



Volume and Issues Obtainable at Center for Sustainability Research and Consultancy

Review of Economics and Development Studies

ISSN:2519-9692 ISSN (E): 2519-9706

Volume 2: Issue 1 June 2016

Journal homepage: www.publishing.globalcsrc.org/reads

Infrastructure and Households' Incomes in Pakistan: A Cross Province Comparative Analysis of Rural Areas

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ARTICLE DETAILS**History**

Revised format: May 2016

Available online: Jun 2016

Keywords

*Personal Income,
Infrastructure,
Rural Analysis,
Households,
Micro Data*

JEL Classification

D31, H54, O18, Q12 & C81

ABSTRACT

Lack of earning opportunities in rural areas of developing countries is the key constraint to rural development and infrastructure has the force to increase such activities. Hence, this study attempts to summarize status of rural infrastructural development along with exploring its role for enhancement of rural household's income in Pakistan. On the basis of 'Pakistan 2008 MOUZA Statistics', a cross-province comparative analysis points out devastated state of rural infrastructural development in Pakistan which is observed to be miserable on account of skewed distribution while favouring Punjab and depriving Balochistan. This study also exploits income generation model based on production function while including infrastructure as external factor with the hypothesis that it has multiplier effect on incomes. For this purpose Household Integrated Economic Survey (HIES) for the year 2005-06 is used for rural areas only, which is latest in the sense that information on rural communities is uniquely available in this dataset. On the basis of analysis using log-lin functional form it has been concluded in this study that even infrastructural development has a positive role for rural households' incomes but its role is secondary in comparison to other attributes i.e. household size, livestock holdings, head's gender, age and education. It is further established that for rural households' income even infrastructure for energy provision is most important but infrastructural need for different regions is different.

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Recommended citation: Ahmad, I., Khan, M. B. and Farooq, F. (2016). Infrastructure and Households' Incomes in Pakistan: A Cross Province Comparative Analysis of Rural Areas. *Review of Economics and Development Studies*, 2 (1) 11-28

DOI: <https://doi.org/10.26710/reads.v2i1.122>

1. Introduction

Development is the long lasting problem of developing countries like Pakistan. Under market-friendly

approach it has been recognized that although free market has a momentous job for economic development of low and middle income countries even then role of government could not be neglected in certain fields such as infrastructure, health, education etc (Todaro and Smith, 2008). Private sector in free market economy works for sole objective of optimization, therefore, could be considered to contribute minimal in social sector and infrastructural development. Role of infrastructure in development process is well recognized because it works in multiple directions. Firstly, infrastructure enhances linkages among different sectors and helps to reduce transaction costs; secondly, it expands economic activities in the regions where installed; thirdly it generates employment for the inhabitants; fourthly it is a source of accelerated productivity in masses, and fifthly public works programmes are exclusive source of employment generation under governments' control. Therefore, infrastructure leads towards social sector development, income enhancement, and poverty reduction. So far as income is concerned it is important indicator of development at household level because it points out living standards along with potential of masses to contribute in resource base of the country and therefore helps to improve human as well as community development. This study takes into consideration the role of infrastructure in income of households, hence, attempts to contribute in development related studies.

Pakistan belongs to South Asia where economy is predominantly rural in nature. This fact is obvious from data also because at the time of inception largest contributor in GDP was agriculture sector. With the passage of time even its contributions in GDP is shrinking in comparison to industrial sector but still its importance has increased because agriculture is the back bone of industrial sector in Pakistan. Nearly 62 percent of population lives in rural areas, two-third of exports in Pakistan comprises of agricultural products, and 44 % of total labour is related to rural areas. Similarly, poverty is also a rural phenomenon in Pakistan because overall poverty trend in Pakistan follows rural poverty trend [Malik (1988), Qureshi and Arif (2001)]. Hence, it is reasonable to explore the determinants of incomes in rural dimension of Pakistan.

This paper is divided into seven major sections. Sections: 1 & 2 represent introduction and literature survey. In Section: 3, data and methodology has been debated and Section: 4 describes a cross-province comparative analysis of infrastructural development in case of Pakistan economy. Thereafter, theoretical framework and model for determining rural households' incomes are discussed in Section: 5. whereas Section: 6 is related to analysis thereof. In the last, the Section: 7 concludes the study and consequently suggests some policy recommendations on the basis of analysis.

2. Survey of Literature

Reardon (1998) found that, as a policy variable, the rural infrastructural development could also play a vital role for increasing rural non-farm activities. Social rate of returns to electricity and road investment was discovered by Canning and Bennathan (2000). It was explored that both these infrastructural variables reflect a highly complementary relationship with other physical and human capital but enforcing a rapid diminishing return if invested in isolation. Kwon (2001) explores that roads have their own explanatory power on income generation and poverty reduction other than economic growth. Germano and Thorbecke (2001) observed urban biased policies for poverty in Sub-Saharan African countries. It was concluded that rural development was an engine for poverty reduction and also a mode to promote incomes via economic growth. While exploring the factors determining the growth and poverty reduction in Africa, Deininger and Okidi (2003) employed household panel survey data and constructed a model of economic growth at micro level. It was found out that access to infrastructure, agricultural exports, human and physical capital had the force, not only, to enhance economic growth and incomes but also to reduce poverty. Nkonya et al (2004) also modeled household's primary income and found public services as an important element in this regard. Fan, Nyange and Rao (2005)

