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Impact of Remittance Income on House Prices: Evidence from Bangladesh

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During the past three decades, the Bangladesh economy has been characterized by higher economic growth, and record levels of remittance income from both foreign and domestic sources. By using household data, and ordinary least squares (OLS) and quantile regressions, this study explores the factors that affect house prices in Bangladesh. Particular attention is given to the role of domestic and foreign remittance incomes. The results reveal that both domestic and foreign remittance incomes have positive and significant effects on housing prices in Bangladesh. The results from this study indicate that house prices and estimated prices of housing attributes may reflect the fact that housing attributes are not priced the same across a given distribution of house prices. Furthermore, the quantile regression shows that unlike the single OLS estimate, parameter estimates differ along the distribution of house prices per square feet.

Keywords

Developing Country, Hedonic Price Functions, Quantile Regression, House Price, Housing Market, Remittance Income, Bangladesh

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1. Introduction

Housing markets have been intensively studied in developed countries, like the U.S. and Great Britain, because these housing markets are local and diverse, and the governments of these countries have actively intervened in the housing market. Furthermore, any efficient intervention by these governments requires detailed knowledge and information on housing prices and other factors that affect housing markets, thus resulting in a plethora of empirical studies that investigate the demand for housing (see, Follain and Jimenez, 1985).[1] However, in the case of developing countries, the opposite is true. For example, there are high transactions costs, a variety of houses (mud, brick, or a combination), and a lack of government intervention/policies in the housing market at either the local or national level. Finally, as noted by Malpezzi and Mayo (1987), cities and urban areas in developing countries are growing at extraordinary rates, both in terms of population and economic growth. This is particularly true for cities and urban[2] areas where available land, due to a greater demand for housing, parks and amenities, is decreasing at a rapid rate. As the middle class expands[3], rising income and concentration of the population in cities and urban areas are putting downward pressure on the supply of housing. In fact according to the World Bank (2014), Bangladesh, is projected to be "a middle-income country by 2021".

During the past three decades, two distinct features have characterized the Bangladesh economy. First, the economy of Bangladesh has been growing at a rapid pace, about 6% per year, since the mid-1990s. At the same time, the 161 million population of Bangladesh (1,118 person/km^2) grew annually at 1.6%, a rate that adds nearly 1.5 million people every year. The population growth trend in Bangladesh shows that the urban population has grown faster than the rural population despite a low urbanization level (UNDESA 2011). In following other developing countries, urbanization in Bangladesh is explained by: (a) a high natural increase in the urban population, (b) territorial extensions and a change in the definition of urban area, and (c) rural to urban migration. People migrate to cities and towns because they are attracted by livelihood opportunities. Regardless of skill, the migrated population can find diversified livelihood opportunities with various incomes in towns and cities. Thus, the poor rural population considers migration as a livelihood coping strategy.

[1] For concise summaries of housing market analyses, see Mayo (1981); Haines and Goodman (1992); Noguchi and Poterba (1994); and Yamada (1999).

[2] Statistics and studies show that for 2000-2015, the urban growth rate is expected to be at an average of 3.7% for Bangladesh. India, one of the most attractive markets of global real estate, is expecting a 4.9% growth in urbanization.

[3] Economists and real estate participants see the middle-income group as a huge market for the real estate sector.

The second distinct feature of the Bangladesh economy is remittance income[4]. Remittance[5] income has emerged as the driving force behind economic growth in Bangladesh. It contributes to the Bangladesh national economy in a large measure by increasing foreign exchange reserve, per capita income, and employment opportunities. In fact, remittance is second among the foreign currency earnings sector of Bangladesh (Bangladesh Bank Research Report, 2012). The remittance sent by the migrant workers is estimated to be 11% of the total gross domestic product (GDP) in Bangladesh.

The data in Table 1 show that the remittance income in 2011 was about $12 billion, compared to $769 million in 1991.[6] Additionally, these remittances are about seven times higher than the amount received by the Government of Bangladesh as foreign aid and thirteen times higher than the amount received by the Government of Bangladesh as foreign investment. A recent report by the World Bank notes that remittance income is not only increasing foreign currency reserves, but also playing a significant role in reducing poverty and enhancing the economic development of Bangladesh (World Bank, 2012). Finally, remittance income plays an important role in developing the standards of family life, including the purchasing of land and houses. Consequently, the above two issues have tremendous implications on the housing sector of Bangladesh. For instance, to meet the housing demand for millions of people who are moving to cities for better living standards, a panoramic view of housing and urban amenities reveals that urban policies and programs are not properly in place to fulfill the demand for housing, or a shortage and inadequate provision of urban services will prevail. Moreover, the Household Income and Expenditure Survey (HIES) also reveals a very poor provision of urban services in Bangladesh (HIES 2010). Despite the given housing shortages and inadequate urban services in urban Bangladesh, hardly any effort has been made to gauge the demand of housing and urban services. In fact, in order to create an efficient housing market, Bangladesh's National Urban Sector Policy (draft) seeks to assess housing supply and demand, and the collection, analysis and dissemination of information about housing markets on a regular basis (Jahan and Nazem 2011).

[4] Remittances are not a new phenomenon. Several European countries, such as Spain, Italy, and Ireland, were heavily dependent on remittances received from their immigrants during the 19th and 20th centuries. In recent times, developing countries like Bangladesh, India, Nepal and others, have enjoyed remittance income.

