Relationship Between Housing and Household Characteristics:
Evidence from Pakistan

G.M. Sajid and Rizwana Kouser
International Institute of Islamic Economics, International Islamic University Islamabad,
Islamabad, Pakistan

Abstract: The main objective of the study is to investigate the relationship between housing characteristics and household characteristics. To comprehend the objective, the study utilizes the data of Pakistan Social and Living Standards Measurement (PSLM) 2010-11. Multinomial logit model is applied for the purpose. The results show that urban households prefer housing units with better facilities. Higher income leads to be residing with better housing characteristics. Moreover, increase in the number of children always related to the substandard housing characteristics, holding household size constant. Increase in the age of household leads to improved housing structure. Marital status of the head of household also matters. Married heads prefer better housing facilities.

Key words: Housing characteristics, household characteristics, multinomial logit model, head characteristics, PSLM, marginal effect

INTRODUCTION

Socio Economic Status (SES) of a person, group or household is the combined measure of both economic and sociological characteristics and it is measured by education, income, religion, occupational and residential status, etc. Housing has a significant role in our lives. It affects all walks of human life directly and indirectly such as education, health, economic, political and social aspects (Sinha, 1978; Alaghbari *et al.*, 2009). House is not only the name of a physical unit but it is actually a full package consisting of all complementary services available in the house like water supply, electricity and gas connections, types of toilet, etc. (Follain and Jimenez, 1985). Housing and household characteristics are related to each other (Mulder and Lauster, 2010). There are many significant differences in the characteristics of the head of household like marital status, education level, income and age, etc. So, in order to estimate the demand for housing, these variables should also be considered along with the conventional economic variables (Lee, 1963).

According to housing finance review (2005-2011) (The report prepared by Infrastructure, Housing and SME, Finance Department State, Bank of Pakistan), Pakistan is the 6th most populated country in the world having 173.5 million population. Pakistan has been facing rapid urbanization but the prevailing infrastructure has not been capable to meet the requirement or to absorb this speed of rapid urbanization. It gave rise to a lot of issues like substandard living conditions and poor housing conditions which affect the whole economy of Pakistan. Provision of shelter or standard housing to the low income group is the basic issue of the developing countries (Irfan and Pant, 2007). In Pakistan household spend a small fraction of their income on housing. In Sindh (Pakistan), 60-70% households spend only 10-20% and <10% households spend >40% of their income on housing (Ahmad *et al.*, 2002). Most of the urban households have pucca houses and rural household have katcha houses (Saddozai *et al.*, 2013). Urban households enjoy better housing conditions rather than rural household with respect to basic facilities (Zaki, 1981).

Every household has different preferences in the selection of housing characteristics. The main reason behind these differences in preferences is the difference in the household's life cycle stages such as income, education level, marital status and age of head of household. They are significantly important in determining the household's preferences (Smith and Olaru, 2013). Household size and income are the main variables that affect the household's preferences strongly (Arimah, 1992). Larger families demand more space (number of rooms) considering income constant. Moreover, demand for number of rooms is higher with the

Corresponding Author: G.M. Sajid, International Institute of Islamic Economics, International Islamic University Islamabad,
Islamabad, Pakistan

higher income than lower family income (Quigley, 1976). Marital status has insignificant impact on the demand for housing space (Du Rietz, 1977). Rich households have higher probability to live in houses with better characteristics than poor households (Shah, 2012). Education level is another determinant of demand for housing attributes. Higher education leads to increase in the probability of living in better quality houses.

Brueckner (2013) depicts very clear picture of link between housing characteristics and household characteristics. He is of the point of view that higher income and education are the main factors that lead to demand for houses with better structural conditions. He is also of point of view that the marital status, education level and age of the head of household, income and size of household are the main variables that increase the demand of rooms.

There are few studies that estimate the link between housing and household characteristics for different countries (Arimah, 1992; Brueckner, 2013; Follain and Jimenez, 1985; Quigley, 1976; Shah, 2012). According to our best knowledge, no study has been conducted that explores the link between housing and household characteristics in the context of Pakistan. It is worth mentioned that Ahmad *et al.* (2002) investigated the demand for houses in the province of Sindh (Pakistan). They compared rent to income ratios and estimated income, price and household size elasticity for the area. They compared the living conditions of homeowners and renters and concluded that the homeowners were living in better housing conditions.

The main objective of this study is to explore the link between housing characteristics and household characteristics, i.e.,; how the change in household's characteristics such as income, education level, marital status and age of head and size and income of household etc affect demand or house with different structure and facilities available in the house. The study may be helpful in designing housing projects which may be more appropriate with the preferences of the households. The estimates can also be used to design housing programs which provide better and more appropriate types of housing to different types of households.