investigated the role of public services for enhancement of household's income while using household level survey and found that public services played a vital role for household's income augmentation. Mujeri (2002) found that infrastructure development generated employment through public works programmes. The impact of rural road projects was examined by Khandker; Bakht, and Koolwal (2006) and it was concluded that roads were important public investments that had both short and long term effects on employment, income, and productivity. Fan and Chan-Kang (2005) estimated that development of rural roads and other infrastructure proficiently widened income via growth and reduced the poverty in China. In considering determinants of market participation in rural areas of Mozambique, Boughton et al (2007) found important role of land, labour, livestock and public goods for crop market participation. Olivia and John (2008) raised question on quality of infrastructure accessible to rural populace of Indonesia in generating income/employment and established the evidence. Angel (2010) investigated infrastructure for productivity and found that initially it worked for productivity enhancement but later this role was diminished after saturation point, hence infrastructure approach was adequate for developing countries. Dillon et al (2011) mentioned road and irrigation as one of best source for productivity in rural areas of Nepal. Short-run and long-run impacts of infrastructural investment on employment and economic activity of US economy were studied by Bivens (2014) who argued a positive impact thereof. Frayne and McCordic (2015) attempted to determine relationship of food security with income and infrastructure and concluded that income alone was not sufficient to achieve the targets. Bridge et al (2016) observed causal connection between electricity and incomes in both the directions.

3. Data and Methodology

This study utilizes two different datasets i.e. 'Pakistan 2008 MOUZA Statistics' and 'HIES 2005-06'. These two datasets are based on two different surveys conducted for the same time, population and interrelated issues. Former dataset is specifically designed for measuring rural infrastructural development while later is related to households' demographics along with economic and social sector issues. Interestingly, HIES also provides data on infrastructure through rural community questionnaire and same is lastly available for the round of 2005-06 and thereafter rural community questionnaire is not included in HIES. This is why this dataset is latest one to be used for analysis purpose of this study. Furthermore, the 'Pakistan 2008 MOUZA Statistics' provides comparatively a comprehensive information on rural infrastructural development, therefore, this dataset is used separately in the analysis for the purpose of comparative analysis of rural infrastructure development among provinces of Pakistan.

Descriptive and graphical analyses are utilized to explore the status of rural infrastructural development at provincial level. In case of analysis relating to determinants of households' incomes, a log-lin income generation model based on production function is exploited wherein infrastructure is included as external factor with the hypothesis that it has multiplier effect for incomes.

4. Rural Infrastructural Development in Pakistan: Provincial Level Comparative Demonstration

More often than not infrastructural services are distributed inter alia among three major categories: social sector development, communication along with energy sector development and markets including banking sector development. Social sector helps to improve productivity, communication and energy sectors help to minimize costs and markets with banking sector help to enhance bargaining power and financial accessibility. Consequently, infrastructure could be termed as skeleton for the life of

economies. Presenting a sketch of rural infrastructural development in Pakistan before examining empirical investigation may offer insights into thesis in question.

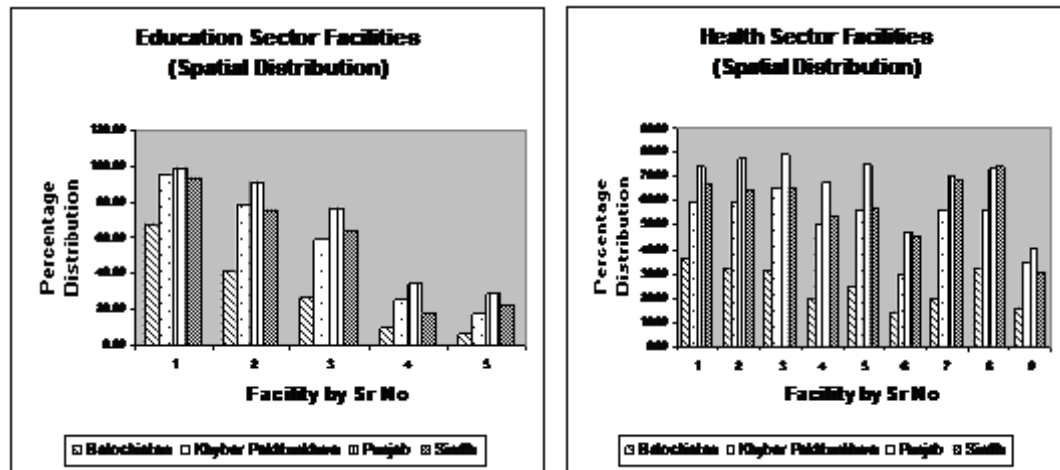


Figure: 4.1 [Source: Authors' estimation-GoP (2008) & Ahmad (2013)] **Figure: 4.2** [Source: Authors' estimation-GoP (2008) & Ahmad (2013)]