[5] A remittance is a transfer of money by a domestic or foreign worker to his or her home country. Workers can move from small villages to big towns and transfer money back to their villages. This is called domestic remittance income. On the other hand, workers can go abroad for work and send money back to their countries, which is referred to as foreign remittance.

[6] The government had anticipated that remittance income would exceed $13 billion at the end of 2012 (World Bank 2012).

Table 1 Population trend of Bangladesh, 1974-2011 (Population in thousands)

	1974	1981	1991	2001	2011
Population[1]	71479	87120	106315	124355	142319
Population change		15614	19195	18040	17964
Population increase%		21.9	22.0	17.0	14.4
Average annual increase [2]		1931	1920	1804	1772
Average annual growth rate		2.32	2.01	1.58	1.34
Remittance from foreign sources (million USD)[3]		526.46	769.37	2104.55	12067.83
Remittance per capita annually (USD)		4.38	7.24	16.92	84.79

Source: Bangladesh Bureau of Statistics. *Population & Housing Census 2011.* Dhaka: Ministry of Planning, Statistics Division. Online: http://www.bbs.gov.bd/WebTestApplication/userfiles/Image/BBS/PHC2011Preliminary%20Result.pdf, accessed July 23, 2013.

Notes: 1. Enumerated population

2. Intercensus period is 2001- 2011, which is 10 years and 51 days

3.Source: The World Bank. 2013. *World Development Indicators- online databank.* Online: http://data.worldbank.org/country/bangladesh, accessed on July 23, 2013.

Therefore, this study fills this gap in the literature and provides estimates of both housing demand and demand for housing attributes (including urban services) in Bangladesh. Particular attention is given to the role of domestic and foreign remittance incomes. To the best of our knowledge, this is the first study that assesses the impact of remittance incomes (domestic and foreign) on a housing market in a developing country. To do so, this study uses household level data and quantile regression analysis to identify the implicit prices of housing characteristics for different points in the distribution of house prices. This explicitly allows high-priced houses to have a different implicit price for housing attributes than lower-priced houses. Finally, the majority of the empirical studies on this topic employ a standard parametric model, an ordinary least squares (OLS) estimator and its variants. Surprisingly, few published studies have used a more flexible semi-parametric regression model in order to explore the potentially complex and heterogeneous relationship between housing attributes and prices. This study attempts to address this limitation through the use of quantile regression.

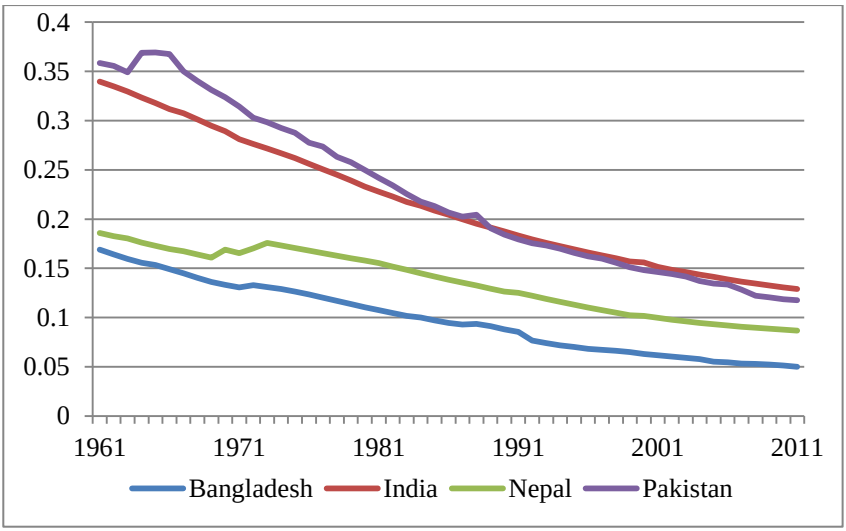
2. Land, Demography and Housing Sector of Bangladesh

Table 1 shows that in the last four decades, the population of Bangladesh has reached more than 142 million, from less than 72 million in 1974. Presently, Bangladesh is one of the most densely populated developing countries in the

world, where the speed of urbanization is accelerating. In 1961, only 5.35% of the total population of Bangladesh was living in an urban area, but this has increased to nearly 29% in 2012 (World Bank, 2013). Consequently, the available and arable land both in rural and urban areas of Bangladesh have been rapidly declining over the years.

The rapid decline of arable land is a common scenario in other South Asian countries as well. For example, in India, Pakistan, and Nepal, per capita arable land has been declining similarly to Bangladesh since the 1960s. Figure 1 clearly presents this fact and shows how rapidly the per capita arable land in Bangladesh and other South Asian countries have been declining over the years. Interestingly, housing shortages are not a problem for high-income groups, but a major problem among middle income and low-income groups. This is the consequence of rapid population growth, accelerated urbanization, high-income growth and inequality, and the displacement of people by natural disasters (Nenova, 2010). According to recent estimates, there is a shortage of 38 million new housing units in South Asia (Nenova, 2010).

Figure 1 **Per Capita Arable Land in Bangladesh & Other South Asian Countries from 1961 to 2011.**



Source: World Bank, 2013. World Development Indicators 2013. Online: http://data.worldbank.org/indicator/AG.LND.ARBL.HA.PC, accessed September 27, 2013.

