in 2013-14 as 29.5 per cent whereas, multidimensional poverty index approach mentions poverty as 38.8 per cent in 2014-15 [GoP (2015-16)].

Even MDGs safeguard humanity remarkable but not yet achieve targeted goals as required [United Nations (2015)]. How to get rid of the problem, is the core but unresolved question till yet. Social safety nets work for poverty reduction but could not be considered a treasured tool for that purpose because this is a way to produce beggars and not the workers. Solution of poverty does not lie in short-run coddling but in the long-run by enhancing opportunities. Hence to increase prospects instead of support, may be proved a helping hand. Most of the efforts to combat the scenario are that of support fund type and no likely emphasis for creating opportunities. That is why vulnerability sustains which demands opportunities enhancing efforts. In this study infrastructure for poverty reduction has been attempted to be verified in case of Pakistan as an income enhancing approach. There is a strong link between infrastructural development and poverty reduction. Link is two way; directly through employment generation by employing pro-poor public works programs for infrastructure and indirectly by enhancement of growth through well-connected and productivity-based economy. If economic growth is accompanied by good governance and macroeconomic management, it results in sustainable and comprehensive development. What required is the access of deprived populace to infrastructure.

This study hypothesizes the link of poverty reduction into infrastructure and aims to produce evidence from Pakistan. A specific segment of academia supports positive role of infrastructure [Ncube (2013)], whereas the other segment questions that how such costs could be met [Collier, et al. (2015)]. Opponents have shown a negative role of infrastructure for economic growth, the indirect rout of poverty reduction. They claim that role of infrastructure is questionable for poverty reduction. The issue should have been resolved after the endorsement by the World Bank for importance of infrastructure in developmental issues [Calderon and Serven (2014)].

One further aspect is worth mentioning here that like other developing economies poverty is a rural phenomenon in Pakistan too. Economy of Pakistan is agrarian in nature and a bigger proportion of population still lives in rural areas. The sectoral share of industry is evident to be higher than agriculture sector but this fact should not be ignored that major industry of Pakistan relies on agricultural products for their raw materials. Historically national poverty estimates are observed to be the follower of rural poverty estimates. On this behalf it is reasonable to explore the issue of infrastructure and poverty in rural dimension of Pakistan economy. It is also imperative to grasp the fact that poverty has substantially been

reduced in Pakistan from 40 per cent in 1970s to 22 per cent in 2005-06. Under this perspective it could be proved worthwhile to explore the causes for this decline and this study takes into consideration rural infrastructural development as one of the cause. Therefore, two major objectives of this study are to find out the state of rural infrastructural development in Pakistan and to capture the impact of infrastructural development on poverty reduction for rural areas of Pakistan.

This paper is divided into six major sections. Section I and Section II are introduction and brief literature survey, respectively. Section III describes rationale for data. Composite index of rural infrastructural development in Pakistan is explained and measured in Section IV. Results capturing the role of infrastructure for poverty reduction in rural Pakistan are presented in Section V. In the last, the Section VI concludes the study and suggests policy options.

II. Survey of Literature

Germano and Thorbecke (2001) attribute inappropriate urban biased policies for poverty in Sub-Saharan African countries. It is also suggested that rural development is an engine for poverty reduction and also is a mode to promote incomes via economic growth. Mujeri (2002) finds that infrastructure development generates employment through public works programmes. Social rate of returns to electricity and road investment has been discovered by Canning and Bennathan (2000) which finds that both these infrastructural variables are highly complementary with other physical and human capital but having rapid diminishing returns if invested in isolation. The impact of rural roads projects has been examined by Khandker, et al. (2006) wherein it has been concluded that roads are important public investments that have both short and long term effects on employment, income, and productivity. Kwon (2001) explores that roads have their own explanatory power on income generation and poverty reduction other than economic growth. Fan and Chan-Kang (2005) estimates that development of rural roads and other infrastructure proficiently widens income via growth and reduces the poverty in China. Relying on a sample of 129 villages in Bangladesh, Ahmed and Hossain (1990) estimates the impact of reformed rural infrastructure on poverty alleviation, and obtains positive results. Fan, et al. (2000), (2002) and (2004) discover positive impact of infrastructural investment on economic growth and poverty for rural India, rural China and rural Thailand respectively. While exploring the factors determining the growth and poverty reduction in Africa, Deininger and Okidi (2003) employs household panel survey data and constructs a model of economic growth at micro level. It has been found that access to infrastructure, agricultural exports, human and physical capital have the force not only to enhance economic growth and incomes but also to reduce poverty. Fan, et al. (2005) investigates the role of public services for human development and finds that public services play a vital role in this regard.