Table: 4.1 SOCIAL SECTOR FACILITIES

A Comparative Analysis of the Provinces (Spatial Distribution)					
Sr. No	TYPE OF FACILITY	MOUZAs Within 10 KM (Percentage)			
		Balochista n	Khyber Pakhtunkhwa	Punja b	Sindh
		1	2	3	4
Education					
1	PRIMARY SCHOOL	67.95	95.21	98.51	93.34
2	MIDDLE SCHOOL	40.91	78.63	91.16	75.01
3	HIGH/HIGHER SECONDARY SCHOOL	26.72	58.40	76.80	63.56
4	COLLEGE	10.40	25.39	34.59	17.50
5	VOCATIONAL CENTER	6.58	17.84	28.58	21.74
Health					
1	HOSPITAL/DISPENSARY	36.03	59.13	74.45	67.27
2	RURAL HEALTH CENTER	32.47	59.44	77.50	64.31
3	BASIC HEALTH UNIT	31.11	64.90	79.51	64.99
4	CHILD & MOTHER CARE CENTRE	19.45	50.11	67.53	53.65
5	POPULATION WELFARE CENTRE	24.80	56.16	74.99	57.08
6	N.G.O. DISPENSARY	14.08	29.49	47.28	45.56
7	PRIVATE DOCTOR [MBBS]	19.85	56.35	70.08	68.65
8	MIDWIFE FACILITY	32.58	56.00	73.48	74.61
9	VETERINARY FACILITY	15.58	34.63	40.40	30.80

Source : Authors' estimation-GoP (2008) & Ahmad (2013)

4.1 Social Sector Facility: A Spatial Distribution

So far as spatial distribution is concerned, the Figures: 4.1 & 4.2 coupled with Table: 4.1 portray a skewed distribution of social sector facilities while favouring Punjab and notifying Balochistan as deprived region. The provinces of Sindh and Khyber Pakhtunkhwa show a moderate level distribution of social sector infrastructural facilities. Such a picture of spatial distribution is in line with the characteristics of developing countries like Pakistan where dualism and unequal distribution prevail dominantly.

4.2 Transport, Communication and Energy Sectors Facilities

Social overhead capital attained a vital position in development process of any country. Tables: 4.2 along with Figures: 4.3 & 4.4 discusses transport, communication and energy sector facilities.

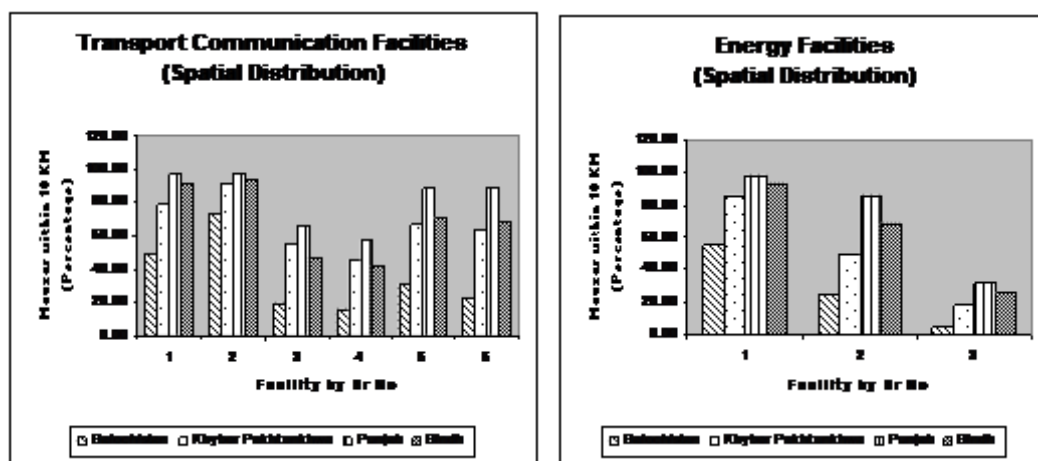


Figure: 4.3 [Source: Authors’ estimation-GoP (2008) & Ahmad (2013)] Figure: 4.4 [Source: Authors estimation-GoP (2008) & Ahmad (2013)]

Table 4.2 TRANSPORT COMMUNICATION & ENERGY SECTOR FACILITIES

A Comparative Analysis of the Provinces (Spatial Distribution)					
Sr. No	TYPE OF FACILITY	MOUZAs Within 10 KM (Percentage)			
		Balochistan	Khyber Pakhtunkhwa	Punjab	Sindh
	1	2	3	4	5
Communication					
1	METALED ROAD	49.38	79.03	97.36	91.60
2	TRANSPORT	72.81	90.62	97.59	93.56
3	FIXED LINE TELEPHONE	19.57	54.89	66.13	46.35
4	COMPUTER/INTERNET	15.91	45.07	58.00	42.19
5	P.C.O.	31.60	66.72	88.89	71.2

6	POST OFFICE	23.24	63.62	88.35	68.15
Energy					
1	ELECTRICITY	54.68	85.80	97.75	92.98
2	DIESEL / PETROL PUMP	24.42	49.46	86.04	68.38
3	CNG / LPG	5.07	18.17	32.19	25.75

Source: Author's estimation-GoP (2008) & Ahmad (2013)

4.2.1 Spatial Distribution

It is clear that spatial distribution of Transport, Communication and Energy services is uneven and shows tilt of balance in favour of Panjab. However, Sindh and Khyber Pakhtunkhwa attained an average level of rural development in comparative statistics and Balochistan is least developed region.

4.3 Market and Banking Sector Facilities

The market and banking sector infrastructure plays a vital role in economic health of a region specifically for rural sector. Table: 4.3 along with Figures: 4.5 & 4.6 are the source for evaluating these services.