Also in Bangladesh, a population explosion together with rapid urbanization and displacement by floods and river erosion has generated severe shortages of affordable housing units both in urban and rural areas (NHA, 2013). There is a shortage of approximately 5 million housing units in Bangladesh, despite

the fact that 0.5 million houses are added annually in urban areas and 3.5 million in rural areas (Nenova, 2010). The need for housing upgrades of housing is also high in Bangladesh, as the majority of the houses in the rural areas and urban slums are temporary in nature and poorly constructed. Ironically, the housing market in Bangladesh is characterized by a surplus of very high quality housing stock, and severe shortages of affordable housing for middle-and low-income people. Particularly, the housing problem is serious for the poor. The housing needs of middle and low-income groups are enormous and mostly unfulfilled. The housing finance market is also weak and rationed throughout the middle and poor classes. Nenova (2010) points out that the ratio of housing finance to GDP in Bangladesh is less than 3%, compared to the 50-70% in developed countries and 7% in India.

More importantly, rapidly declining arable and available land, caused by unplanned housing by individuals both in rural and urban areas, is a serious concern in Bangladesh. In considering the emergent problems related to the housing demand of the burgeoning population of the country, the government of Bangladesh has strengthened the National Housing Authority (NHA) in 2001 in order to assist a planned development of the housing sector in Bangladesh. The government has adopted plans, which include a "*House for all by 2012*" in order to ensure the safe shelter of their citizens (NHA 2013). Note that the constitution of the People's Republic of Bangladesh guarantees shelter for its citizens, which is one of the basic needs.

In considering the supply side, the housing sector in Bangladesh can be broadly divided into formal and informal sub-sectors. In the formal sub-sector, the major agents are private owners, the government and cooperative housing societies. In the informal sub-sector, where individuals build their own houses without permission or approval of the design from the authorities, the major agents are the sole suppliers, which cover more than 60% of the total supply of houses in Bangladesh, including urban slum/squatter and others (Ahmad, 2012).

Given that the acuity of the shortage of housing is not only in Bangladesh but also in other South Asian countries, and particularly for the low-and middle-income groups, it would be interesting to examine the impacts of remittance and the overall incomes of the household on housing prices. Particularly, it might be the case that there may be noticeable differences in the elasticity of house price with respect to access to remittance income and house characteristics across the distribution of housing prices. Therefore, since house prices can drive the poor households out of the market, and a low house price is a strong disincentive for entry by a rich household, one of the major tasks in this paper is to identify the different segments of the housing market and their implicit prices in Bangladesh.

3. The Implicit Pricing of Housing Attributes

To assess the impact of remittance income (both domestic and foreign) and other housing attributes on housing prices, we use the hedonic pricing method. Hedonic pricing models (see surveys by Boyle and Kiel, 2001; Sirmans et al., 2005) have been used to assess the impacts of housing attributes on house prices. In particular, Sirmans et al. (2005) provide an in-depth review of housing pricing models from 125 empirical studies. In essence, the hedonic relation arises because of heterogeneity due to immobility and resulting locational differences. Since houses have both unique technical and architectural qualities, to take into consideration these heterogeneities in the estimation method, the use of the hedonic theory is very crucial. The object of the hedonic pricing approach is valuing the characteristics of specific goods depending on their utility for potential buyers. Sirmans et al. (2005) point out that a dwelling unit is made up of many characteristics, all of which may affect its value.[7] Moreover, the hedonic pricing approach is typically used to estimate the contribution of individual attributes to the total value of the house.

Therefore, the hedonic housing pricing model of the following form is estimated to assess the impact of foreign and domestic remittances on housing prices:

$$P = \beta_0 + \beta_R R + \beta_H H + \beta_L L + \varepsilon \tag{1}$$

where $\boldsymbol{P}$ is a vector of house prices, $\boldsymbol{R}$ is a matrix of foreign and domestic remittances, $\boldsymbol{H}$ is a matrix of house characteristics, and $\boldsymbol{L}$ is a matrix of one or more location characteristics. Therefore, β_0 is a constant term vector, β_R , β_H and β_L are matrices of the corresponding parameters, and ε is a vector of error terms. Finally, because housing prices are skewed, a semi-log model is used, with $\boldsymbol{P}$ consisting of the natural log of house prices. This is the most commonly used specification in the hedonic housing price models. An additional advantage is that the log transformation reduces the problem of heterogeneity associated with the use of highly skewed sales price variable.

The model presented in Equation (1) could be estimated by using the OLS methods of estimation; however, as Zietz and Zietz (2008) point out, rich and poor households differ in their preferences for attributes associated with housing. Zietz and Zietz (2008) conclude that rich and poor households may develop group-specific likes and dislikes of certain housing attributes, thus leading to marked differences in the elasticity of house prices with respect to remittance (domestic and foreign), and housing and locational attributes

[7] Lancaster (1966) applies the hedonic theory in the field of real estate for the first time in the sixties. Löchl (2010) points out that the hedonic approach is regularly used for property taxation and mortgage underwriting.

across the distribution of housing prices. Therefore, OLS regression may not be a useful procedure and a more appropriate method of estimation would be to use the quantile regression method, as pointed by Zietz and Zietz (2008).