Literature review: The existing literature shows that there is a significant association between housing characteristics and household characteristics. Arimah (1992) conducts a study on Ibadan (Nigeria). The results show that education of the head does not affect the demand for number of rooms whereas Brueckner (2013) utilizing the data of Indonesian Family Life Survey (IFLS) for the year 1993 concludes that there is a positive and significant relationship between literate head and demand for number of rooms.

The income of households has significant and positive impact on the demand for number of rooms (Arimah, 1992; Brueckner, 2013; Du Rietz, 1977; Follain and Jimenez, 1985; North and Griffin, 1993; Quigley, 1976). Demand for number of rooms significantly increases as the family size increases (Arimah, 1992; Brueckner, 2013; Du Rietz, 1977; Quigley, 1976; Tiwari and Parikh, 1998; Witte *et al.*, 1979), however, there is a negative relationship between kids share and number of rooms (Brueckner, 2013). There is significant and positive relationship between age of household and demand of number of rooms (Arimah, 1992; Brueckner, 2013; Du Rietz, 1977). Literature related to the marital status of the head of household shows that marital status has insignificant impact on the demand for housing space (Arimah, 1992; Du Rietz, 1977). However, Brueckner (2013) shows that there is positive and significant relationship between demand for number of rooms and married head.

The literature also documents response of roof material to increase in income. As the income increases, there is less chances to use foliage leaves roof or raw material (Brueckner, 2013; Follain and Jimenez, 1985; Shah 2012). The demand for better construction material for houses increases as the income increases (North and Griffin, 1993). There is more probability for the rural household to be residing in the houses whose roofs are built of foliage. Houses that have substandard roof material are less demanded by the literate head. Moreover, with an increase in the family size there is less chances to be residing in a house whose roof is made of leaves (Brueckner, 2013; Shah, 2012). Average age of household has significant and negative impact with respect to substandard roof material (Brueckner, 2013).

The literature shows that as the income increases, household are more likely to be lived in a house with better wall material (Brueckner, 2013; Follain and Jimenez, 1985; Shah, 2012). According to Shah (2012) literate head and larger family size decrease the chances to live in a house having bamboo wall, however, as the share of the children increases then there are more chances of having bamboo wall. Brueckner (2013) points that in Indonesia there is less probability to be residing in a house whose walls are made of wood or bamboo with an increase in the income, education, family size and age.

Female headed household have more chances of having piped water facility (Jalan and Ravallion, 2003). Shah (2012) and Brueckner (2013) find that higher income, education and larger family size have more chances of having water connection. Moreover, with an increase in the kids share there is more chance of having no water connection.

The probability of having toilet facility increases with an increase in income (Brueckner, 2013; Follain and Jimenez, 1985; Shah, 2012). In the urban area there are

less chances of having no toilet. Low income, education, family size, age and larger kids share increases the probability of residing without toilet (Brueckner, 2013; Shah, 2012). Moreover, if the head is married then there are more chances for own toilet (Brueckner, 2013).

Existing literature reveals that there is positive and significant relationship among higher income, education, household size and electricity (Brueckner, 2013; Shah, 2012). There is higher probability for the urban household to be residing in a house where electricity is available. Shah (2012) finds that as the share of the kids increases then there are more chances of having other fuel for light than electricity. Brueckner (2013) explains that with an increase in the average age of household and share of kids there are more chances of having electricity. Married headed households prefer those houses that have electricity connection.

The review of literature made above shows that there is a significant association between housing characteristics and household characteristics. The review also shows that if the household resides in the rural area, then there is more chances of using foliage leaves as roof material, bamboo wall material, no proper piped water, no toilet facility and have no electricity connection. With an increase in the education of head or education of household there are more chances of residing in a better housing structure. Literature concludes that with an increase in the income of head or income of household there are more chances of having piped connection, flush system and better housing material for wall and roof and electricity connection. The review of the literature also helps us to conclude that with an increase in the household size, the demand for rooms, better housing roof and wall material, piped water facility, toilet facility and electricity increases. We also conclude from literature that gender, age and marital status of the head, age of the household have significant association with housing characteristics.

The literature reviewed above make it clear that a few studies are carried out to explore the link between housing characteristics and household characteristics for different countries like Indonesia, Nigeria, Philippine, etc. This type of study has not been conducted for Pakistan. Hence, this study is an attempt to fill this gap in the literature.