Bryceson, et al. (2008) termed transportation infrastructure as sufficient condition for mobility of rural poor in an environment of relative exclusion. It is also notified that roads approach is reemerging for rural development. Structural Autoregressive Technique is employed by Ogun (2010) on Nigerian data from 1970 to 2005 for exploring the role of physical and social infrastructure on urban poverty and finds a positive role thereof. Furthermore, social infrastructure comparatively is found to be more beneficial for this purpose. Kanbur and Rauniyar (2010) differentiate the idea of inclusive development from growth and its auxiliries concepts. The study finds that even infrastructure plays a key role for inclusive development but need of the time is that such investments should be pro-poor in execution so as to get incremental advantages. Mu and de-Walle (2011) explores impact of reintegration of rural roads on development of markets at communes' level and finds that markets located in poor communes have been proved advantageous one. Wang (2014) appraises Chongqing Comprehensive Poverty Alleviation Project to highlight future guideline for project implementation in China and also establishes a healthy role of infrastructure for poverty reduction and sustainable development. Sapkota (2014) mentions infrastructural facilities as important tool for poverty reduction and developmental process. Household level analysis is conducted by Charlery, et al. (2015) in Nepal which finds that infrastructure affects incomes positively for severely poor households and also reduces income inequality at household level.

After review of studies it comes to the surface that most of the research, in the area of infrastructure for poverty reduction, follows a macro level analysis. However in case of data limitations micro datasets are also used for analysis purposes and same is the case for Pakistan. For Pakistan economy limited evidence is available on the topic which lacks comprehensiveness for infrastructure and data. On this account it is needed to explore the issue of infrastructure and poverty reduction for Pakistan. Hence, this study contributes by exploring this issue exuberantly and presents an evidence for this purpose while encompassing rural areas of all the four provinces in Pakistan. No earlier study in Pakistan explores this topic so comprehensively that whole of the information available in a household surveys is utilized for analysis purpose and for as many variables of infrastructure as chosen by this study.

III. Rationale for Two Distinct Analyses based on Distinctive Datasets

Two different datasets have been used in this study for the purpose of achieving objectives as mentioned above. For each of these two objectives a separate dataset has been utilized as per need. Dataset to be used for analyzing status of rural infrastructural development is 'Pakistan 2008 MOUZA Statistics' and dataset to be used for finding out the impact of rural infrastructural development on poverty reduction is 'Household Integrated Economic Survey, 2005-06'. Use of different datasets is justified on account of the reason that surveys of both these datasets were conducted in the same time period

and for the same population. The HIES (2005-06) is latest dataset for this particular study because community questionnaire is lastly available for this round of HIES surveys. With the help of community questionnaire it is possible to collect household level data along with community level data for infrastructure from the same survey which could be utilized for the analysis related to role of infrastructure in poverty reduction. The community questionnaire was explicitly designed to collect community level information from villages (MAUZAs in Urdu) where household reside. Household is secondary sampling unit whereas community of household is primary sampling unit in this survey and representatives from each community were interviewed for collecting the information. So far as 'Pakistan 2008 MOUZA Statistics' is concerned, this dataset is used separately because purpose of this survey data is to sort out rural infrastructural development in Pakistan and more comprehensive information is available in MOUZA statistics in comparison to community level questionnaire of HIES dataset. For finding status of rural infrastructural development, technique of indexation with higher weights to lower variances is used on principal variables of infrastructure. For finding out the impact of infrastructure on poverty reduction, Logit modeling is exploited on account of the reason that response variable is qualitative in nature.

Hence, in perspective of the objectives of this study the two datasets have not merged for the purpose of analysis but following two consecutive analyses, in Section IV and V, made use of 'Pakistan 2008 MOUZA Statistics' for finding out status of rural infrastructural development and 'HIES (2005-06)' for exploring the role of infrastructure in poverty reduction, respectively.

IV. Rural Infrastructural Development in Pakistan: A Composite Index

In this section of the study, an effort is made to construct a composite index of principal variables relating to rural infrastructural development as discussed in Table 2, such an attempt may prove helpful to observe the overall status of rural infrastructural development in Pakistan. Dataset employed to construct this index is 'Pakistan 2008 MOUZA Statistics'. Principal variables (Z_m), selected out of the dataset are infrastructural variables used to provide facilities of education, health, transport and communications, energy, credit and sales and purchase of inputs and outputs (markets) to the rural people. Therefore, information of all these variables is summarized in the composite index and status of rural infrastructural development in Pakistan will be highlighted compositely and swiftly.

