A Note on Hedonic Price Estimation of Urban Residential Services: A Case Study of Rawalpindi City

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A prerequisite for planning in the housing sector, be it urban renewal in slum areas or public provision of housing for the urban poor, is the availability of some indices of consumer preferences regarding the various housing services consumed by them. Such information facilitates decision-making as regards the size, and quality of dwellings which 'best' meet the needs of the urban poor. This study estimates the market prices (marginal valuations) of the various housing services consumed by urban households in Rawalpindi City. This is done by regressing rent/imputed rent of the residential units on the different characteristics embodied in the various units. The analysis indicates that the quantitative variable (number of rooms) explains a significant proportion of the variance in the dependent variable (rent/imputed rent). The qualitative variables (electricity, drinking water, garbage disposal and sanitary facilities, type of structure of house); when included in the model contribute significantly to the explained variance in the dependent variable. The analysis reveals (and 'quantities') consumer preference for housing services.

Rental values of urban residential units are determined by large number of its characteristics. However, the Rawalpindi Socio-Economic Survey 1975, on which the present analysis is based, permits us the use of only those characteristics of the housing units included in this study. It needs to be pointed out that certain characteristics which could not be incorporated in this study such as school and health facilities, pollution etc., representing neighbourhood characteristics, may be quite significant determinants of rental values. The impact of the location of the dwelling unit on rent could not be ascertained, since information on the distance of the place of work from the dwelling units was not available. Ridker and Henning in their study [9] attempted to estimate the effect of variable like pollution, accessibility to downtown and school quality on residential property values. Their findings indicate that such

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neighbourhood characteristics contribute significantly to the variation in property values.

The United Nations World Housing Survey 1974 [11], prepared by the Centre for Housing, Building and Planning concludes that the housing shortage in most developing countries is qualitative and not quantitative. The existing housing stocks are sufficient to accommodate the current populations. The United Nations have proposed a number of statistical indicators of housing conditions: percentage distribution of households/persons according to type of living quarters; average number of persons per room; percentage distribution of households/persons according to availability of water supply, toilets, lighting, cooking and bathing facilities; tenure status and housing expenditure. However, the non-availability of relevant statistical data has not permitted them to calculate all the proposed indicators.

For Pakistan (1960), the Survey's [11] findings are that the current population can be accommodated in the existing housing stock at the rate of between 1 to 2 households per dwelling unit. Fifty-nine percent of urban dwellings are over-crowded (*i.e.* have 3 or more persons per room). The other indicator of housing conditions namely, percentage of dwellings with piped water-supply and toilet facilities could not be calculated for Pakistan due to non-availability of data. Hence the Survey was not able to reach any conclusion regarding the quality of housing in Pakistan.

A latter part of this paper, describes the current housing conditions in Rawalpindi City. Two important aspects of the housing conditions namely, levels of occupancy and availability of housing facilities are reviewed.

METHODOLOGY

Conventional studies of consumer behaviour have treated housing as homogeneous consumer durables. The present study is a departure from this approach. Housing has been incorporated as a 'multi-characteristic' commodity in the analysis. The study follows the approach normally associated with Kelvin Lancaster and Zvi Griliches the 'hedonic' hypothesis, which postulates that goods are valued for their utility bearing characteristics. A good is characterised by a set of characteristics, each of which has a hedonic price (implicit market price); the market price of the good is the sum of the values of these characteristics. The hypothesis assumes the existence of markets for 'imaginary' physical characteristics of commodities.

Given that a residential unit is described by a set of characteristics and has a rental value/market price associated with this given fixed vector of characteristics; the market implicitly reveals a price function:

$$P = f(C)$$

relating prices and characteristics of each residential unit; where P, the dependent variable is vector of price of the different houses and C is a matrix, the rows of which represent characteristics embodied in each residential unit.