MATERIALS AND METHODS

Model and data source and variable description
Model: To accomplish our objective, we use Multinomial Logit Model (MLM). It is the extension form of the binomial logit model. The general form of logit model is:

$$P(Y_i = 1) = \frac{\exp(\beta_1 + \beta_2 x_i)}{1 + \exp(\beta_1 + \beta_2 x_i)} \quad (1)$$

The extension form of logit model is:

$$\rho(Y_i = j) = \frac{\exp(\beta_{j0} + \beta_{j1} x_i)}{\sum_{k=0}^{k} \exp(\beta_{k0} + \beta_{k1} x_i)} \quad j = 0, ..., k \quad (2)$$

Where:
Y_i = $\in (0, 1, 2, ..., k)$
i = The households
j = The housing alternatives or categories
x = The household characteristics
β_k = The covariate effects of response category with reference to base category

The coefficients of model are relative probabilities. To calculate the actual probabilities, we need to calculate marginal effects. For the categorical variables, discrete change is measured, whereas, for the continuous variables instantaneous rate of change is measured.

Calculation of marginal effects is based on Eq. 3 borrowed from Long and Freese (2006):

$$\frac{\partial \rho(y_i = k)}{\partial x_i} = \rho(y_i = k) \left\{ \beta_{k1} + \sum_{j=0}^{k} \rho(y_i = j)\beta_{j1} \right\} \quad (3)$$

Or:

$$\frac{\partial \rho(y_i = k)}{\partial x_i} = \rho(y_i = k) \left\{ \frac{\beta_{k1} - \left[\sum_{j=0}^{k} \beta_{j1} \exp(\beta_{j0} + \beta_{j1} x_i) \right]}{1 + \sum_{k=1}^{k} \exp(\beta_{k0} + \beta_{k1} x_i)} \right\}$$

The marginal effects show the effect of change in "x" on the probability of the housing alternatives that household can choose, keeping all other variables constant at their average value. To estimate the impact of household characteristics on housing characteristics, we estimate following equation:

$$\text{Housing characteristics} = \alpha + \beta_1 (\text{Region}) + \beta_2 (\text{Head's literacy status}) +$$
$$\beta_3 (\text{H education}) + \beta_4 (\text{T income}) + \beta_5 (\text{H size}) + \beta_6 (\text{kid share}) +$$
$$\beta_7 (\text{H gender}) + \beta_8 (\text{Average}) + \beta_9 (\text{H marital status}) + \varepsilon$$

$$(4)$$

In equation, housing characteristics are used as a dependent variable. We use six categorical variables-roof material, wall material, source of drinking water, fuel for cooking and fuel for lighting and type of toilet-as a representative of housing characteristics. The number of rooms in the housing characteristics is the only dependent variable which is not a categorical variable. Multinomial logit model for this variable is not applicable.

Variables (It is worth stated that number of categories of housing and household characteristics reported and used in the analysis are different from PSLM's (2010-11) categories. We have reduced these categories keeping in

Table 1: Housing characteristics and their categories

Housing characteristics	Description/categories
Rooms	No. of rooms in a house
Roof material	RCC/RBC
	Wood/bamboo
	Others
Wall material	Burnt bricks/blocks
	Raw bricks/mud
	Others (stone and wood/bamboo etc.)
Source of drinking water	Piped water (both inside and outside the home)
	Hand pump
	Others (motor pump, well (both covered and open well), river, stream, pond, tanker truck, water fetcher etc.)
Type of toilet	Facility not available
	Flush system (flush system linked to sewerage, connected with open drain, linked to septic tank)
	Others (privy seat, digged ditch etc.)
Source of fuel to cook food	Fire-wood
	Gas
	Others (kerosene oil, cow- dung cakes, electricity, coal, wooden coal etc.)
Source of fuel for light	Electricity
	Kerosene oil
	Others (gas, fire wood and candle etc.)

Table 2: Household characteristics and their description/categories

Household characteristics	Description/categories
Region	Region of residence which is a dummy variable. It takes value 1 if household belongs to rural areas otherwise 0
Head's literacy status	Dummy variables indicating that head is illiterate
Heducation	Maximum years of education of the head of the household
Tincome	Total income of a household (In 10,000 Rs.)
Hsize	Household size which is measured by number of members above 10 years in the household.
Kidshare	The number of the children up to 10 years in the household
Hgender	Dummy variable indicating that head is female
Avergage	Average age of household's members of age above 10 years
Hmaritalstatus	Dummy variable indicating that marital status of the head is other than married (unmarried, widow/widower, divorced, nikkah solemnised but rukhsati has not taken place)

view the percentage/frequencies of responses under any categories) description: The housing characteristics and their categories are reported in Table 1. The variable rooms mean the number of rooms in a house. It is one of the dependent variable which is a continuous variable. All other variables are categorical and have three categories. Household characteristics and their categories which act as independent variables in the analysis are reported in Table 2.