Table: 4.3 MARKETS & BANKING SECTOR FACILITIES (Accessibility Analysis)

A Comparative Analysis of the Provinces (Spatial Distribution)					
Sr. No	TYPE OF FACILITY	MOUZAs Within 10 KM (Percentage)			
		Balochistan	Khyber Pakhtunkhwa	Punjab	Sindh
		2	3	4	5
Markets					
1	LIVESTOCK MARKET	10.22	27.45	34.50	43.96
2	GRAINS MARKET	8.15	24.12	37.87	45.68
3	FRUITS MARKET	7.45	22.31	38.19	39.51
4	VEGETABLES MARKET	8.76	22.95	40.79	41.27
5	GOVT. PROCURE. CNT	6.64	16.47	45.06	44.95
6	SEEDS SHOP	12.68	39.57	70.08	55.46
7	FERTILIZERS SHOP	12.21	36.23	66.66	54.57
8	PESTICIDES SHOP	12.20	36.31	66.54	54.58
Banking Facilities					
1	COMMERCIAL BANK	10.73	30.38	55.69	44.37
2	ON-LINE BANKING	6.86	17.52	34.99	27.81

Source: Author's estimation-GoP (2008) & Ahmad (2013)

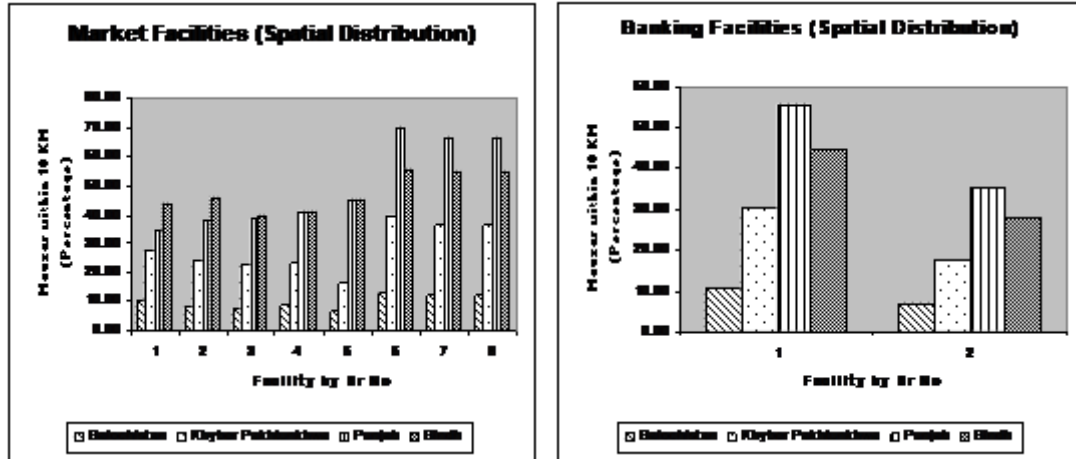


Figure: 4.5 [Source: Authour’s estimation-GoP (2008) & Ahmad (2013)]

Figure: 4.6 [Source: Authour’s estimation-GoP (2008) & Ahmad (2013)]

4.3.1 Spatial Distribution

It could be easily inferred that in case of market and banking sector facilities also, the region of Balochistan has remained far behind as compare to the other regions of Pakistan which fact has already been come to the surface throughout this analysis. Similarly, the region of Punjab is highest beneficiary in this perspective.

5 Theoretical and Empirical Framework for Determinants of Rural Households’ Incomes

Now, it has been tried to explore the factors responsible for livelihood of rural households. Normally, there are two major income sources available to rural civilization; farm and non-farm sectors. Farm sector income depends upon labour and investment in land cultivation and non-farm income mostly comprises of economic activities other than farm e.g. shops, transportation, brick-kilns, workshops, labour activities etc. Along with farm and non-farm income, rural populace also earns their livelihood while holding livestock and physical capital which comprises of farm mechanization tools (tractor and its accessories, tube-wells, livestock farms etc). On this behalf, total rural households income could be divided into two sectors i.e. farm and non-farm. Then following Nyange and Rao (2005) and Onyeiwu and Liu (2011) while exploiting production function approach, rural households’ income could be modeled as:

$$Y_f = A_f u(z^\theta l^{1-\theta}) \tag{1}$$

$$Y_{nf} = A_{nf}(1 - u)(lhk) \tag{2}$$

Where $z > 0, k \geq 0, 1 \geq u \geq 0, 1 > \theta > 0$

Y_f and Y_{nf} represents rural households income from farm and non-farm sectors. A represents the total factor productivity. Total time allocated to livelihood activities for a household is considered as “1” out of which u is allocated to farm sector and $(1 - u)$ is allocated to non-farm sector. Here, $z, h, l,$ and k represent land holdings, human capital (education and health), labour, livestock and physical capital holdings of rural households. Now total rural households’ income could be shown as:

$$Y = Y_f + Y_{nf}$$

$$Y = A_f u(z^\theta l^{1-\theta}) + A_{nf}(1 - u)(lhk) \tag{3}$$

If households want to maximize their income [3] subject to time constraint:

$$u^* = \left[\frac{A_f(1-\theta)}{A_{nf}} \right]^{\frac{1}{\theta}} \left(\frac{z}{l} \right) h^{-\frac{1}{\theta}} k^{-\frac{1}{\theta}} \quad [4]$$