From observed prices of residential units and the specific amounts of characteristics associated with them, consumers infer the hedonic prices of these

characteristics. Hedonic price estimation technique in effect, defines the above price function by a comparison of the rental values and the differentiated characteristics of the residential units. Econometrically, hedonic prices are the regression coefficients (*i.e.* $\partial P_{...} \partial C$) estimated by regressing rent/imputed rent on the characteristics of the residential units.

Classical least squares regression technique with both continuous and binary variables is used to estimate the contribution (implicit price) of each characteristic to the rental values of residential units. The functional form of our regression is:

$$\ln R_i = \alpha + \beta \ln r_i + \sum_{j=1}^{n} \gamma_j C_{ij} + u_i \qquad i=1,\ldots.988$$

where R_i is the observed/imputed rental value for the i^{th} housing unit; r_i is the number of rooms in i^{th} housing unit and C_{ij} is a vector of housing unit characteristics embodied in the i^{th} housing units; C_{ij} are binary variables measuring the presence or absence of specific characteristics in a housing unit, u_i is the residual variable with zero mean and constant variance.

A number of recent studies of consumer durables have resorted to the use of the hedonic approach. A sample of the literature is: King's study [5] and; Kain and Quigley's study [4] on housing. Also Otha and Griliches study [8] on automobiles.

DATA

The data used in the analysis is derived from the Socio-Economic Survey of Rawalpind (1975), which consists of cross-section observations on 1,000 households. However, because of certain inaccuracies and inconsistencies in data reporting in the housing section of the survey, 12 household observations are omitted from the data set used in this study.[1] For a detailed discussion of the sample design of the socio-economic survey refer to Hamdani's study [3].

It would be appropriate here to point out certain definitional problems raised by some variables used in our analysis. In particular, the variables walls and roofs. Both these variables have been classified in the survey into the following six categories: (1) cement concrete, backed bricks or stones; (2) sun-dried bricks or mud; (3) galvanised iron sheets; (4) wood/bamboo; (5) thatch and; (6) other materials. In an effort to define: a permanent; a temporary; and a semi-permanent dwelling structure in this study; a certain amount of discretion has been exercised. For example, a permanent structure has been defined as a house with walls and roofs both made of cement, concrete, baked bricks or stones. There does not seem to be much doubt regarding the validity of this definition. However, problems are encountered in the definitions of the semi-permanent and temporary dwelling structures. Is it valid to classify a dwelling which has walls and roofs made of sun-dried bricks, mud or wood, as temporary? How should one best define a structure with walls of cement, concrete, baked bricks or stones, and roofs made of sun-dried bricks mud or wood? In the present study, dwelling structures have been classified into four basic categories.

[1]I am grateful to my colleague, Annice Mahmood, for processing the data and spotting the inconsistencies in data reporting.

A brief description of the sample data used in the analysis is as follows: Roughly, 42.6 percent of the households live in rented houses and 57.4 percent are either owner-occupiers or else live in rent-free houses. The average income (wage+non-wage) per household per month is Rs. 688.83. The average number of members per household is 6.1 while the average number of earners per household is 1.51. The percentage expenditure on housing per month per household (for renters) is 10.22.[2] The mean value of rent for the renters sub-sample is Rs. 71.04 with a standard deviation of Rs. 74.75; while the mean number of rooms is 1.85 with a standard deviation of 1.09. For the owner-occupied dwellings, the mean imputed rent is Rs. 165.33 with a standard deviation of Rs. 164.57, and the mean number of rooms is 2.64 with a standard deviation of 1.41.

ANALYSIS

Profile of Housing Conditions

Following the United Nations approch to measuring housing conditions that is, using level of occupancy (average number of persons per room) and percentage distribution of households according to the availability of residential services like electricity, water, sanitary and garbage disposal facilities etc., as indicators of housing conditions; the housing characteristics both quantitative and qualitative for Rawalpindi City are summarised in Table 1.