Data sources: Data is taken from the Pakistan Social and Living Standards Measurement (PSLM) for the year 2010-11. This survey was planned to collect information about the social, demographic and economic indicators of households in Pakistan for a particular year. Total sample size of 2010-11 PSLM survey was 16,341 households.

RESULTS AND DISCUSSION

Descriptive analysis
Housing characteristics: The percentage/mean values and frequencies of housing characteristics are reported in Table 3. Table indicates that on average urban and rural households have 3 and 2 rooms, respectively. The 49.31% urban and 11.70% rural households are residing in those houses whose roofs are built of RCC/RBC. It means that in urban area most common roof material is RCC/RBC. Table 3 also indicates that 54.63 and 20.06% households

Table 3: Housing characteristics and their summary statistics

	Percentage/mean	
Housing characteristics description/categories	Urban	Rural
Region	40.32	59.68
Rooms		
No. of rooms in a house	2.58	2.29
Roof material		
RCC/RBC	49.32	11.70
Wood/bamboo	20.06	54.63
Others	30.63	33.66
Wall material		
Burnt bricks/blocks	86.13	52.02
Raw bricks/mud	12.1	36.97
Others	61.71	11.01
Source of drinking water		
Piped water (both inside and outside the house)	47.94	15.19
Hand pump	8.12	34.54
Others	43.94	50.28
Type of toilet		
Facility not available	2.41	21.92
Flush system	91.52	46.61
Others	6.07	31.47
Source of fuel to cook food		
Fire-wood	21.14	65.47
Gas	74.85	11.37
Others	4.01	23.15
Source of fuel for light		
Electricity	97.78	85.50
Kerosene oil	0.62	11.43
Others	1.59	3.07

use wood/bamboo in rural and urban area, respectively. The 30.63% urban and 33.66% rural households reside in those houses which are made of other type of roof

material. Table 3 also reveals that the most common wall material is burned bricks/blocks. The 52.02% rural households and 86.13% urban households have preferences for houses made of burned bricks/blocks. In rural area 36.97% and in urban area 12.16% households live in houses where wall are built of raw bricks or mud bricks. We can conclude that most of the urban households residing in those houses whose roof and wall are made of better material.

The 47.94% urban households have access to piped water whereas only 15.19% rural households have facility of piped water. Hand pump facility as a source of drinking water is available to 34.54% urban and 8.12% rural households. This table also reveals that about half of the households in Pakistan (43.94% in urban and 50.28% in rural areas) uses other sources of drinking water like motor pump, well (both covered and open well), river, stream, pond, tanker truck, water fetcher, mineral water etc. We can conclude safely that urban households have accesses to better source of drinking water as compared to rural households. Table 3 also makes it clear that most of the urban households (91.52%) have toilet facility with flush system in their houses whereas only 46.61% rural households have this facility. The 31.47 and 21.92% rural households use other types of toilet facility and have no toilet facility in their houses, respectively.

Table 3 also demonstrates that fire wood and gas is the most common source of fuel for cooking in rural and urban areas, respectively. The 65.47% rural and 21.14% urban households use fire wood for cooking. Gas facility for cooking is available to 11.37% urban and 74.85% urban households. Only 4.01% in urban and 23.37% in rural areas households use sources of fuel for cooking other than fire-wood and gas. Table verifies that electricity is the most common fuel for light in both rural (85.50%) and urban (97.78%) areas. In rural area 11.43% households use kerosene oil as a source of fuel for cooking.

Household characteristics: The mean values/percentage of households characteristics are reported in Table 4. Table 4 shows that about 55% households in both rural and urban areas are headed by literate persons. Average years of education of head about 5 in both regions. The average income of urban and rural households is Rs. 23.72 and 14.84 thousand, respectively. The mean household size in both areas is about 5 members. The average age of household members who are above 11 years is almost same (33 year) in both areas. Most of the heads of households are married. Figure in table reveals that 91.06 and 89.10% heads of households are married in rural and urban areas, respectively.