Accessibility of rural people to the core services of infrastructure, as principal variables, is measured in terms of distances i.e. the number of kilometers at which the service is available. Each principal variable comprises of some certain components (X_i) of that service e.g. education comprises of primary school, middle school, high school, college and vocational center. All other components are explained in Table 1 to construct the composite index the study follows the methodology used

in Morris and Liser (1977), Mukherjee (1980), Iyengar and Sudarshan (1982), and Patra and Acharya (2011). As per this methodology, for the purpose of constructing an index, weighted average of principal infrastructural services is computed in such a way that weights varies inversely to the variation in different components of principal variables. A range of 10 KM is selected and frequency of villages where service is available within this range is computed. After measuring frequency of components (X_i), the statistic (Y_i) is measured in such a way that it represents proportional value of components' frequency out of total range of all frequencies. Afterwards averages of proportional values are estimated so as to find out values of principal variables (Z_m) which are then used to construct composite index of rural infrastructural development. Let X_i represents the value of the different components of a principal variable. Then,

$$Y_i = \frac{X_i - Min\ X_i}{Max\ X_i - Min\ X_i} \tag{1}$$

where, Max and Min means maximum and minimum value of frequencies respectively. In this way Y_i will be measured with value ranges between zero to one. From the matrix of [Y_i], vector of principal variables [Z_m] is constructed by averaging and then composite infrastructural development index (I) of principal variables will be constructed as under:

TABLE 1

Principal Variables and their Components

Principal Variables → / ↓ Components	Education	Health	Transport and Communication	Energy	Market	Banking
	Primary School	Hospital/ Dispensary	Metaled Road	Electricity	Livestock Market	Commercial Bank
	Middle School	Rural Health Center	Transport	Diesel/ Petrol Pump	Grains Market	On-Line Banking
	High/Higher Secondary School	Basic Health Unit	Fixed Line Telephone	CNG/LPG	Fruit Market	-
	College	Child & Mother Care Centre	Computer/ Internet	-	Vegetable Markets	-
	Vocational Center	Population Welfare Centre	P.C.O.	-	Govt. Procure. CNT	-
	-	N.G.O. Dispensary	Post Office	-	Seeds Shop	-
	-	Private Doctor[MBBS]	-	-	Fertilizers Shop	-
	-	Midwife Facility	-	-	Pesticides Shop	-
	-	Veterinary Facility	-	-	-	-

$$I = \sum_{m}^{1} W_m Z_m$$

where

$Z_m = \sum Y_i \Big|_i$, and m represents number of principal variables,

$0 < W_m < 1$ and $\sum_m^1 W_m = 1$, such that:

$$W_m = \frac{K}{\sqrt{Variance\ Y_i}} \text{ and } K = \left[\sum_I^m \frac{1}{\sqrt{Variance\ Y_i}}\right]^{-1}$$

TABLE 2

Composite Index of Principal Variables

Principal Variables	Weights (Wm)	Average of Components of Principal Variables (Zm)	Wm x Zm
Education	0.163338	0.49923	0.0815431
Health	0.222619	0.72619	0.1616630
Transport and Communication	0.181420	0.52456	0.0951652
Energy	0.153936	0.55372	0.0852374
Markets	0.150841	0.37695	0.0568592
Banks	0.127846	0.5	0.0639230
Sum	1	-	0.5443910

Results: Authors' estimation.

In this way inverse relationship of weights with variances in components of principal infrastructural variables is obvious. Composite index has been measured in Table 2. Composite Index of Principal Variables have observed to be 0.54 which means that on average there are 54 per cent MOUZAs wherein all the infrastructure services on the whole are available within the range of 10 KM, which is a clear sign of underdevelopment on account that almost half of the MOUZAs are at a distance of more than 10 KM from all the infrastructural variables.

V. Infrastructural Development and Poverty Reduction in Rural Pakistan

Data employed for this purpose is HIES (2005-06) which is sub-sample of PSLM (2005-06). Secondary sampling unit (SSU) in HIES is household. Information of a household is collected through separate questionnaires for males and females. The Data obtained could also be decomposed in rural and urban, male and female, and for four provinces along with northern areas and Jammu and Kashmir. Primary sampling unit (PSU) in HIES is rural community. Information for rural communities is collected through a separate rural community questionnaire. Each PSU comprises 15000-25000 population and includes nearly twelve to sixteen SSUs and PSU is representative of revenue record having a specific 'Revenue Unit No' and known as MOUZA/DEH in case of rural sector of Pakistan. There are 1109 PSUs of the survey out of which 531 belong to urban and 578 belong to rural areas. During this survey in total 15453 households were interviewed and this study employed observations related to rural areas only.