Table 1

Housing Characteristics of Rawalpindi City

	Variable	*Relative Frequency* (%)
1.	Density of Occupation	
	At most 1	12.4
	2	26.7
	3	23.1
	4	13.1
	5	9.8
	6	4.8
	7	4.5
	8	2.7
	9+	2.9
2.	Number of Rooms per Household	
	1	34.0
	2	28.7
	3	21.6
	4	9.2
	5	3.5
	6	1.9
	7+	1.1

—*Continued*

[2]This figure compares quite favourably with the estimate of 11.74 percent for income expenditure on housing per household per month in the urban areas of Pakistan, as reported in the Household Income and Expenditure Survey 1970-1971.

Table 1—*Contd.*

	Variable	Relative Frequency (%)
3.	Structure of House	
	(*a*) Walls and Roofs of cement, baked bricks	41.7
	(*b*) Walls (sun-dried bricks, mud, wood) and Roofs (cement, baked bricks)	2.1
	(*c*) Walls and Roofs of mud, sun-dried bricks, wood	12.9
	(*d*) Walls (cement, baked bricks) and Roofs (mud, sun-dried bricks)	43.3
4.	Bathroom	
	(*a*) Separate	50.7
	(*b*) Commo n	5.2
	(*c*) No	44.1
5.	Latrine Facility	
	(*a*) Flush inside	6.3
	(*b*) No flush inside	77.7
	(*c*) Facility outside (municipal)	3.7
	(*d*) Open country	12.3
6.	Primary Source of Drinking Water	
	(*a*) Running water (piped) inside	31.9
	(*b*) Running water (piped) outside	35.9
	(*c*) Hand-Pumped/well water	1.0
	(*d*) Any other (*e.g.* water-carrier)	31.2
7.	Lighting Facility	
	(*a*) Electricity	72.2
	(*b*) Kerosene Oil	27.8
8.	Garbage Disposal Facility	
	(*a*) Regular municipal collection from house	1.0
	(*b*) Dumped at designated location for municipal collection	38.3
	(*c*) No arrangement for regular municipal collection (dumped on street)	60.7
9.	Type of Access Street	
	(*a*) Metalled	29.5
	(*b*) Non-metalled (brick)	36.2
	(*c*) Unpaved	28.3
	(*d*) No regular street	6.0

The salient features of the housing conditions are summarised as follows. 37.8 percent of the urban dwellings in the city are overcrowded (*i.e.* have more than three persons per room). 41.7 percent of the households live in dwellings, the roofs and walls of which are made of cement, concrete or baked bricks. 50.7 percent of the households have a bathroom facility which is not shared with other households. 77.7 percent of the households have a latrine facility inside the house but without flushing arrangement and almost 12.3 percent of the households in the absence of any facility use open country (*i.e.* fields or open spaces adjoining the house). 67.8 percent of the households have access to piped drinking water facility while 31.2 percent have access to either hand-pumped/well water or have water delivered by water-carriers. 72.2 percent of all houses are electrified. Finally, 60.7 percent of all houses have no arrangement for regular municipal garbage clearance, that is garbage is dumped on the street. An attempt has also been made to specify what could be regarded as 'impoverished or inadequate' housing units. Specification of impoverished housing is difficult since local conditions play an important role in determining any standard. The specifications attributed to dwellings which could be considered 'impoverished' are: dwellings without bathroom and latrine facilities inside the house (*i.e.* residents have access to municipal latrine facilities located outside house or use open country), without running water inside or outside house, without electricity (*i.e.* kerosene used for lighting), with no arrangement for regular municipal garbage collection (*i.e.* garbage dumped on street) and a non-permanent dwelling structure (*i.e.* houses with walls and roofs made of mud, sun-dried bricks, thatch or wood/bamboo). The analysis indicates that about 22.30 percent of all households in Rawalpindi City live in impoverished housing conditions, the remaining could be considered 'adequately' housed. Furthermore, 30.40 percent of households in rented houses live impoverished housing conditions, as compared to 16.23 percent for owner-occupied/rent free households.

Table 2 presents a breakdown of the means of rents, incomes, earners, number of rooms, occupation density and housing expenditure by tenure status and housing category.