Table 4: Household characteristics and their summary statistics

Household characteristics description/categories	Urban	Rural
Head's literacy rate (%)		
Yes	55.11	55.86
No	44.89	44.14
Heducation (years)	5.11	5.06
Tincome (Rs)	23.72	14.84
Hsize (No.)	4.69	4.46
Kidshare	1.73	2.19
Hgender (%)		
Male	92.11	91.58
Female	7.89	8.42
Avergage (years)	33.01	33.29
Hmaritalstatus (%)		
Married	89.10	91.06
Others	10.90	8.94

Computed by the researchers from the data available in PSLM 2010-11

Estimates of number of rooms and household characteristics: The OLS estimates of number of rooms and household characteristics are reported in Table 5. Table 5 reveals that rural household demands 8% less rooms as compared to urban households. The result of our study are consistent with Arimah (1992). A one unit (10,000) (We take total income of household in 10,000 Rs.) increase in the income of the households increases demand for rooms more then 2 %. These results are in line with the results of Arimah (1992), Brueckner (2013), Du Rietz (1977), Follain and Jimenez (1985), North and Griffin (1993) and Quigley (1976). One person increase in the household size as well as in kid's shares in households increase the consumption of rooms by 1 and 4%, respectively. These results are supported by the findings of Arimah (1992), Brueckner (2013), Du Rietz (1977), Quigley (1976), Tiwari and Parikh (1998) and Witte *et al.* (1979). It means that effect of increase in household size is higher than increase in kids share. The reason behind is that kids can share rooms easily. Female headed household demands 53% more rooms as compared to male headed households. The one year increase in the average age of the households significantly and positively affects the consumption of number of rooms. These findings are consistent with Arimah (1992), Brueckner (2013) and Du Rietz (1977). Our results of marital status of head of household does not support the results of Arimah (1992) and Du Rietz (1977).

Estimates of link between housing characteristics and households characteristics: The results of the multinomial logit are also presented in Table 6. The estimates of roof material and household characteristics at their average show that households in the rural areas have 31% less chances to be residing in a house whose roof is made of RCC/RBC. These findings are in line with the findings of Brueckner (2013) and Shah (2012). Moreover, there are 2% more chances of rural households

Table 5: Estimates of link between housing characteristics and households characteristics

Household characteristics	No. of rooms	Roof material		Wall material		Source of drinking water	
		RCC/RBC	Others	Mud bricks	Others	Piped water	Hand pump
Region (rural)	-0.080**	-0.314***	0.0265***	0.209***	0.0828***	-0.306***	0.226***
	(3.43)	(0.0072)	(0.0078)	(0.0066)	(0.0035)	(0.0074)	(0.006)
Head' literacy status(illiterate)	-0.020	0.012	-0.0022	0.0117	0.0028	-0.0244*	-0.0118
Constant, 0.443** (7.06)	(0.58)	(0.011)	(0.0133)	(0.0119)	(0.0072)	(0.0121)	(0.0113)
Heducation	-0.003	0.002*	-0.0016	0.0021	-0.0000	0.0006	-0.00064
	(1.01)	(0.0009)	(0.0012)	(0.0010)	(0.0006)	(0.0010)	(0.00104)
Tincome	0.022**	0.0052***	0.0018***	-0.0047***	-0.0015***	0.0020***	-0.0068***
	(13.29)	(0.0002)	(0.0003)	(0.003)	(0.0002)	(0.00018)	(0.0003)
Hsize	0.194**	-0.0033*	0.0023	-0.0044**	0.0021*	-0.0002	0.005***
	(29.93)	(0.0014)	(0.0017)	(0.0016)	(0.0009)	(0.0015)	(0.0016)
Kidshare	0.041**	-0.0235***	-0.0002	0.0240***	0.0058***	-0.0093***	0.0114***
	(7.04)	(0.0017)	(0.0020)	(0.0017)	(0.0010)	(0.0018)	(0.0017)
Hgender (female)	0.534**	0.182***	-0.0270	-0.183***	-0.0141*	0.0471**	-0.134***
	(12.16)	(0.0142)	(0.0142)	(0.0086)	(0.0068)	(0.0144)	(0.0088)
Avrgage	0.019**	0.0019***	0.0002	-0.0033***	-0.000**	-0.0001	-0.0000
	(15.04)	(0.0003)	(0.0004)	(0.0004)	(0.0002)	(0.0004)	(0.0003)
Hmaritalstatus	-0.007	-0.0507***	0.0146	0.0167	-0.022***	-0.0239*	0.0538***
(other than married)	(0.18)	(0.0101)	(0.0137)	(0.0130)	(0.0066)	(0.0116)	(0.0125)

N, 16.309, 16309, 16309, 16309; R^2, 0.27; Prob>χ^2, 0.0000, 0.0000, 0.0000; Adj R^2, 0.2739; Pseudo R^2, 0.1301, 0.1228, 0.0987; Base categories: Wood/bamboo, Burnt bricks/blocks, Others sources; All multinomial logit estimates give the marginal effects at their average. Standard errors in parentheses ** p<0.01, * p<0.05, *** p<0.1