4. Quantile Methodology

An econometric framework that can allow for different relationships between the regressands and regressors at different points of the conditional distribution of the regressands is quantile regression. Quantile regression (Koenker and Bassett, (1978) and (2001); Buchinsky, (1998) and (2001)) involves the minimization of $1/n\{\sum_{i:y_i \geq \beta' x_i} q|y_i - \beta' x_i + \sum_{i:y_i < \beta' x_i}(1 - q)|y_i - \beta' x_i|\}$, where q is a specified quantile and n is the sample size. In other words, quantile regression involves the minimization of the weighted absolute values of the residuals and uses the maximum information available. In short, the quantile regression method allows an investigator to differentiate the contribution of the regressors along the distribution of the dependent variables.

To summarize the discussion so far, it is worth mentioning the advantages of quantile regression over the least squares method. First, quantile regression provides a more complete picture of the conditional distributions of a dependent variable given a set of regressors. Therefore, researchers can first estimate any point on the locus of the conditional distributions. In addition, different coefficient estimates at different quantiles would be a manifestation that a pure location model is inadequate for explaining the underlying relationship between the variables of interest. Second, linear programming makes the estimation of quantile regression relatively easy. Third, the estimated coefficient vector of quantile regression is more robust to outliers as the objective function minimizes the weighted sum of absolute deviations. Fourth, quantile regression can be more efficient than the least squares method when the error term is not independently and identically distributed. Although the computational cost of calculating bootstrap standard errors had been a major drawback of quantile regression, it is no longer the case with recent advancements in computer processing speed and adjustments. Finally, Deaton (1997) notes that heteroskedasticity can be conveniently analyzed and displayed by estimating quantile regressions. The reader may wish to refer to Zietz and Zietz (2008) for additional information on quantile regression.

In the literature, Malpezzi (2002) identifies structural (describes the dwelling unit itself, such as size, number of rooms, age, etc.), locational (depends on the absolute location within the study area, such as distance to central business district, etc.), and neighborhood (incorporates qualities of contiguous areas, such as availability of public schools, population density, etc.) characteristics, contract conditions, and time specific attributes. Sirmans et al. (2005) additionally mention internal (bathrooms, fireplace, air conditioning,

hardwood floor, basements, etc.), external (garage space, decks, pools, porches, carports, garages, etc.), and natural environmental features (lake view, lakefront, ocean view, etc.). Due to data limitations, especially for a developing country like Bangladesh, it is not surprising that we will not be including these environmental features.

5. Data

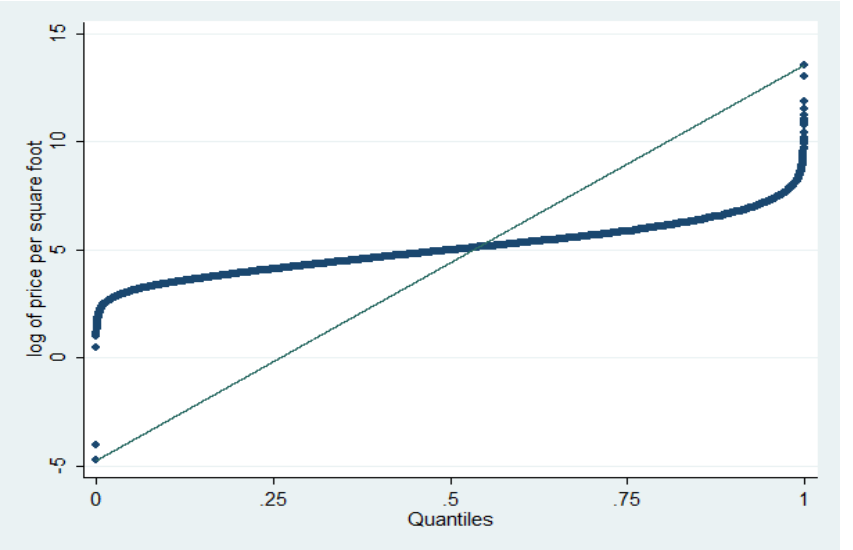
To assess the impact of remittance income (both domestic and foreign) and other housing attributes on housing prices, the Bangladesh's HIES data collected in 2000, 2005 and 2010 will be used in this study, which were made available by the Bangladesh Bureau of Statistics (BBS). The BBS uses two-stage stratified random sampling to ensure greater precision in its data generation and collection process. In the first stage, the BBS selects primary sampling units (PSUs) that consist of specific geographical areas, whereas in the second stage, it randomly selects 20 households from each PSU that represent the rural, urban, and statistical metropolitan areas (SMAs).

In the HIES 2000 survey, a total of 7,440 households were randomly selected from 7 divisions, 64 districts and 303 sub-districts. In the HIES 2005, a total of 10,078 households were randomly selected from 7 divisions, 64 districts and 355 sub-districts. Finally, in the HIES 2010, a total of 12,240 households were randomly selected from 7 divisions, 64 districts and 384 sub-districts. The present study is thus based on information collected from 29,758 households in 2000, 2005 and 2010, of which 9,204 are from urban areas and the remaining 20,556 are from rural areas. Table 2 presents a description of the variables, which are mostly housing characteristics, household income status and location specific characteristics. The data also include a few geographic and location neighborhood variables, for example, the road distance in kilometers from the sampled district headquarters to Dhaka, the capital city of Bangladesh, whether the house is located in a rural or urban area, and the population density at the district level. In the empirical model, we also include 6 dummies for 7 divisions of Bangladesh to examine the unobserved local specific effects on implicit housing prices.