Table 2

Housing Characteristics

Variable	Renters			Owners		
	Impove-rished	Adequate	t*	Impove-rished	Adequate	t*
Mean earners	1.47	1.57	1.11	1.27	1.53	2.46
Mean income (Rs)	598.23	713.18	2.28	503.55	726.94	3.74
Mean rent (Rs)	35.91	86.34	6.67	86.79**	179.86**	5.08
Mean number of rooms	1.32	2.10	6.89	2.20	2.72	3.30
Mean persons per room	3.95	3.47	1.87	2.94	3.10	0.61
Mean housing expen-diture (%)	6.00	12.11		17.24	24.74	
Number of observations	128	293		92	475	

*t-statistic (for difference between means)
**Imputed Rent

The analysis of variance suggests that the mean income of the two sub-samples namely renters and owners, are not significantly different (Rs. 681.30 for renters and Rs. 694.43 for owners). The mean rents are however, significantly different for the two sub-samples (Rs. 71.04 for renters and Rs. 165.32 for owners). This can be explained partly, be the fact that owners on the average live in larger houses. The mean number of rooms for owners (2.66) and the mean number of rooms for renters (1.85) are significantly different (t=9.61). Moreover, owner-occupier households may have a tendency to over-estimate the rents of their dwellings.

For both the renters and owners sub-samples, the mean rents, mean incomes and mean number of rooms for the two housing categories (*i.e.* impoverished and adequate) are significantly different. As expected, these mean values are lower for the impoverished housing category. However, the density of occupation (mean persons per room) for houses in the two categories are not significantly different for the sub-samples. The United Nations Research Institute for Social Development [1] suggests the use of occupation density as a quantitative indicator for measuring the adequacy of housing facilities. The present analysis indicates that density of occupation is, in fact, not a decisive indicator for measuring the adequacy of residential units. The qualitative indicators like availability of electricity, water and sanitary facilities etc. are, it is felt, better measures of housing conditions.

Hedonic Price Estimation

The housing sample is stratified by tenure status of households. Using least squares regression techniques, separate regressions are run for two sub-samples comprising of renter-occupied and owner-occupied/rent free dwellings. Besides the continuous variable, rent/imputed rent; the regression functions contain 12 binary variables: 3 for structure of dwelling units, 2 for bathroom facilities, 3 for latrine facilities, 2 for sources of drinking water, and one each for lighting and garbage disposal facilities. The dependent variable is rent in the case of rented houses and imputed rent in the case owner-occupied/rent free houses. The explanatory variables for both sub-samples remain the same. The binary variables take the value 1, when a particular qualitative characteristics is observed in a given house and a value 0, in case of its absence. (*see* Table 3 for definitions).

Since there is no a prior reason to believe that a particular form of the regression function "best" explains the relationship between the dependent and the explanatory variables, both linear and logrithmic models are relied on in the estimation. The latter specification gives 'better' fits. Because of the functional form (*i.e.* logrithmic) of the regressions in the analysis, the regression coefficients of the continuous independent variables should be interpreted as giving a percentage in rental values for each unit increase in an independent variable. While the regression coefficients of the binary explanatory variables should be read as giving the difference in the rental values of a house belonging to a particular category rather than to an excluded category, since the intercept them has not been constrained to equal zero. It would seem reasonable to assume that the price for residential quality ought to increase as the size of a housing unit (*i.e.* number of rooms) increases. However, the logrithmic form used in the analysis implies that the price for quality is a constant proportion of

the price paid for the size of the housing unit.[3] Although, this assumption is more restrictive; the functional form used explains a substantial variation in the regressand.

The regression results are presented in Table 4. The results indicate that roughly 65 percent of the variation in the dependent variables, rent and imputed rent, is explained by the independent variables included in the analysis (*i.e.* $R^2 = 0.658$ for the renters model; $R^2 = 0.699$ for the owners model). The F-statistics indicate that the specified relationships for both renters and owners are significant at the one percent level. The majority of the explanatorv variables included in the analysis are significant, by the standard t-test criterion, in their effect on rental values.