Equation [4] implies that as the land per capita ($\frac{z}{l}$) is higher, more time is allocated to farm sector and similarly when human capital is high, more time is devoted to non-farm sector. Maximization of rural households' income leads to:

$$\frac{y^*}{l} = A_{nf} h k - [(1-\theta)^{\frac{1}{\theta}} - (1-\theta)^{\frac{1-\theta}{\theta}}] \frac{A_f^{\frac{1}{\theta}}}{A_{nf}^{\frac{1-\theta}{\theta}}} \left(\frac{z}{l} \right) (h k)^{\frac{1-\theta}{\theta}} \quad [5]$$

In developing countries like Pakistan land distribution is skewed and majority of rural inhabitants have no land holdings and mostly depends upon their labour, human capital, physical capital and livestock. Same fact is obvious in equation [5] whereby in case of no land holding the dependence of rural households' income is correlated with human and physical capital along with livestock. With this perspective now this equation could be used to construct an econometric model as:

$$HHI = \alpha + \sum \beta_i X_i + u$$

Admittedly at micro level, incomes of households (HHI) vary due to the variations in household's socio-economic and demographic characteristics (X_i) as depicted in equation [5]. On behalf of hypothesis that infrastructure has the force to affect rural households' income due to lowering transaction costs, increasing economic activities, generating employment opportunities and enhancing growth, a vector of infrastructure (Z_i) is added in the equation. It is adequate to add this vector because in literature survey the role of infrastructure in production function has specified as an input. Hence, now the equation used for econometric analysis will be:

$$HHI = \alpha + \sum \beta_i X_i + \sum \gamma_i Z_i + u \quad [6]$$

Data employed in this study is Household Integrated Economic Survey (HIES) 2005-06, which is sub-sample of Pakistan Social and Living Measurement (PSLM) survey 2005-06. Secondary sampling unit (SSU) in HIES is household. Information for a household has been collected through male and female separate questionnaires. Data obtained could also be decomposed between rural & urban, male & female, and also for all the four provinces along with northern areas and Kashmir. Primary sampling unit (PSU) in HIES is rural community. Information for rural communities has been collected through a separate rural community questionnaire. Each PSU includes 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.

5.1 Operational Model

In this study two main vectors are utilized for analysis purpose; vector of households' socio-economic conditions as main determinants and vector of infrastructural variables hypothesized as useful in income augmentation of rural households' incomes, which are explained as under:

Households' Income (HHI): Households' income per capita per month is measured for this purpose and all provided incomes earned by households are included so that a comprehensive measure could be

achieved for analysis.

Household Size (HHS): This is the number of the members in a household and is a ratio scale variable. It is hypothesized that as the household size is increased, higher will be the income of household because in that case more opportunities are available to household for earnings.

Household's Head Age (HHHA): Age of household head is quantified with the number of years after birth. This is a discrete and interval scale variable and if age is less than 12 months it is quantified with 0 years. Hypothesis shows a positive relationship between household head age and household's income. In rural areas of Pakistan normally economically established people are holding the space of head of household in each income group. So, as the age of household head is higher, he is more established and able to earn more income.

Household's Head Gender (HHHG): This is a binary variable and is measured with 1 if household's head gender is male and in case of female, it is measured by 0. It is hypothesized that male household's head have higher level of incomes.

Household's Head Education (HHHE): This shows the education of household head in number of years in school attended by him. This is a discrete and interval scale variable which is hypothesized to be positively related with household income.

Value of Livestock (VLS): Value of livestock is a measure of price in 1000 of rupees for livestock if owned by household. Data of prices are available in HIES. Value of livestock is positively correlated with household income level as described in equation [6] above.

Roads (ROAD): Roads is a measure of accessibility of rural inhabitants for different types of roads. This is a multi-category dummy variable with three attributes i.e. metaled, paved and unpaved roads. It is hypothesized that as the quality of roads is higher, rural development is higher and there are more opportunities available to household for earning more incomes, hence, households' incomes will be higher. ROAD1, ROAD2 and ROAD3 represent metaled, paved and unpaved types of road respectively.

Electricity (ELECT) and Gas (GAS): These variables are measure of accessibility of the facility to households. Using dummy variable technique, if facility is available in the vicinity than its value is taken as '1', otherwise the value is '0'. Load-shedding, failure to provide the facility in available capacity, in rural areas of Pakistan is also a problem but even then economic activities in villages with the facility are comparatively more than villages without the facility. This is why the measure is taken as accessibility and not the time period of load-shedding for this variable and also the hypothesis of positive correlation between the facility and household's income is considered in this study.

Primary Schools (PS): Number of primary schools in vicinity is taken as a measure of this variable. This is a discrete and ratio scale variable. In case no school is available in the vicinity then its value will be zero. As the number of schools is higher, higher will be the chance of productivity of masses and higher will be the income of households, hence a positive relationship with households' income is hypothesized.

Phone (PHOND) and Basic Health Units (BHUD): Normally these services are not available in rural vicinities of Pakistan, therefore, to measure these variables a distance approach is used. By this approach it is attempted to find out that at how many distance the service is available. If service is available in the vicinity then distance is taken as zero otherwise distance is measured in kilometers. As the distance is higher, it means a low level of rural development and there will be a little chance of enhancement in productivity and communication system of the rural inhabitants which in turn results in lower level of income. Therefore, a negative relationship is hypothesized for these variables.

6 Results And Discussion

After using FBS procedure for cleaning process 8480 observations relating to rural areas of the survey in Pakistan have been used for analysis purpose. First of all an analysis regarding Pakistan economy is conducted, thereafter, the analysis is decomposed for the four provinces of Pakistan so as to explore regional differences.