Table 3 provides the summary statistics for the explanatory variables and a dependent variable, the price of housing per square feet in real Bangladesh Taka (BDT). Note that all monetary figures in this paper are deflated by using a GDP deflator, setting 1995-96=100. The quantile values reported in Table 3 are the averages of the values that are associated with the quantile of sale prices. The dependent variable in our analysis is the log of house price per square feet. Figure 2 shows the distribution of the variable across the quantile (qplot). In Table 3, the annual income of a household is computed by adding income from rent from agricultural land, net revenue from businesses, wages and salaries from both farming and non-farming sectors, income from forestry, livestock and fisheries, and annual crop income. To examine the

impacts of the remittances, we treat the remittances from domestic and foreign sources separately in the empirical model.

Figure 2 Distribution of Housing Price Per Square Feet



The house characteristics related variables, such as electricity connection, supply and tube-well water, sanitation system (latrine), roof, wall, separate kitchen and rural (whether located in rural area) are the dummy variables, which take the value 1 or 0 for a specific attribute. For example, 1 if a house is connected to electricity and 0 otherwise. If a house is located in a rural area, then the variable rural takes the value 1 and 0 otherwise. To examine whether house characteristics related variables significantly affect the price of a house, Table 4 presents the statistical properties of these attributes.

Moreover, Table 4 presents the mean prices of houses based on the availability of the attributes and whether the differences in prices are statistically significant. On the one hand, Table 4 demonstrates that on average, brick built houses with a concrete roof that are connected to a water supply and electricity with a separate kitchen, command higher prices compared to the others. On the other hand, houses located in rural areas have lower prices. According to Table 4, the average price of a house (per square feet) in a rural area is BDT 252.72 whereas it is BDT 859.11 in urban areas, which is a difference of BDT 606.39, and statistically significant at the 1% level.

Table 2 Variable Definitions

Variable	Definition
doremitt	Remittance income received, in 000 BDT, domestic sources
foremitt	Remittance income received, in 000 BDT, foreign sources
inchhld	Real total income from all sources excluding remittances in 000 BDT
electri	1 if the house is connected to electricity, 0 otherwise
water1	1 if supply water (connected to public or municipality water supply) is the major source of water, 0 otherwise
water2	1 if tube well with hand pump is the major source of water, 0 otherwise
sanitation1	1 if there was a sanitary latrine, 0 otherwise
sanitation2	1 if there was a concrete made waterproof latrine, 0 otherwise
roof1	1 if cement made roof, 0 otherwise
roof2	1 if C.I sheet/wooden made roof, 0 otherwise
wall1	1 if brick/cement made wall, 0 otherwise
wall2	1 if C.I sheet/wooden made wall, 0 otherwise
kitchen	1 if the house has a separate kitchen, 0 otherwise
room	Number of rooms in the house
year05	Dummy for year 2005 (base is year 2000)
year10	Dummy for year 2010 (base is year 2000)
rural	1 if house is located in a rural area, 0 otherwise
distance	Road distance from Dhaka district to other district headquarter where the house is located
sp	Price per square feet in real BDT
sqfeet	Size of the house in square feet
population	Population density per square kilometer at the district headquarter

Table 3 Summary Statistics and Selected Quantiles of Variables

Variable	Mean	Std. Dev.	0.1	0.3	0.5	0.7	0.8	0.9
sp	440.280	5491.615	21.269	61.183	125.116	243.425	356.998	601.784
sqfeet	389.734	787.148	314.295	364.852	367.068	378.649	383.742	412.494
doremitt	1.611	7.962	0.787	1.085	1.474	1.872	1.966	2.008
foremitt	5.372	33.562	0.506	1.981	3.627	7.045	8.867	11.489
inchhld	58.435	132.300	31.283	43.217	52.112	66.940	64.638	82.867
electri	0.490	0.500	0.154	0.319	0.431	0.550	0.670	0.778
water1	0.078	0.268	0.011	0.026	0.041	0.053	0.089	0.153
water2	0.889	0.314	0.953	0.929	0.919	0.915	0.889	0.834
sanitation1	0.213	0.409	0.082	0.133	0.189	0.258	0.272	0.296
sanitation2	0.109	0.311	0.025	0.051	0.081	0.116	0.163	0.196
roof1	0.093	0.290	0.004	0.008	0.031	0.070	0.128	0.229
Iroof2	0.786	0.410	0.671	0.833	0.861	0.863	0.814	0.733
wall1	0.228	0.420	0.016	0.059	0.147	0.246	0.366	0.475
wall2	0.340	0.474	0.166	0.346	0.415	0.434	0.378	0.318
kitchen	0.735	0.442	0.595	0.675	0.741	0.787	0.803	0.809
room	2.305	1.328	1.851	2.072	2.238	2.453	2.544	2.666
rural	0.691	0.462	0.841	0.806	0.763	0.704	0.618	0.490
distance	182.160	96.399	230.216	196.219	185.054	172.691	168.214	159.471
population	1395.053	1588.966	1052.210	1117.052	1202.606	1319.287	1425.011	1728.162