1. Model

This study follows Malik (1996) and Fan, et al. (2005) for the purpose of constructing theoretical model. Suppose that poverty of a person (POV) depends upon household level characteristics (α_i) and community level characteristics (γ_i). If a person is poor, then POV = 1, and otherwise POV = 0. Now if probability (p_i) of a person to be poor depends upon α_i and γ_i, then,

$$p_i = \text{E (POV} = 1 / \alpha_i \gamma_i)$$

The model while using (p_i):

$$p_i = \beta_0 + \beta_1 \alpha_i + \beta_2 \gamma i$$

$$p_i = \text{f} (\beta_s, \beta_i, \gamma_i)$$

$$p_i = \theta_i \text{ [where } \theta_i = \text{f} (\beta_s, \beta_i, \gamma_i)]$$

where $f(.)$ is the cumulative distribution function of logistic random variable whereby as θ_i ranges from $-\infty$ to ∞, p_i will lie strictly from 0 to 1, and non-linearity exists between p_i and θ_i, therefore:

$$p_i = \frac{1}{1 + e^{-\theta_i}} \;\&\; 1 - p_i = 1 - \frac{1}{1 + e^{-\theta_i}} \Rightarrow \frac{p_i}{1 - p_i} = e^{\theta_i}$$

$$\Rightarrow \log \left(\frac{p_i}{1 - p_i} \right) = \theta_i = > \acute{L} = \beta_0 + \beta_1 \alpha_i + \beta_2 \gamma_i$$

where Ĺ is the Logit. Now the regression model will be:

$$\acute{L} = \beta_0 + \beta_1 \alpha_i + \beta_2 \gamma_i + \mu_i \text{ [2]}$$

2. Operational Model

Variables of the model, their definitions, hypotheses and expected signs are discussed in Table 3. This study comprises of two main vectors i.e. vector of household level characteristics (α_i) and vector of community level characteristics (γ_i) which are hypothesized to affect poverty as described in table.

3. Poverty

For the purpose of quantification of poverty first of all household's consumption per month was computed with the help of fortnightly food items, non-food and non-durable goods, and durable goods. Fortnightly food items represent consumption of households on basic necessities which they consumed within 14 days of the date of interview. After computing total expenditures of household next step is to find out expenditures per member of the household. For this purpose adult equivalent scale has been utilized in this study. Adult equivalent scale is preferred over per capita approach because households have divergent characteristics on the basis of size and number of children.

This study has used adult equivalence scale approach while following World Bank (2009) for computing expenditure per member of households. After having computed per adult equivalent consumption, next step is to compare it with the poverty line. In case that per adult equivalent consumption of household is less than the poverty line the household will be poor, otherwise non-poor. The study has used official poverty line of Pakistan for the period 2005-06 described by the Planning Commission, Government of Pakistan as threshold, which is equal to Rs947.47 per adult equivalent per month. As per methodology, Planning Commission employs PIHS (1998-99) survey and uses 2,350 calories per adult equivalent per day on the basis of Food Energy Intake approach. In this behalf official poverty line of Rs673.54 per adult equivalent per month is mentioned by official sources in Economic Survey of Pakistan. Thereafter, the poverty line has been updated for each round of household's survey (i.e., 2001-02, 2004-05 and 2005-06) by exploiting CPI of surveyed months of each round.

The official poverty line is employed because of two reasons; firstly the study has utilized HIES (2005-06) for estimation purposes and Planning Commission also utilizes the price data of the months when HIES (2005-06) was conducted for updating poverty line, secondly the official poverty line of Pakistan is validated by the World Bank on request of Government of Pakistan [World Bank, (2008)].

TABLE 3

Variables used in Logit Model, their Definitions and Theoretical Expectations

Variable	Definition	Expected Sign
	Dependent Variable	
Poverty	Discrete Response Variable i.e. 1=Poor & 0=Non-Poor	Dependent Variable
	Household Level Characteristics	
Household Head Gender	(1=Male & 0=Female) Hypothesis: If gender is male then less is the chance that household will be poor	Negative
Household Head Education	(Number of schooling years) Hypothesis: Higher the education of household head, less is the chance that household will be poor	Negative
Household Head Age	(Number of years from birth) Hypothesis: Higher the age of rural household head, less is the chance that household will be poor	Negative
Household Size	(Number of members in household) Hypothesis: Higher the size of household, more is the chance that household will be poor	Positive
Dependency Ratio	(Dependents/Independents) Hypothesis: Higher the dependency ratio, more is the chance that household will be poor	Positive
Participation Ratio	(Workers/Household aged 10 years and above) Hypothesis: higher the participation ratio, less is the chance that household will be the poor	Negative
	Community Level Characteristics Hypothesis: Higher the rural infrastructural development, less is the chance that household will be poor	
Road Facility	Availability of Road to household. A Dummy variable with three attributes: Metaled Road (1=metaled road, & 0=otherwise) Paved Road (1=paved road, & 0=otherwise) Unpaved Road (1=unpaved road & 0=otherwise)	Negative
Electricity	Availability of Electricity to households (1=yes, 0=no)	Negative
Gas	Availability of Gas to households (1=yes, 0=no)	Negative
Primary Schools	(Number of primary schools accessible to household where he resides)	Negative
Phone Facility	Phone Service Distance in KM from household's residence.	Positive
Basic Health Units	Basic Health Unit Distance in KM from household's residence.	Positive