Table 6: Estimates of link between housing characteristics and households characteristics

Household characteristics	Type of toilet		Fuel for cooking		Fuel for lighting	
	No toilet	Others	Gas	Others	Kerosene oil	Others
Region (rural)	0.172***	0.230***	-0.590***	0.183***	0.0141***	0.100***
	(0.0045)	(0.00574)	(0.0069)	(0.0051)	(0.00244)	(0.0033)
Head's literacy status (illiterate)	-0.0159	0.0131	0.0164	-0.0282**	0.0119**	-0.0118
	(0.0092)	(0.0109)	(0.0104)	(0.0096)	(0.00419)	(0.00689)
Heducation	-0.0018*	0.0018	0.0012	-0.0023*	-0.0006	-0.0008
	(0.0008)	(0.0009)	(0.0009)	(0.0009)	(0.0003)	(0.00065)
Tincome	-0.0047***	-0.0023***	0.0036***	-0.0007***	-0.0000	-0.0012***
	(0.00036)	(0.0003)	(0.0002)	(0.0002)	(0.0000)	(0.00023)
Hsize	-0.0043**	-0.0058***	-0.0023	-0.0023	-0.0012*	-0.0094***
	(0.0014)	(0.0015)	(0.0013)	(0.00139)	(0.00062)	(0.0011)
Kidshare	0.0029*	0.0169***	-0.0176***	-0.0006	-0.0005	0.0036***
	(0.0014)	(0.0016)	(0.00162)	(0.00151)	(0.0007)	(0.0010)
Hgender (female)	-0.0423***	-0.166***	0.0701***	-0.0138	-0.0079*	-0.0609***
	(0.0079)	(0.0070)	(0.0119)	(0.0101)	(0.00392)	(0.0038)
Avrgage	0.000	-0.0035***	0.0006	0.0007*	0.0000	-0.0007**
	(0.0003)	(0.00039)	(0.00035)	(0.00023)	(0.0001)	(0.0002)
Hmaritalstatus (other than married)	0.0182	-0.0136	-0.0214*	0.0188	0.0001	-0.0232***
	(0.0101)	(0.0120)	(0.0103)	(0.0106)	(0.0045)	(0.0068)

N; 16309, 16309, 16309; Prob>χ^2, 0.0000, 0.0000, 0.0000; Pseudo R ,^{2}0.1794, 0.2374, 0.1072; Base categories: Flush system, Wood, Electricity; All multinomial logit estimates give the marginal effects at their average. Standard errors are in parentheses. **p<0.01, *p<0.05,***p<0.1

to use other roof material as compared to urban households. The 1 year increase in the head's level of education increase the chances to live in a house whose roof is made of RCC/RBC with reference to wood/bamboo as concluded by Brueckner (2013). It means that more educated heads prefer to live in those houses which are built of better material. An increase in the income also increases the chances to have RCC/RBC and other roof material as compared to wood/bamboo. These results are

consistent with the results of Brueckner (2013), Follain and Jimenez (1985) and Shah (2012). There is less probability for a household to live in a house which roof is made of RCC/RBC due significant rise in the household size and kid's share as concluded by Brueckner (2013) and Shah (2012). Female headed households have 18% more chances to live in a house whose roofs are built of RCC/RBC. A one year increase in the average age of the household is also significantly increases the probability

to use RCC/RBC. Our results are consistent with the finding of Brueckner (2013). The results also indicate that if marital status of the head of household is other than married then chances to reside in a house whose roof is made of RCC/RBC, decrease by 5%.

House's walls in rural areas as compared to urban areas have 20 and 8% more chances to be made of raw bricks and other wall material respectively with reference to burnt bricks. The table also shows that an increase in the total income of the household decreases the chances to live in a house whose walls are made of mud bricks and also other wall material. These results are in line with the studies of Brueckner (2013), Follain and Jimenez (1985) and Shah (2012). The results also reveal that a one person increase in the household size significantly decreases the probability to be reside in the mud bricks/blocks and increase the chances to be reside in a house whose wall is made of other wall material rather than burnt bricks/block as concluded by Brueckner (2013) and Shah (2012). In addition to it, increase in the kids share in the household increases the probability to live in a house whose wall is made of mud bricks and other wall material as evidenced by Shah (2012). Female headed households have fewer chances to live in those houses that have walls of raw bricks and other wall material by 18 and 1%, respectively as compared to burnt bricks/blocks. The one year increase in the average age of the household significantly decreases the chances to live in raw bricks and other wall material as reported in Brueckner (2013). If the marital status of the head is other than married then there is 2% less chances to live in a house whose walls are made of other wall material as compared to married head.