Note: Monetary values computed in terms of real BDT by using GDP deflator 1995-96=100

Table 4 Effects of House Attributes on Price Per Square Foot

	Mean price per square foot		Mean difference (t-statistics)
Attribute	**Yes**	**No**	
Supply water	1099.30	384.64	714.66*** (6.02)
Brick/Cement wall	904.34	303.02	602.33*** (7.94)
Cement roof	1341.07	348.02	993.05*** (9.07)
Sanitary latrine	666.92	379.01	287.90*** (3.70)
Separate kitchen	468.66	361.76	106.90 (1.48))
Rural area	252.72	859.11	-606.39*** (-8.81)
Connected to electricity	726.62	165.19	561.43*** (8.82)

Note: One sided t-statistics of the differences of the mean values of some attributes of the houses. ***, ** and * indicate significance at 1%, 5% and 10% levels, respectively.

6. Results and Discussion

Table 5 presents the parameter estimates for the standard OLS regression[1] in the leftmost column and the estimates of the quantile regression in the other columns. Unlike Zietz and Zietz (2008), we only provide selected quantile estimates in Table 5.[2] The last column shows the F-statistics from the Wald test that examines if at least one coefficient is significantly different from other coefficients estimated at other quantiles. Finally, a significant F-score underlines the suitability of the quantile regression approach over the conventional OLS approach. While the OLS regression results only give the average estimates, the quantile regression results indicate that the coefficients of a number of variables vary considerably across the OLS and the selected quantiles both in terms of magnitude and direction. For example, the coefficient of domestic remittance (*doremitt*) is three times larger for the 70th and higher quantiles, compared to the coefficient in the OLS regression. Also, the parameter estimate of the OLS regression is closer to the estimate of the 30th quantile. In another example, the estimates of foreign remittance income

[1] The Breusch-Pagan test for heteroskedasticity reveals the presence of heteroskedasticity (χ^2 =447.89), hence the standard errors of the OLS estimates are based on an estimate of the variance–covariance matrix that is robust to heteroskedasticity.

[2] A significant F-score underlines the suitability of the quantile regression approach over the conventional OLS approach.

(*foremitt*) are significantly positive and about 11% higher in the 50th and higher quantiles when compared to the coefficient in the OLS regression. In each case, the quantile regression shows that unlike the single OLS estimate, parameter estimates differ along the distribution of housing prices, especially at the 50th and higher quantiles.

The primary variable of interest in this study is the relationship between both domestic and foreign remittance incomes, and house prices. The parameter estimates in Table 5 indicate that both domestic and foreign remittance incomes have positive and significant coefficients on the 50th or higher quantiles (70th, 80th, and 90th). Figure 3 (Panel A), shows a comparison of the estimates of the OLS (dotted line with confidence interval) and quantile (smooth line with shaded confidence interval) regressions for domestic (*doremitt*) and foreign (*foremitt*) remittance incomes (Panel B). In each case, the quantile regression shows that unlike the single OLS estimate, parameter estimates differ along the distribution of house prices per square feet. In each case, the quantile regression shows that unlike the single OLS estimate, parameter estimates differ along the distribution of house prices (Figure 3, Panels A and B).

Figure 3 **Domestic and Foreign Remittance Incomes, and Total Household Income; Housing Price Per Square Feet: A Comparison of OLS And Quantile Estimates**

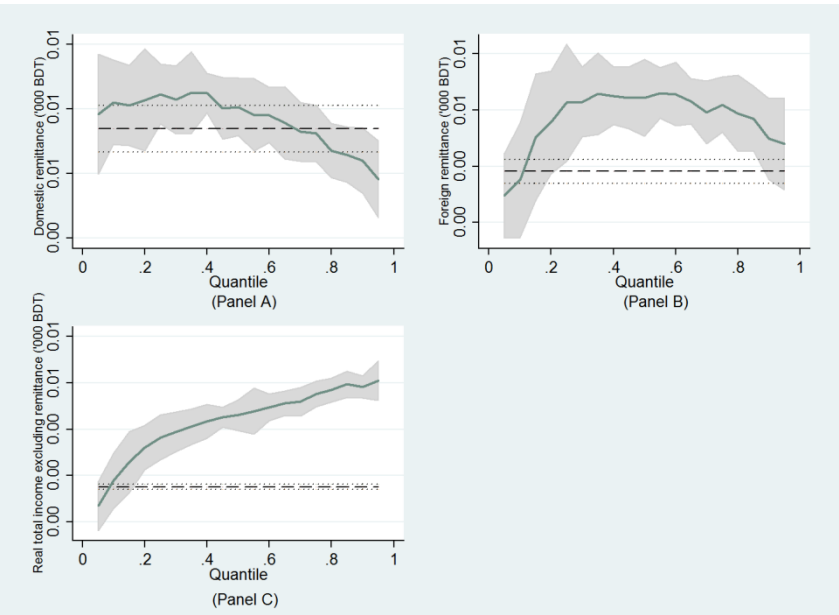


Table 5 Parameter Estimates for Factors That Affect Housing Price in Bangladesh, OLS and Selected Quantile Regression Dependent Variable: ln(housing price per square feet)