Table 3

Definition of Variables

Original	Derived (Regressors)
Rooms	X_1 = Rooms (natural log)
Walls/Roofs	X_2 = 1, if walls and roofs are cement cencrete, baked brickes. = 0 otherwise. X_3 = 1, if walls are sun-dried bricks, mud, or wood; and roofs are cement concrete, baked bricks. = 0 otherwise. X_4 = 1, if walls and roofs are sun-dried bricks, mud, wood or other materials. = 0 otherwise. Houses with walls of cement concrete, baked bricks; and roofs of sun-dried bricks, mud, wood (intercept).
Bathroom	X_5 = 1, if no bathroom. = 0 otherwise. X_6 = 1, if bathroom (common). = 0 otherwise. bathroom (separate) (intercept).

—Continued

[3] $\ln R_i = \alpha + \beta \ln r_i + \gamma \sum_{j=i}^{n} c_{ij}$

$$\frac{\partial \ln R_i}{\partial c_{ij}} = \gamma$$

or $$\frac{\partial R_i}{\partial c_{ij}} = \gamma R_i \text{ since } \partial \ln R_i = \frac{1}{R_i} \partial R_i$$

Original	Derived (Regressors)
Latrine facilities	X_7 = 1, if flush inside house.
	= 0 otherwise.
	X_8 = 1, if any facility outside house.
	= 0 otherwise.
	X_9 = 1, if onen country.
	= 0 otherwise.
	No flush inside house (intercept).
Primary source of drinking water	X_{10} = 1, if running water (piped) inside house.
	= 0 otherwise.
	X_{11} = 1, if running water (piped) outside house.
	= 0 otherwise.
	Hand-Pumped water, any other (intercept).
Lighting facilities	X_{12} = 1, if no electricity.
	= 0 otherwise.
	Electricity (intercept).
Garbage Disposal	X_{13} = 1, if regulr municipal collection from house.
	= 0 otherwise.
	No regular municipal clearance (intercept).

Table 4

Regression Results

Variables		Renters Equation		Owners Equation	
		Mean (S.D.)	Reg. 1 (log rent)	Mean (S.D.)	Reg. 2 (log imputed rent)
Rooms	X_1 (nat. log)	0.468 (0.520)	0.718 (12.034)	0.830 (0.538)	0.887 (21.347)
Structure of house	X_2	0.430 (0.495)	0.308 (5.171)	0.407 (0.491)	0.230 (4.882)
	X_3	0.024 (0.152)	0.186 (1.109)	0.019 (0.138)	0.417 (2.807)
	X_4	0.105 (0.306)	—0.127 (1.452)	0.146 (0.354)	0.192 (3.048)

—Continued

Table 4—*Contd.*

Variable		Renters Equation		Owners Equation	
		Mean (S.D.)	Reg. 1 (log rent)	Mean (S.D.)	Reg. 2 (long imputed rent)
Bathroom facility	X_5	0.513 (0.499)	−0.262 (4.117)	0.388 (0.487)	−0.151 (3.097)
	X_6	0.064 (0.245)	−0.378 (3.486)	0.042 (0.201)	−0.062 (0.597)
Latrine facility	X_7	0.055 (0.227)	0.023 (0.185)	0.069 (0.253)	0.320 (3.828)
	X_8	0.055 (0.227)	−0.465 (4.075)	0.025 (0.155)	−0.296 (2.304)
	X_9	0.121 (0.326)	−0.245 (2.938)	0.123 (0.330)	−0.621 (8.747)
Soure of drinking water	X_{10}	0.209 (0.406)	0.317 (3.743)	0.400 (0.489)	0.069 (1.241)
	X_{11}	0.418 (0.493)	0.007 (0.109)	0.316 (0.465)	0.031 (0.636)
Lighting facility	X_{12}	0.392 (0.488)	−0.120 (2.058)	0.194 (0.395)	−0.100 (1.761)
Garbage disposal	X_{13}	0.354 (0.478)	0.063 (1.105)	0.422 (0.494)	0.235 (4.901)
	Intercept		3.601		3.931
	R^2		0.658		0.699
	F		60.276		98.932
	Number of observation		421		567
	Mean dependent variable		3.897		4.769
	Standard deviation of dependent variable		0.841		0.835