Estimates of source of drinking water show that rural households have 22% more chances to use hand pump water and 30% less chances to use piped water as compared to urban households. Our results support the findings of Brueckner (2013) and Shah (2012). As compared to illiterate headed household, literate headed household have 2% more chances to use piped water than other sources of drinking water. This result is also concluded by Brueckner (2013) and Shah (2012). Moreover, an increase in the total income of the household decreases the chances to use hand pump facility and increases the chances to use piped water. The results of our study are in line with Brueckner (2013), North and Griffin (1993) and Shah (2012). Increase in the household size and kids share decrease the chances to use piped water and increase the probability to use hand pump as a source of drinking water as compared to other sources of drinking water. Gender of the head of household has also significant impact on source of

drinking water. Female headed households have 4% more chances to use piped water and 13% less chances to use hand pump as concluded by Jalan and Ravallion (2003). There is 5% more chances to use hand pump and 2% less chances to use piped water as compared to other sources if the marital status of the head is other than married.

As compared to urban households, rural households have 17 and 23% more chances to live in a house where no toilet facility and other type of toilet facility is available, respectively as compared to flush system. These results are in line with Brueckner (2013) and Shah (2012). Table 6 also reveals that as the level of education of head of household increases, he does not prefer to live in a house which has no toilet facility as indicated by Brueckner (2013) and Shah (2012). Total income of the households has significant impact on the type of toilet as well. As the income increases there is less chances to be residing in a house that has no toilet facility or other types of toilet rather than flush system. Our results are consistent with the study of Brueckner (2013) and Shah (2012). The results also indicate that one person increase in the household's size decreases the chances to live in a house that have no toilet or other type of toilet facilities. Moreover, increase in the kids share increases the chances to be residing in a house that have no toilet facility or the other type of toilet as compared to flush system as concluded by Brueckner (2013) and Shah (2012). In addition to it increase in the average age of the households decreases the chances to use other type of toilet. These results are in line with the results of Brueckner (2013) and Shah (2012).

Estimates of source of fuel to cook food indicates that rural households have 59% less chances to use gas and 18% more chances to use other sources of fuel to cook food as compared to wood. If the head is illiterate then there are 3% less chances to use other fuel sources. With an increase in the income of household there are more chances to use gas and less chance to use other fuel sources to cook food. The results also reveal that if there is increase in the kid's share, the chances to use gas decreases by 2%. If the head is female, the probability to use gas increases by 7% as compared to wood to cook food. Married headed households have 2% more chances to use gas as a source of fuel for cooking.

Table 6 also indicates that rural households have 1 and 10% more chances to use kerosene oil and other fuel sources, respectively as compared to electricity as a source of fuel for lighting as concluded by Shah (2012). Table also shows that literate heads have fewer chances to use kerosene oil and others fuel because electricity is available in most of the areas. An increase in the total

income of household decreases the probability to use other fuel as a source of lighting. These results are in line with the results of Brueckner (2013) and Shah (2012). One person increase in the household size decreases the probability to use kerosene oil and other sources as compared to electricity. The result is in line with Brueckner (2013) and Shah (2012). Increase in the kids share increases the probability to use other fuel sources as already concluded by Shah (2012).The results also reveal that female headed household have less chances to use kerosene oil and others fuel as source of fuel for lighting. A one year increase in the average age of the household decreases the chances to use kerosene oil. These results are in lined with Brueckner (2013). The chances to use kerosene oil as a source of lighting decreases when the marital status of head is other than married.

CONCLUSION

We can conclude that rural households demand less number of rooms. They also have less chances to resid in houses whose roofs are built of RCC/RBC rural households have more chances to live in a house whose walls are made of raw/mud bricks and other material rather than burnt bricks. They are more likely to use hand pumps as a source of drinking water, to be residing in a house that has no toilet facility and other types of toilet as compared to flush system. There is more probability to use other sources of fuels for cooking food than gas and more chances to use kerosene and other fuels for lighting as compared to urban area. The reason may be that urban households enjoy better basic facilities than rural households (Zaki, 1981). Households having educated heads have preference for houses with RCC/RBC roofs, piped water, toilets having flush system and electricity facility because households with educated heads prefer to reside in better housing characteristics as explained by Brueckner (2013) and Shah (2012). The households with higher income demand more rooms, live in a house of RCC/RBC and others as a roof material, less likely to reside in a house whose walls are constructed with mud bricks and other wall material. There is less probability for a household to live in a house that's roof is made of RCC/RBC due to significant rising of the household size and kids share as concluded by Brueckner (2013) and Shah (2012).