Note: If the distance of community services (infrastructure) from household's residence is high, it means low rural development i.e. higher the distance, lower will be rural development, more is the chance that household will be poor. This is why where distance is the measure of infrastructuralvariable, the relationship is shown positively as below. A distance of 0 K.M. means availability of the service (infrastructure) within the community of the household.

4. Household Level Characteristics

Household level characteristics comprises of household size, household head's gender, age and education, dependency ratio and participation ratio of the households. Household level characteristics are the renowned determinants of rural household's poverty.

5. Community Level Characteristics

Community level characteristics comprise of infrastructural variables as hypothesized by this study as determinants of poverty reduction. This study takes into consideration the infrastructure relating to the facilities of roads, electricity, gas, primary schools, basic health units and telephone.

6. Descriptive Statistics

Descriptive analysis of data used in this analysis is presented in Tables 4-7 and first of all basic statistics regarding individual variables are discussed. The variables analyzed in this analysis have two major types i.e. ratio scale variables and nominal scale variables, hence on this account Tables 4 and 5 report the statistics respectively.

First column of Table 4 points out the mean values and the statistic points are sufficient to be believed because average level of household size, education level and age of upper generation are nearly equal to the official statistics in this regard [GoP (various issues)]. Second column is about the standard deviations and no major weakness could be witnessed. Skew-ness of the variables is relatively better than kurtosis but not even present an abstract picture of the data relating to individual variables e.g. the data of phone facility is highly skewed. Kurtosis of the

TABLE 4

Descriptive Analysis of Ratio Scale Variables

Variable	Mean	Standard Deviation	Skew-ness	Kurtosis
Household Head Education	3.45	4.59	1.08	3.19
Household Head Age	45.39	14.09	0.44	2.73
Participation Ratio	0.46	0.26	0.47	2.6
Dependency Ratio	1.17	0.99	1.59	7.25
Primary School	4.24	3.89	1.3	4.23
Basic Health Unit	18.05	18.17	1.55	5.42
Phone Facility	3.81	11.14	4.27	23.6

variables shows a bit high tailed-ness. However, this entire picture is not disturbing in the sense that the data is that of cross-sectional nature and in reality perfect normal distribution is out of question. Specifically, for the services not available in the rural vicinities which are measured by distance from vicinity, show relatively high skew-ness and kurtosis-ness.

Table 5 presents the descriptive statistics of individual variables which are nominal in nature and except road facility all variables are binary whereas road variable has three categories i.e. metaled, paved and unpaved road. Frequencies percentages and cumulative percentages of each of the category of all variables could be observed in columns 3, 4 and 5 respectively. Percentage of poor people as shown in table is in line with the official evidence regarding poverty [GoP (2005-06)]. Similarly, evidence of gender-ness of household head is also reasonable because most of the households in Pakistan are headed by male. Facilities of roads and electricity point out that the rural areas are reasonably developed. The evidence for electricity is not surprising because most of the rural areas in Pakistan specifically in Punjab and Sindh, are connected to the network/infrastructure but that does not mean that electricity is also available smoothly because high level of load-shedding is also a routine of rural areas in Pakistan. Evidence regarding gas facility, is also reasonable.

The statistics that about 75 per cent rural communities have access to metal road is looking strange in first instance but keep in mind that this does not mean that

TABLE 5

Descriptive Statistics for Binary/Categorical Variables

Variable	Categories	Frequency	Per cent	Cumulative
Poverty	Poor	2128	25.09	25.09
	Non Poor	6352	74.91	100
Household Head Gender	Male	7831	92.35	92.35
	Female	649	7.65	100
Metaled Road	Metalled	6529	76.99	76.99
	Otherwise	1951	23.01	100
Paved Road	Paved	616	7.26	7.26
	Otherwise	7864	92.74	100
Unpaved Road	Unpaved	1335	15.74	15.74
	Otherwise	7145	84.26	100
Electricity	Available	7570	89.27	89.27
	Not Available	910	10.73	100
Gas	Available	712	8.4	8.4
	Not Available	7768	91.6	100