(t-values in parentheses)

In regression 1 (renters model), the coefficient of the quantitative variables, number of rooms ($X_1 = 0.718$), being an elasticity estimate indicates that a 10 percent increase in the number of rooms results in a 7.18 percent rise in rent. For example, a renter living in a 2 room house would be willing to pay upto 37 percent more rent than he is presently paying to have an extra room (*i.e.* for a 50 percent increase in the number of rooms).

The coefficient of the dwelling structure variables X_2, indicates that houses with both walls and roofs made of cement, concrete or baked bricks (*i.e.* permanent dwellings), have rental values which are 30.80 percent higher than houses with walls made of cement, concrete or baked bricks; and roofs made of sun-dried bricks, mud or wood. That is, for houses with permanent roofs renters are willing to pay more rent than houses with non-permanent roofs (*i.e.* roofs made of sun-dried bricks, mud, wood etc.). The coefficients of the other dwelling variables X_3 and X_4 are not significantly different from zero.

The variables representing bathroom facilities, X_5 and X_6, indicate that houses with no bathrooms or shared bathrooms have lower rents than houses with bathrooms (separate) *i.e.* bathrooms which are not shared with another household. However, the variable for shared bathroom (X_6) has a larger negative value than the variable X_5, representing no bathroom facilities. This shows renter households preference for no bathroom facility over shared bathroom facility. The coefficient of latrine facility variable X_7, representing latrine facility inside the house with flush, is not significantly different from zero. The other variables, X_8 and X_9, qualifying the type of latrine facilities available, indicate that the rental values of houses, the residents of which have access either to the use of municipal latrine facilities located outside the house or use open country (*i.e.* fields or open spaces adjoining the dwelling), are lower than houses which have latrines but no flushing facility. It could be concluded that renters prefer some sort of latrine facility inside the house (*e.g.* latrines which are manually cleared), but will not pay extra rent for a latrine facility in side the house with flush.

Dwelling units with running water (piped) inside ($X_{10} = 0.317$) have rental values which are 31.7 percent higher than dwellings which have access to hand-pumped/well water or have arrangements for water delivery by water-carriers. The variable X_{11}, representing municipal/communal piped water facilities outside the dwelling unit, is insignificant. This shows that renters prefer and are willing to pay for the facility of having (piped) inside the house but not for access to a communal water tap.

The qualitative variable $X_{12} = 0.120$, indicates that the rental values of houses without electricity are 12 percent lower than those with electricity. X_{13}, representing regular municipal garbage collection facility, is insignificant. That is, renters are not willing to pay higher rents for houses provided with this facility.

A comparative analysis of the renters and owners sub-samples reveals certain basic differences in preferences characterising the two sub-markets. The regression coefficients of the dwelling structure variables, X_2, X_3, X_4 are all significant. However, variables X_3 and X_4 ought to be interpreted with reservations. They neither display the expected signs nor a rational ordering of preferences. The problem lies mainly in the definition of these variables,

which has already been explained in the data section of the paper. The variable X_5 indicates that owner-occupiers assign 15.10 percent lower rents to houses with no bathrooms than houses containing separate bathrooms. However, they are indifferent to having a shared or separate bathroom facilities. (*i.e.* X_6 is not significantly different from zero). The latrine facility variables (X_7, X_8, X_9) are all significant, display the expected signs and a rational ordering of preferences. Owner-occupiers impute 32 percent higher rents to houses containing latrine facilities (inside) with flush than those with latrines (inside) but without flush. The lowest values are assigned to houses with no latrine facilities inside the house nor have access to municipal latrine facilities *i.e.* to housing units, the residents of which have to use open country in the absence of latrine facilities. The variable X_{10} representing running (piped) water facility inside the house is insignificant in its effect on rental values; however, this variable is significant for the renters model. Owner-occupiers are indifferent to having piped water facility or hand/pumped/well water etc. The electricity variable X_{12} is significant at the 10 percent level. Owner-occupiers impute upto 23.50 percent ($X_{13} = 0.235$) higher rents for houses with the facility of regular municipal garbage collection.