	(OLS)	0.1	0.3	0.5	0.7	0.8	0.9	Wald F-Score
doremitt	0.001**	0.001	0.001	0.002***	0.003***	0.003**	0.004***	3.07***
	(0.0007)	(0.001)	(0.007)	(0.0006)	(0.001)	(0.001)	(0.001)	
foremitt	0.0009**	0.001	0.0014	0.001***	0.001**	0.001***	0.001**	2.78***
	(0.0002)	(0.004)	(0.0001)	(0.0002)	(0.0003)	(0.0004)	(0.000)	
inchhld	0.0003***	0.0002*	0.0004***	0.0004***	0.002***	0.004***	0.005***	3.33***
	(0.0000)	(0.0001)	(0.0001)	(0.0001)	(0.000)	(0.000)	(0.000)	
electri	0.34***	0.29***	0.29***	0.32***	0.35***	0.36***	0.35***	2.84**
	(0.013)	(0.018)	(0.016)	(0.016)	(0.018)	(0.020)	(0.016)	
water1	0.11***	-0.07	0.006	0.09**	0.16***	0.20***	0.24***	3.09***
	(0.0371)	(0.072)	(0.053)	(0.042)	(0.05)	(0.065)	(0.102)	
water2	-0.170	-0.18***	-0.23***	-0.23**	-0.17***	-0.14***	-0.11*	1.21
	(0.050)	(0.056)	(0.042)	(0.014)	(0.025)	(0.025)	(0.074)	
sanitation1	0.20***	0.12***	0.17***	0.23***	0.25***	0.26***	0.25***	5.17***
	(0.014)	(0.026)	(0.016)	(0.016)	(0.013)	(0.014)	(0.024)	
sanitation2	0.029	-0.04	0.02	0.03	0.04**	0.03	0.002	2.05**
	(0.018)	(0.030)	(0.03)	(0.026)	(0.025)	(0.030)	(0.030)	
roof1	0.64***	0.72***	0.73***	0.63***	0.58***	0.56***	0.53***	5.31***
	(0.028)	(0.040)	(0.024)	(0.037)	(0.032)	(0.043)	(0.046)	
roof2	0.24***	0.36***	0.27***	0.22***	0.19***	0.17***	0.15***	1.65
	(0.017)	(0.031)	(0.014)	(0.019)	(0.015)	(0.022)	(0.024)	
wall1	0.69***	0.86***	0.77***	0.72***	0.75***	0.77***	0.79***	12.92***
	(0.178)	(0.027)	(0.024)	(0.025)	(0.022)	(0.029)	(0.037)	

(Continued…)

(Table 5 Continued)

	(OLS)	0.1	0.3	0.5	0.7	0.8	0.9	Wald F-Score
wall2	0.20***	0.19***	0.23***	0.23***	0.19***	0.19***	0.21***	1.96*
	(0.013)	(0.022)	(0.012)	(0.014)	(0.023)	(0.031)	(0.023)	
kitchen	0.089***	0.08***	0.10***	0.09***	0.07***	0.09***	0.12***	2.17**
	(0.012)	(0.019)	(0.016)	(0.011)	(0.014)	(0.019)	(0.024)	
room	0.05***	0.04***	0.05***	0.06***	0.06***	0.07***	0.07***	3.24***
	(0.004)	(0.100)	(0.005)	(0.005)	(0.003)	(0.004)	(0.007)	
year05	-0.18***	-0.151***	-0.19***	-0.20***	-0.17***	-0.17***	-0.23***	4.18***
	(0.183)	(0.024)	(0.021)	(0.022)	(0.021)	(0.025)	(0.023)	
year10	0.89***	0.77***	0.86***	0.89***	0.94***	0.95***	0.99***	9.03***
	(0.014)	(0.026)	(0.019)	(0.016)	(0.019)	(0.023)	(0.025)	
rural	-0.31***	-0.22***	-0.21***	-0.27***	-0.33***	-0.36***	-0.42***	41.03***
	(0.013)	(0.017)	(0.014)	(0.020)	(0.022)	(0.026)	(0.023)	
distance	-0.001***	-0.001***	-0.001***	-0.001***	-0.002***	-0.001***	-0.001***	6.28***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	
constant	4.26***	2.94***	3.90***	4.41***	4.82***	5.05***	5.54***	
	(0.039)	(0.076)	(0.054)	(0.043)	(0.041)	(0.045)	(0.085)	
N	29,746	29,746	29,746	29,746	29,746	29,746	29,746	
R^2 (OLS)/*Pseudo* R^2	0.54	0.29	0.34	0.36	0.36	0.36	0.35	

Note: 1. Numbers in parentheses are bootstrapped standard errors. *Significant at the 10% level. **Significant at the 5% level. ***Significant at the 1% level.

2. All monetary values are computed in terms of real BDT by using GDP deflator 1995-96=100. Model is also controlled for population density per square kilometer at the district headquarters level. Due to space limitations, the results are not shown in the table but can be obtained from the authors.