TABLE 6

Correlation Martix

Variable	Correlation Measure	Poverty	House-hold Size	Household Head Education	House-hold Head Age	House-hold Head Gender	Participa-tion Ratio	Depen-dency Ratio	Metaled Road	Paved Road	Unpaved Road	Electri-city	Gas	Primary School	Basic Health Unit	Phone Facility
Poverty	Pearson	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Tetrachoric	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Household Size	Pearson	0.088	1	-	-	-	-	-	-	-	-	-	-	-	-	-
	Point-Biserial	0.088	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Household Head	Pearson	-0.211	0.023	1	-	-	-	-	-	-	-	-	-	-	-	-
	Point-Biserial	-0.212	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Household Head	Pearson	-0.118	0.04	0.03	1	-	-	-	-	-	-	-	-	-	-	-
	Point-Biserial	-0.118	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Household Head	Pearson	-0.046	0.067	0.088	0.24	1	-	-	-	-	-	-	-	-	-	-
	Tetrachoric	-0.111	-	-	-	1	-	-	-	-	-	-	-	-	-	-
Participation Ratio	Pearson	-0.197	-0.12	-0.028	-0.135	-0.064	1	-	-	-	-	-	-	-	-	-
	Point-Biserial	-0.197	-	-	-	-	1	-	-	-	-	-	-	-	-	-
Dependency Ratio	Pearson	0.287	0.127	-0.093	-0.047	0.003	-0.45	1	-	-	-	-	-	-	-	-
	Point-Biserial	0.287	-	-	-	-	-	1	-	-	-	-	-	-	-	-
Metaled Road	Pearson	-0.091	-0.02	0.111	0.001	-0.032	0.03	-0.04	1	-	-	-	-	-	-	-
	Tetrachoric	-0.165	-	-	-	-0.086	-	-	1	-	-	-	-	-	-	-
Paved Road	Pearson	-0.002	-0.01	-0.025	0.037	0.021	-0.08	0.05	-0.511	1	-	-	-	-	-	-
	Tetrachoric	-0.001	-	-	-	0.078	-	-	-1	1	-	-	-	-	-	-
Unpaved Road	Pearson	0.108	0.026	-0.11	-0.028	0.022	0.03	0.01	-0.791	-0.121	1	-	-	-	-	-
	Tetrachoric	0.206	-	-	-	0.065	-	-	-1	-1	1	-	-	-	-	-
Electricity	Pearson	-0.114	0.053	0.095	0.035	-0.068	0.05	0.01	0.429	-0.065	-0.449	1	-	-	-	-
	Tetrachoric	-0.236	-	-	-	-0.279	-	-	0.726	-0.175	-0.732	1	-	-	-	-
Gas	Pearson	-0.063	0.023	0.073	0.026	-0.004	0	-0.03	0.072	0.033	-0.108	0.012	1	-	-	-
	Tetrachoric	-0.169	-	-	-	-0.013	-	-	0.203	0.102	-0.413	0.036	1	-	-	-
Primary School	Pearson	-0.05	0.095	0.09	-0.004	0.018	0.01	-0.03	0.136	-0.033	-0.134	0.183	-0.03	1	-	-
	Point-Biserial	-0.05	-	-	-	-	-	-	-	-	-	-	-	1	-	-
Basic Health Unit	Pearson	0.098	0	-0.063	-0.017	0.048	-0.06	0	-0.256	0.057	0.255	-0.478	-0.08	-0.11	1	-
	Point-Biserial	0.098	-	-	-	-	-	-	-	-	-	-	-	-	1	-
Phone Facility	Pearson	0.098	-0.02	-0.084	-0.053	0.06	-0.07	0.02	-0.315	0.031	0.342	-0.449	-0.09	-0.11	0.443	1
	Point-Biserial	0.098	-	-	-	-	-	-	-	-	-	-	-	-	-	1

streets of the villages are metaled but it shows the road access to village. As per information disseminated through official sources, these villages comprises of the population of about 15000-25000, therefore such evidence is not astonishing one.

7. Correlational Analysis

After having discussed individual variable descriptions now it is time to investigate the correlations of the variables of the model. On this front major hurdle is again that of distinctive nature of the variables. Correlation of ratio scale variables is straightforward but in case that either one or both the variables are nominal scale then simple Spearman's Correlation Coefficient is not adequate. This is why in Table: 6 it has been tried to present not only the statistics of Spearman's Correlation Coefficient but also the statistics of Tetrachoric Correlation Coefficient and Point Bi-serial Correlation Coefficient. These statistics are adequate for correlations when one or both the variables are nominal. When one of the variables is nominal then Tetrachoric Correlation is used while when both the variables are nominal then Point Bi-Serial Correlation is utilized. The dependent variable of the study is nominal and some of the independent variables are also nominal. This is why in Table 6, two different correlation coefficients are given for each pair of variables in two consecutive rows. In upper row Spearman's Correlation Coefficient is mentioned as reference and in lower row Tetrachoric and Point biserial Correlation Coefficient are mentioned as per type of the variables.