Table 5 presents the upper and lower limits of the proportion of the explained variation in rental values attributable to size (*i.e.* number of rooms per house) and quality, by tenure status.

Table 5

Explained Variation in Rental Values Attributable to Size and Quality

	Proportion Attributable to Size (percent)		Proportion Attributable to Quality (percent)	
	Upper Limit	Lower Limit	Upper Limit	Lower Limit
Renter-occupied dwellings	77.50	18.70	81.30	22.50
Owner-occupied dwellings	70.10	35.48	64.52	29.90

The contribution of residential quality toward determining rental values of renter-occupied dwellings is at most 81.30 percent and at least 22.50 percent. In the case of owner-occupied dwellings, a maximum of 64.52 percent and a minimum of 29.90 percent of the explained variation in rental values is attributable to residential quality.

Variables qualifying the type of access street to a housing unit were initially included in the analysis. However, since they were found to be insignificant in their effect on the dependent variables, rent and imputed rent, they were omitted from the final regressions which are presented in this paper.

CONCLUSIONS

The preceding analysis emphasizes the importance of residential quality (besides the size of a dwelling unit) as a determinant of rental values. Qualitative residential characteristics such as the type of dwelling structure, availability of electricity, running (piped) water, latrine and bathroom facilities, and garbage removal facility; are found to be significant in their effect on rental values. In order to determine the relative importance of the explanatory variables in determining the variation in rental values, the variables are ranked according to the magnitude of their 'beta-coefficients'.[4]

As expected, the ranking indicates that the variable, number of rooms per house (proxy for dwelling unit size/space) is the most important determinant of rental values; followed by the variables characterising residenial quality. It is worth noting that size and structure of a house, and the availability of bathrooms facilities are ranked higher than the availability of electricity and running (piped) water in a house.

Ranking of preferences by renter and owner households as regards the qualitative residential characteristics reveal some interesting differences. For example, renter households attach a higher value to the structure of a house being 'permanent' (*i.e.* houses made of cement concrete or baked bricks). Surprisingly, electricity and running (piped) water are ranked quite low by both renter and owner households; although renter households attach relatively higher values to these quality variables than owner households. On the other hand, owner households' preference for regular municipal garbage collection facility is much higher than that of renters. A more complete ranking of the 'beta-coefficients' of the explanatory variables is presented in Table 6.

Assessment of the prevailing housing conditions in Rawalpindi City reveals that approximately, 22 percent of all households in the city reside in 'impoverished' housing units. That is, in housing units without bathrooms, without latrine facility inside the house (*i.e.* residents have access to municipal latrine facilities located outside the house or use open country), without running (piped) water inside or outside the house, without electricity (*i.e.* kerosene used for lighting purposes, with no arrangement for regular municipal garbage removal (*i.e.* garbage dumped on street) and with a non-permanent dwelling structure (*i.e.* houses with walls and roofs made of mud, sun-dried bricks, thatch or wood). The mean rent for the 'impoverished' housing category is Rs. 57.19 per month; while the mean income of households in this category is Rs. 558.64 per month.

Finally, I would like to add that I am aware of some of the flaws that may have crept into the analysis. Data limitations have certainly contributed towards reducing the scope of this study. However, as with most pioneering efforts there is room for improvement. This incidentally, is the first attempt in Pakistan of price estimation of urban residential characteristics.

[4]Beta-coefficient (Standardised data) is the regeression coefficient times the ratio of standard deviation of the independent variable (rent) to standard deviation of the explanatory variable [2].