Table 6.1 Rural Infrastructural Development as Determinant of Rural Household Income: Log-Linear Regression Results of Pakistan

Dependent Variable:	Logarithm of Rural Household Income		
Observations:	8480		
Method:	Least Square		
Explanatory Variables	Coefficient	t-Statistic	Probability
C	4.971101	77.334900	0.0000
HHS	-0.055638	-20.845630	0.0000
HHHA	0.026774	36.593370	0.0000
HHHG	0.440660	11.400640	0.0000
HHHE	0.045529	20.785280	0.0000
VLS	0.000557	10.334840	0.0000
ROAD2	-0.076668	-1.977636	0.0480
ROAD3	-0.011099	-0.351108	0.7255
ELECT	0.278119	6.770413	0.0000
GAS	0.087557	2.419880	0.0155
PS	0.005511	2.113817	0.0346
BHUD	-0.000671	-1.034927	0.3007
PHOND	-0.002217	-2.099303	0.0358
R ²	0.273007	F Statistic	264.967400
Adjusted R ²	0.271977	Probability	0.0000

Note : Decimals up to maximum six decimal places have been used

Estimated By: Authors on the basis of data collected through PSLM Survey [GoP (2005-6)]

6.1 Infrastructure and Rural Households Income in Pakistan: The Country Analysis

Value of R^2 equal to 0.273 shows that model is overall good fit and F-statistics, with a value of 264.97, shows that in the model there exists considerable simultaneous impact of all independent variables on household's income with a 1% significance level. There are two main vectors of explanatory variables i.e. one relates to household level characteristics and other relates to community level characteristics. First of all the vector relating to household level characteristics has been discussed. Household size is significant at 1% level but the relationship of the variable with household's income is not in line with hypothesis.

Joint family system is still a main characteristic of households in developing countries including Pakistan and joint family system is working strongly in rural areas. This is why in a family structure like Pakistani rural areas, most of the family members are dependent while few family member are independent/earner which pointed out towards high dependency ratio and low participation ratio. It is also important to mention here that household's per capita income is the variable of interest as households' incomes. Hence, as the number of dependents is increased per capita income will be decreased and vice versa. On this behalf such a result should not be surprising. However, household head's age, education and gender are statistically significant at 1% level and their relationship with dependent variable is as per expectation. Similarly, livestock is not only significant at 1% level but also have the expected sign.

In case of vector relating to community characteristics, keeping in view two important elements i.e. role of public sector in provision of different types of services, and the problems arising through multicollinearity, only six variables are selected for the study. Unpaved roads and basic health units have been proved insignificant while electricity is significant at 1% level. Paved roads, gas, primary schools and phones are significant at 5% level and show expected sign. Metaled road has shown to be comparatively more important than paved and unpaved roads, which is in line with the hypothesis of the study. Overall it looks that in relation to the vector of community related determinants of households' incomes, the vector of household composition shows comparatively high level of significance and closer to economic theory in this regard.

6.2 *Infrastructure and Rural Households Income in Pakistan: A Provincial Level Analysis*

Overall the models in provincial level analyses are shown to be good fit for all the provinces discussed below and on account of F-Statistics it could also be believed that explanatory variables have simultaneous significant impact on households' incomes.

6.2.1 Results for Balochistan

Household size is again significant at 1% level and has an inverse relationship with household income as discussed above. Household head's age, gender and education are significant at 1% and appear as per expectation in line with the hypothesis and livestock is also significant at 1% level and have direct relationship with household income which follows the analysis related to Pakistan economy.

So far as community level characteristics are concerned unpaved roads, gas and basic health units are observed to be insignificant just like the analysis of Pakistan economy. It is also worth mentioning here that relationship of gas has shown inverse relationship with household income which is against our expectation but statistically insignificant. Primary schools and electricity are apparently significant at 5% and 1% level respectively and have direct relationship as per hypothesis. So far as roads are concerned metaled road has more strength than paved road i.e. higher the rural development, higher will be the income of households. It is also observed that access to phone facility is significant at 5% level

but have a positive sign against hypothesis which means that as the distance of phone shop is increased, the level of rural development is decreased and households will earn more income. As per social phenomenon of rural areas in Pakistan, it could be noticed that in early stages of development when people find the facility of phone they use it for strengthening their social and family contacts, therefore, it will be a cause of increase in family expenditures. Normally, in the absence of a phone facility the service of post office is used for informing relatives regarding family's happiness and sorrows due to which comparatively a little number of relatives will join different types of ceremonies and family has to bear relatively little expenditures. These facts inter alia may be a cause of this result in case of Balochistan. The fact is evident from the definition of income:

$$\text{Income} \equiv \text{consumption} + \text{change in net worth} \quad \{\text{World Bank (2009)}\}$$

However, as the development process has increased and reached to a sufficient level, then households also use phone facility for business and commercial purposes, therefore, their incomes will be increased. The increased income is then sufficient enough to overcome the expenditures incurred on social and family set up of the households. Therefore, hypothesizing phone facility for increased household income is correct but in set ups like Balochistan, which is under-developed in nature and still in a phase of development, a positive sign in the analysis may be justified.