Overall, third column of the correlation matrix support the hypotheses of relationships of the model for dependent and independent variables in line with the last column of Table 3.

8. Disaggregated Analysis of Poverty with its Determinants

Now it may be adequate to find out the poverty level of different subgroups for each determinant of poverty as shown in Table 7. With the increase in number of household the poverty is also increased. But when number of households is more than twenty then this evidence is not verified in the table. Reason for this deviance is explicable because the household where size is more than twenty are normally affluent families therefore; in such specific scenario evidence is bit different. In case of household head's education and age, the relationship is negative because educated family head earn more and aged family head are established in life so there is a little chance for household to be poor. Similarly the household where the gender of the head of the family is male there is less probability of poverty and the same evidence could be observed in table. In case of participation ratio it is established that as the participation ratio is increased poverty will be reduced which is also evident in table with the exception that when participation ratio is greater than 0.70, the poverty is shown to be increased. The reason for this result could be understood straightforwardly because in such cases where participation ratio is more

than 0.70, the household size is less than or equal to 3 and all of the family members are tumbled in vicious circle of poverty. Dependency ratio shows a fair evidence for its relationship with poverty because as dependence increase, poverty is also increased.

TABLE 7

Disaggregated Analysis

Household Level Characteristics and Poverty					
Variable	Categories	Poor		Non-Poor	
		No	Per cent	No	Per cent
Household Size	0-10	1704	24	5544	76
	11-20	405	35	745	65
	More than 20	19	23	63	77
Household Head Education	01-10	2089	26	5774	74
	10-16	37	6	550	94
	More than 16	1	3	29	97
Household Head Age	0-25	117	36	205	64
	26-50	1355	26	3760	74
	More than 50	580	20	2250	80
Household Head Gender	Male	1920	24	5911	76
	Female	208	32	441	68
Participation Ratio	0.00 - 0.35	1312	37	2155	63
	0.36 - 0.70	528	15	2929	85
	0.71 - 1.00	288	18	1268	82
Dependency Ratio	0-2	1531	20	5812	80
	3-5	576	52	524	48
	6-8	21	56	16	46
Infrastructure and Poverty					
Road Facility	Metalled	1497	22	5032	78
	Paved	152	24	464	76
	Unpaved	479	35	856	65
Electricity	Available	1770	23	5800	77
	Not Available	358	39	552	61
Gas	Available	114	16	598	84
	Not Available	2014	25	5754	75
Primary Schools	1 - 6	1661	26	4694	74
	7 - 12	407	23	1340	77
	13 - 18	60	15	318	85
Basic Health Unit	1 - 30	1680	23	5344	77
	31 - 60	314	27	836	73
	More than 60	448	30	1008	70
Phone Facility	1 - 30	1980	24	6151	76
	31 - 60	134	44	170	56
	More than 60	14	31	31	69

The vector of infrastructural variables also prove the relationship that as the infrastructure is more developed, the poverty is reduced. The facility of road indicates that if the available road is developed from unpaved to metaled, the poverty level is decreased. In the same way the household accessing the facilities of gas and electricity are comparatively less victimized than household without access to these facilities. Number of primary schools also has a negative relationship with poverty level. When focus is infrastructures for Basic Health Unit and phone facility then these variables are not available in the vicinities and some are measured by the distances at which the facilities are available and when the distance is increased, it indicates low level of development. On this account it could be observed in the table that as the development regarding the facilities of health and telecommunication is increased, the poverty level has decreased. The household to whom phone facility is available at a distance more than 60 KM, are not able to rely on telephone for telecommunication; therefore, its result is not reliable.

TABLE 8

Logit Regression Estimates of Rural Infrastructural Development and Rural Poverty: Evidence from Pakitan

Independent Variables	Coefficient	z-Statistic	Probability	Odd
C	0.369631	1.905976	0.0567***	1.447
Household Size	0.047657	6.621234	0.0000*	1.049
Household Head Age	-0.024344	-11.18611	0.0000*	0.976
Household Head Gender	-0.179198	-1.787296	0.0739***	0.836
Household Head Education	-0.12649	-16.79457	0.0000*	0.881
Participation Ratio	-1.269385	-9.963761	0.0000***	0.281
Dependency Ratio	0.468132	15.34057	0.0000*	1.597
Paved Road	-0.224418	-2.069476	0.0385**	0.799
Unpaved Road	0.29232	3.552242	0.0004*	1.34
Electricity	-0.396249	-3.786653	0.000*	0.673
Gas	-0.377397	-3.304925	0.0010*	0.686
Primary Schools	-0.010623	-1.407971	0.1591	0.989
Basic Health Unit	0.004883	2.818057	0.0048*	1.005
Phone Facility	0.000085	0.031975	0.9745	1
McFadden R^2	0.148451	LR Statistic		1418.4160
		Probability LR (Statistic)		0.0000
Number of Observations		8480		

Note: Odd $= e^x$ where x is the value of concerned coefficients.
Authors' estimation on the basis of data collected through PSLM [GoP (2005-06)] using E-Views.
*, **, *** represents 1%, 5%, 10% significant level.