Table 6

Beta-Coefficients

Variables		Renters Equation		Owners Equation	
		Reg. 1 (log rent)	Rank	Reg. 2 (log imp. rent)	Rank
Rooms	X_1)	0.448*	1	0.574*	1
Structure of house (walls roof)	X_2)	0.182*	2	0.136*	4
	X_3)	0.032	11	0.069*	8
	X_4)	−0.046	9	0.081*	6
Bathroom facility	X_5)	−0.164*	4	−0.095	7
	X_6)	−0.083*	8	0.019	13
Latrine facility	X_7)	0.009	12	0.097*	5
	X_8)	−0.127*	3	−0.055*	9
	X_9)	−0.099*	6	−0.243*	2
Source of drinking water	X_{10})	0.147*	5	0.039	11
	X_{11})	0.002	13	−0.022	12
Lighting facility	X_{12}	−0.074*	7	−0.049	10
Garbage disposal	X_{13}	0.038	10	0.139*	3

*Coefficient significant at the 1 percent level of significance.

Some Policy Implications

Analysis of the prevailing housing coditions in Rawalpindi City, suggests that the problem of over-crowding; and the quality of dwelling structures and sanitation are a cause of concern. Nearly 61 percent of the dewllings are over-crowded (*i.e.* have 3 or more persons per room). Thirteen percent of the households live in dwellings made of mud, sun-dried bricks or wood, *i.e.* in 'temporary' dwellings; only 42 percent of the households live in 'permanent' dwellings, that is, in dwellings made of cement concrete or baked bricks. Almost 78 percent of the dwellings have latrines inside the house but without proper plumbing for flushing (*i.e.* latrines are cleared manually). Twelve percent of the dwellings have no latrine facilities inside nor have access to municipal latrine facilities, hence use is made of open spaces around the dwellings. About 32 percent of the dwellings have piped drinking water facilities, the remaining have access to either communal water taps, hand-pumped well water or utilise the services of 'water carriers'. A significant proportion (61 percent) of the dwellings have no arrangement for regular municipal garbage collection; refuse is normally dumped on the street.

The most immediate concern is the lack of adequate provision of sanitary, drinking water and garbage disposal facilities. Public housing policies ought to give priority to raising the quality of the existng housing

conditions in the city. Provision of public services is costly. However, it is worth noting that demand exists and hence, a price can be charged for certain essential services. This will enable the government to provide these services under a self-financing scheme. The results bear this out. Renter households having access to municipal latrine facilities are willing to pay 47 percent more to have a facility in the house; those using open country in the absence of latrine facilities are willing to pay upto 25 percent more to have a facility in the house. However, renter households are indifferent to having latrines inside the house with or without flushing facilities. Renter households are willing to pay upto 21 percent more to have piped drinking water facility inside the house rather than have access to hand-pumped or well water or 'water carriers'. As far as the facility of garbage collection is concerned renter households are indifferent to its availability.

Owner-households on the other hand, are willing to pay upto 32 percent more to have a latrine in the house with flushing facility than to have one without it. Those households having access to municipal latrine facilities are willing to pay 30 percent more to have a facility in the house: and those willing to pay upto 62 percent more rent. Owner households are willing to pay 7 percent more to have piped drinking water facility inside the house than to have access to hand-pumped or well water or 'water carriers'. Owner households like renters are indifferent to having access to a communal water tap or hand-pumped or well water. For the facility of regular municipal garbage collection, owner households are willing to pay upto 24 percent more rent.

Further, the analysis provides estimates of the prices of the various residential characteristics. The priorities that consumers assign to these characteristics are also derived. Estimates of the prices of the individual characteristics will assist public agencies in formulating pricing (rent) policies for different categories of public housing. Information regarding the priorities assigned to the various residential characteristics by consumers will be of considerable value of public agencies (with limited resources, especially in a developing country, like Pakistan) concerned with state provision of housing facilities, in determining the nature of public housing which would 'best' meet the needs of the urban poor.

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