Table 6.2. Rural Infrastructural Development as Determinant of Rural Household Income: Log-Linear Regression Results of Balochistan

Dependent Variable:	Logarithm of Rural Household Income		
Observations:	1184		
Method:	Least Square		
Explanatory Variables	Coefficient	t-Statistic	Probability
C	3.079417	8.487509	0.0000
HHS	-0.079327	-8.284783	0.0000
HHHA	0.037104	14.12323	0.0000
HHHG	1.863101	5.549513	0.0000
HHHE	0.054164	7.403706	0.0000
VLS	0.004271	5.466601	0.0000
ROAD2	-0.387321	-3.46746	0.0005
ROAD3	-0.162847	-1.644211	0.1004
ELECT	0.268172	2.545525	0.0110
GAS	-0.067855	-0.523892	0.6005
PS	0.020409	1.895086	0.0583
BHUD	0.000324	0.210952	0.8330
PHOND	0.00374	2.102426	0.0357

R ²	0.280005	F Statistic	37.9500
Adjusted R ²	0.272627	Probability	0.0000
Note : Decimals up to maximum six decimal places have been used			
Estimated By: Authors on the basis of data collected through PSLM Survey [GoP (2005-06)]			

6.2.2 Results for Khyber Pakhtunkhwa

The vector of household level characteristics show the same behaviour as witnessed in datasets of Pakistan, Balochistan and Khyber Pakhtunkhwa. Household size is significant at 1% level and has an inverse relationship with the household income. Household head's age, education and gender are also significant at 1% level and their relationship with household income is evident to be positive in table below. Livestock is again significant at 1% level and positively related with household income.

Table 6.3 Rural Infrastructural Development as Determinant of Rural Household Income: Log-Linear Regression Results of Khyber Pakhtunkhwa

Dependent Variable	Logarithm of Rural Household Income		
Observations	1841		
Method	Least Square		
Explanatory Variables	Coefficient	t-Statistic	Probability
C	4.809422	19.69138	0.0000
HHS	-0.034802	-8.119922	0.0000
HHHA	0.021505	15.26032	0.0000
HHHG	0.261628	4.176199	0.0000
HHHE	0.038189	9.506964	0.0000
VLS	0.00054	6.671405	0.0000
ROAD2	0.125556	1.268779	0.2047
ROAD3	0.081949	1.473274	0.1408
ELECT	0.843821	3.692188	0.0002
GAS	0.008101	0.114429	0.9089
PS	0.011763	2.647186	0.0082
BHUD	0.000612	0.446212	0.6555
PHOND	-0.007643	-3.111019	0.0019
R ²	0.257063	F Statistic	52.7087
Adjusted R ²	0.252186	Probability	0.0000

Note : Decimals up to maximum six decimal places have been used

Estimated By: Authors on the basis of data collected through PSLM Survey [GoP (2005-06)]

Variables related to paved road, unpaved road, gas and basic health units are perceived to be insignificant in case of Khyber Pakhtunkhwa. Electricity is significant at 1% level and has a positive relationship with household income. Primary schools and access to phone facility are also significant at 1% level and have expected relationship with household income. So far as roads are concerned, the only reference category i.e. metaled road is significant at 1% level, therefore, it could be analyzed that impact of roads on household's income is experimentally insignificant in case of Khyber Pakhtunkhwa.

Comparative analysis of provinces till yet shows that basic health units and unpaved roads are thoroughly insignificant. However, gas is proved insignificant for Balochistan and Khyber Pakhtunkhwa, while paved road is shown to be insignificant for the analysis of Khyber Pakhtunkhwa only.

6.2.3 Results for Punjab

In case of province of Punjab the results of the vector related to household characteristics has shown the same behaviour which we have already observed in all the above analyses. All the variables i.e. household size, household head's age, gender and education along with the variable of livestock, have been demonstrated to be significant at 1% level and their relationship with household income is as per expectation except the relationship of household size. But it has earlier been discussed that the cause of negative relationship of household size with household incomes in rural areas of Pakistan is justified on account of higher dependency ratio and lower participation rate.

In case of community level characteristics as mentioned in table above, first of all the relationship of roads with household's incomes is analyzed and it came to the surface that reference category as metaled road along with unpaved road are found to be significant at 1% level whereas variable of paved road is insignificant. Impact of metaled road is higher than paved and unpaved road. In the same pattern, impact of paved road is higher than the unpaved road. On this behalf it could be assessed in this analysis that metaled road is more beneficial than unpaved road which is in line with the theoretical aspect of the relationship. The variable of electricity has expected relationship with household's income and is significant at 5% level. The variable of gas is also positively related with household's income in line with the expectation presented by the literature in this regard. The gas is also significant at 1% level. The number of primary school has a negative relationship with household's income but at the same time it has been proved an insignificant variable on statistical grounds. So far as the distances of basic health units and facility of phone are concerned, same have been evidenced as insignificant despite of the fact that these variables show an expected relationship with the household's income level.