9. Results and Discussion

After using FBS procedure for cleaning process 8480 observations relating to rural areas of the survey, have been used for analysis purpose. Value of McFadden R^2 is sufficient to prove the robustness of estimated coefficients and LR-statistic shows significant simultaneous impact of independent variables.

10. Vector of Household Level Characteristics

Except gender of household head, all the household level characteristics (i.e. household head's age and education, household size, dependency ratio and participation ratio) have been proved to be significant at 1 per cent level while household head gender is significant at 10 per cent level. Such statistical behavior shows strong experimental base for the results of household characteristics. Along with this signs of household level characteristics are observed to be in line with the expected relationship with poverty. Such an analysis is enough to believe that renowned determinants of poverty reduction are also proved to be strongly positive in case of Pakistan also.

11. Vector of Community Level Characteristics

On the other hand vector of community characteristics (i.e. rural infrastructural development) shows that the variables of electricity, gas, primary schools, basic health units and telecommunication have expected signs. Metaled road is taken as reference category. For road infrastructure, it has been observed that significant and highest impact on poverty reduction has been shown by un-paved road. For unexpected estimates of un-paved roads, the result is in line with Fan and Chan-Kang (2005) which focused only on road infrastructure for poverty reduction of China and concluded that low type roads had more impact on poverty reduction. The variables of primary schools and telecommunication are not significant but have expected signs, and the variables of electricity, gas and basic health units have been proved significant at 1 per cent level which shows important implications not only for result relating to vector of community characteristics but also for its comparative analysis with vector of household characteristics because experimental base of this vector is weedier in relation to vector of household characteristics which points out that importance of renowned determinants is observed to be comparatively more than infrastructural variables. One more point is also important to mention here that impact of roads is also not proved to be as robust and significant as it should be in line with theory and literature. In this perspective it is argued that infrastructural variables specifically the road infrastructure is also important in case of Pakistan but in developing countries like Pakistan it is a routine phenomenon that non-poor segment of the society exploit the benefits of poor segment and poor people are severely deprived of their rights. Hence, same phenomenon works in case of fruits relating to infrastructure (road) and

poor community is unable to be effectively benefited by the increased opportunities and prospects. Therefore, in developing countries it is needed that infrastructural investment should be pro-poor not only in execution but also in utilization.

Results relating to health and education infrastructure are also unexpected because infrastructural variables of electricity and gas are proved more beneficial for poverty reduction in comparison to health and education infrastructures. Reason behind this result is simple because we are analyzing infrastructural development and infrastructure relating to gas and electricity are promptly used in production activities of rural areas and helps to generate employment. On the other hand schools and hospitals affects productivity and it is a time taking process to improve productivity of populace as sufficient as required to change the fate. Therefore, results relating to health and education infrastructures are looking like paradox. However, it is argued that if panel data is available for analysis purpose then results could be more realistic one.

VI. Conclusion and Policy Implication

Overall status of rural infrastructural development in Pakistan could be termed as poor because most of the public services are not available to rural inhabitants in their areas of residence. The composite index shows almost half of the MOUZAs to be located at a distance of more than 10 KM from infrastructural services. It is also found that the vectors of household's characteristics and community characteristics have shown significant and robust impact on poverty reduction in rural areas of Pakistan. So far as comparison of household level characteristics and community level characteristics is concerned it could easily be inferred that community level characteristics have secondary role for poverty reduction while household level characteristics have played primary role. Out of community level characteristics, the variables of gas and electricity are proved to be comparatively more important for poverty reduction of rural areas of Pakistan.

Keeping in view agrarian nature of the country and bleakly low level of rural development there is a dire need of rural infrastructural development in Pakistan and same should be pro-poor in nature. So far as objective of poverty reduction is concerned then rural infrastructural development could not be considered a vital element and basic focus of policy makers should be towards household level characteristics. On this behalf demographic awareness should have been enhanced in rural households along with diverting the direction of support type funds from sponsoring expenditures through little amounts to a bit heavy amounts which should be sufficient enough to increase economic opportunities of the households and they may be able to exploit the opportunities meant for them. Otherwise, the routine that non-poor communities are depriving the poor communities will remain continued.

Islamia University of Bahawalpur,
NUR International University, Lahore, Pakistan.

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