Female headed households demand houses with more rooms, roofs RCC/RBC material, piped water and gas as a source of drinking water and cooking. Increase in the average age of the household also affects the demand for characteristics of houses because difference in the age of

the households shows the difference in taste and needs of the households as noted by Lee (1963). According to Smith and Olaru (2013) the individuals who are above 35 years are able to get all facilities because this is the age when households are stable in their profession as well as their income. The marital status of the head of household also affects the preferences about housing characteristics. Married headed households demand better housing characteristics such as roofs with RCC/RBC material, piped water and gas for cooking as noticed by Brueckner (2013). This study may be helpful in designing housing projects which may be more appropriate with the preferences of the households. These estimates can also be used to design housing programs which provide better and more appropriate types of housing to different types of households. It is also helpful for housing planners and policy makers in designing and appraising housing policy.

REFERENCES

Ahmad, N., S. Ahmad and S. Ali, 2002. Demand for housing in province of Sindh (Pakistan). Pak. Econ. Social Rev., 40: 19-34.

Alaghbari, W.E., A. Salim, K. Dola and A.A. Ali, 2009. Housing shortage for low-income in Yemen: Causes and suggestions. Intl. J. Hous. Markets Anal., 2: 363-372.

Arimah, B.C., 1992. An empirical analysis of the demand for housing attributes in a third world city. Land Econ., 64: 366-379.

Brueckner, J.K., 2013. Slums in developing countries: New evidence for Indonesia. J. Hous. Econ., 22: 278-290.

Du Rietz, G., 1977. Determinants of housing demand: Analysis of census data for the county of stockholm, 1970. Scand. J. Econ., 79: 312-325.

Follain, J.R. and E. Jimenez, 1985. The demand for housing characteristics in developing countries. Urban Stud., 22: 421-432.

Irfan, M. and K.P. Pant, 2007. The Impact of open sewerage smell on house rent in Rawalpindi. Pak. Dev. Rev., 46: 803-815.

Jalan, J. and M. Ravallion, 2003. Does piped water reduce diarrhea for children in rural India? J. Econ., 112: 153-173.

Lee, T.H., 1963. Demand for housing: A cross-section analysis. Rev. Econ. Stat., 45: 190-196.

Long, J.S. and J. Freese, 2006. Regression Models for Categorical Dependent Variables Using Stata. 2nd Edn., Stata Press, New York, USA., Pages: 517.

Mulder, C.H. and N.T. Lauster, 2010. Housing and family: An introduction. Hous. Stud., 25: 433-440.

North, J.H. and C.C. Griffin, 1993. Water source as a housing characteristic: Hedonic property valuation and willingness to pay for water. Water Resour. Res., 29: 1923-1929.

Quigley, J.M., 1976. Housing Demand in the Short Run: An Analysis of Polytomous Choice. In: Explorations in Economic Research, Quigley, J.M. (Ed.). National Bureau of Economic Research, New York, New York, USA., pp: 76-102.

Saddozai, R.M., I. Hussain, M. Shah and A. Manan, 2013. Descriptive analysis of determinants of quality of housing in Pakistan. Gomal Univ. J. Res., 29: 55-65.

Shah, N., 2012. Characterizing slums and slum-dwellers: Exploring household-level Indonesian data. Master Thesis, Department of Economics, University of California, Irvine, California.

Sinha, I.B., 1978. A Solution to the Problem of Low-Income Group Housing in Developing Countries by use of Prefabricated System. In: Housing Problems in Developing Countries, Dakhil, H.F., O. Ural and M.F. Tewfik (Eds.). The University of Petroleum and Minerals, Dhahran, Saudi Arabia, pp: 50-51.

Smith, B. and D. Olaru, 2013. Lifecycle stages and residential location choice in the presence of latent preference heterogeneity. Environ. Plann. Econ. Space, 45: 2495-2514.

Tiwari, P. and J. Parikh, 1998. Affordability, housing demand and housing policy in Urban India. Urban Stud., 35: 2111-2129.

Witte, A.D., H.J. Sumka and H. Erekson, 1979. An estimate of a structural hedonic price model of the housing market: An application of rosen's theory of implicit markets. Econ. J. Econ. Soc., 47: 1151-1173.

Zaki, M.J.A., 1981. Housing conditions in Pakistan: 1960-80. Pak. Dev. Rev., 20: 215-246.