Table 6.4 Rural Infrastructural Development as Determinant of Rural Household Income: Log-Linear Regression Results of Punjab

Dependent Variable:	Logarithm of Rural Household Income		
Observations:	3645		
Method:	Least Square		
Explanatory Variables	Coefficient	t-Statistic	Probability
C	5.27158	49.24431	0.0000
HHS	-0.065546	-15.01364	0.0000

HHHA	0.022048	21.03643	0.0000
HHHG	0.653095	13.77949	0.0000
HHHE	0.041617	12.57122	0.0000
VLS	0.000447	6.944426	0.0000
ROAD2	-0.032714	-0.659846	0.5094
ROAD3	-0.204344	-3.922374	0.0001
ELECT	0.142586	1.751055	0.0800
GAS	0.214304	4.054777	0.0001
PS	-0.008001	-1.601001	0.1095
BHUD	-0.001536	-1.358682	0.1743
PHOND	-0.003333	-0.597373	0.5503
R ²	0.306682	F Statistic	133.8815
Adjusted R ²	0.304391	Probability	0.0000

Note : Decimals up to maximum six decimal places have been used

Estimated By: Authors on the basis of data collected through PSLM Survey [GoP (2005-06)] while using E- Views

In case of province of Punjab, nearly three variables from community characteristics have been proved insignificant and one variable is proved partially insignificant. These variables are number of primary schools, distances of basic health units along with phone facility and paved roads.

It looks till yet in the provincial level analysis of Pakistan that vector of community characteristics is even found to be beneficial for rural regions of Pakistan but on experimental grounds it could not establish reliability because as the comparative analysis among provinces is progressed the number of insignificant variables is increased. Hence, in comparison to the impact of household level characteristics the impact of community level characteristics is not found to be consistent statistically.

6.2.4 Results for Sindh

Household level characteristics of the model in case of Sindh also have not changed its response in the analysis. The variable of household size has inverse relationship with dependent variable and is significant at 1% level. The variables of household head's age, gender and education are again noticed to be significant at 1% level and their relationship with the household income is positive as per expectation. In the same manner, the variable of livestock holdings is evidenced to be positive and significant at 1% level.

Throughout the analysis started from economy of Pakistan up till the province of Sindh in provincial level analysis, it has been witnessed that the vector of household characteristics have shown similar results for their relationship with the household's income while having strongly significant experimental base. This could be a very good sign of the analysis in the sense that it follows the theory regarding

household level attributes which has already been proved in repeated researches conducted in Pakistan and Worldwide.

Table 6.5. Rural Infrastructural Development as Determinant of Rural Household Income: Log-Linear Regression Results of Sindh

Dependent Variable:	Logarithm of Rural Household Income		
Observations:	1810		
Method:	Least Square		
Explanatory Variables	Coefficient	t-Statistic	Probability
C	3.372402	13.748410	0.0000
HHS	-0.069117	-12.847980	0.0000
HHHA	0.024166	16.305610	0.0000
HHHG	2.379764	10.557500	0.0000
HHHE	0.044412	10.839440	0.0000
VLS	0.003110	10.306420	0.0000
ROAD2	-0.239390	-2.260978	0.0239
ROAD3	0.064212	0.970812	0.3318
ELECT	-0.022312	-0.273432	0.7846
GAS	-0.020620	-0.289674	0.7721
PS	0.005087	0.918607	0.3584
BHUD	-0.002797	-1.973598	0.0486
PHOND	-0.013819	-3.763403	0.0002
R ²	0.379828	F Statistic	91.71529
Adjusted R ²	0.375687	Probability	0.0000
Note :	Decimals up to maximum six decimal places have been used		
Estimated By:	Authors on the basis of data collected through PSLM Survey [GoP (2005-06)] while using E- Views		

In case of Sindh, variable of accessibility to roads has shown the similar results that metaled road and paved road are significant at 1% and 5% level respectively and impact of metaled road is higher than paved road while unpaved road is proved to be insignificant. The accessibility of vicinities to electricity

and gas facilities has shown unexpected relationship with the household income but in case of data regarding the province of Sindh, these have been observed as insignificant. Even the variable related to number of schools has the expected relationship but same have also been noticed as insignificant. In case of Sindh, the only two variables which have been proved significant are distances of basic health units and phone facility from household's regions which have also expected signs. In case of vector of community level characteristics, the analysis of Sindh is in line with notion presented above that comparatively more variables have been proved insignificant.

7 Conclusion and Policy Implication

It has been concluded in this study that household level attributes of livestock holding, household head's age, gender, and education along with rural infrastructural development in shape of community level characteristics of roads, electricity, gas, schools, hospitals and telephone, have positive role for rural households' income. Notwithstanding, noteworthy state of affairs depicted in the analysis points out the role of rural infrastructural development as secondary in nature when compared with renowned determinants as household level attributes. It could also be inferred that in rural areas joint family system, with intrinsic higher dependency ratio and low participation ratio, will be responsible for decline in income of the households. So far as provincial level analysis is concerned the same conclusion is obvious fact which strongly endorses earlier findings of the study. When specifically pursued the role of rural infrastructural development then electricity could be mentioned as most important factor for enhancing rural households' income. Important information came to the surface from provincial level analysis is that need of infrastructure type, for different provinces, is different. Need for electricity in income generation process of households is a common factor for all provinces except the province of Sindh. Along with this facility of phone is of importance for provinces of Sindh and Balochistan, while facilities of gas and primary schools are proved to be beneficial in provinces of Punjab and Khyber Pakhtunkhwa respectively.

Ultimately this study suggests that if the purpose of public policy is to enhance the income of rural inhabitants then infrastructural development may not be the priority, however, if focus is the development of rural areas then its role is of importance. It is also necessary to probe the need of regions when government of Pakistan aims to provide public infrastructure for the purpose of enhancement of rural development and rural households' incomes.

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