The results in Table 5 indicate that the impact of domestic remittance income (*doremitt*) has a higher impact on house prices, compared to foreign remittance income (*foremitt*). For example, at the 50th quantile, an additional 1,000 BDT increase in domestic remittance income increases house prices by 0.2-0.4%. Additionally, the impact of foreign remittance income (*foremitt*) decreases, while that of domestic remittance income (*doremitt*) increases at higher quantiles (70th, 80th, and 90th). For example, the impact of domestic remittance, at the 80th and 90th quantiles, is two to three times larger in magnitude than that of foreign remittance income.[1] A plausible explanation is that only affluent or wealthy families can afford foreign migration; the foreign migrant is not under pressure to remit income for family members back in their home country while the opposite is true of domestic migrant workers. Nonetheless, the findings here underscore the importance of remittance income, in particular, domestic remittance income, and in house prices in Bangladesh.

The total household income (*inchhld*), excluding remittance income, has a positive and significant impact on house prices. Note that the OLS parameter estimate is much lower (0.0003), which indicates that a 1,000 BDT increase in total household income (*inchhld*) increases house prices by about 0.03%, compared to the quantile regression estimates, especially at the 70th and higher quantiles. However, the effect of total household income is greater at higher quantiles, which indicates that housing is a normal luxury good with rising income people in Bangladesh who prefer expensive housing, perhaps even showing a higher willingness to pay for quality of housing (Figure 3, Panel C).

The results in Table 5 reveal that several housing attributes and location determine house prices in Bangladesh. For example, houses connected to the electric grid (*electri*) have higher prices compared to their counterparts. The quantile regression coefficient of *electri* is positive and significant for all quantiles, thus suggesting some important differences across different points in the conditional distribution of house prices in Bangladesh. The magnitude of the coefficient monotonically increases with quantile (see Table 5). Another interesting result in Table 5 is the positive and significant coefficient of sources of water supply to the house. Houses that are connected to a municipal water supply (*water1*) have higher prices. On average, only 8% of the houses in Bangladesh are connected to a municipal or public water supply system; 89% of the houses are connected to a low cost water supply system, a tube well which uses a hand pump. The coefficient on *water1* is positive and significant for most of the quantiles, except for the 10th and 30th quantiles, thus suggesting some important differences across different points in the conditional distribution of housing values; the magnitude of the coefficient monotonically increases with quantile (Table 5). However, it should be

[1] A 1,000 BDT increase in domestic remittance income increases housing prices by 0.2% and 0.3% at the 80th and 90th quantiles.

pointed out that houses with tube wells (*water2*) have a negative impact on house prices. Since a connection to the municipal water supply system requires an initial investment in installing pipes, usually galvanized pipefittings, in places like the kitchen, bathrooms, and in terms of operating expenses, our findings are not surprising. Therefore, houses at the upper price range are likely to have these attributes and wealthier households in Bangladesh are willing to pay extra for such luxuries, which are basic in developed countries. Out findings are consistent with those of Islam et al. (1994) and Singh et al. (2003), who find that people in Bangladesh and Varanasi (India), respectively, are willing to pay more for the city water supply, and a sanitation system.

Substantial economic losses are incurred each year in Bangladesh, and in developing countries in general, as a result of inadequate sanitation. Malpezzi (1996) also notes that improved sanitation facilities are associated with lower rates of mortality and morbidity. Additionally, proper and improved sanitation facilities are capitalized into house prices (Arimah, 1996). In our model, we have included two dummy variables - *sanitation1* and *sanitation2*[2] - to measure the impact of sanitation systems on house prices. Only 11% of the houses in our sample have a concrete sanitary system; however, the average increases with quantile. The coefficient on *sanitation2* is positive and significant for all quantiles presented in Table 5, thus suggesting some important differences across different points in the conditional distribution of housing values; the magnitude of the coefficient monotonically increases with quantile (Table 5). Note that the OLS parameter estimate falls in between the 30^{th} and 50^{th} quantiles. Finally, the results in Table 5, in general, also show that house prices are higher for houses that have: (a) a cement (concrete made) roof, (b) walls made of brick and mortar; and (c) a separate kitchen area.

Finally, the location of the houses has a significant impact on the house prices. Location characteristics that influence house prices include neighborhood characteristics, accessibility, and proximity externalities. About 70% of the houses in our sample are located in rural areas (Table 3). The coefficient on *rural* is negative and significant for OLS and all quantiles, thus suggesting some important differences across different points in the conditional distribution of housing values; the magnitude of the coefficient monotonically increases with quantile (Table 5). It should be pointed out that the estimating of the empirical model by using an OLS method would have yielded a parameter estimate that falls in between the 50^{th} and 70^{th} quantiles. These findings are reinforced with a negative and significant coefficient on the *distance* variable. The results in Table 5 show that as the distance between the location of house within the district and Dhaka capital city increases, the prices of houses fall. Most interestingly, our findings are consistent with those of Ottensmann et al. (2008) and Basu and Thibodeau (1998).

[2] *Sanitation2* refers to the concrete waterproof sanitation (latrine) system that costs more money and is usually inside the house.

7. Conclusions

Asset pricing estimation and analysis, especially in real estate, have been very challenging in both developed and developing countries. However, both housing price and demand for housing attributes (in urban services) in South Asia have received very little attention in the literature and particularly in Bangladesh. However, according to the International Monetary Fund (IMF) (1996), South Asia is very much a central point where trade, manufacturing and accumulation of wealth are taking place at a faster rate than any other part of the world. This paper finds that the impacts of remittances on socioeconomic factors are increasingly changing the landscape of the housing market in Bangladesh. Our results show that remittances directly channeled to household members of migrant workers are significantly improving the livelihood of the urban and rural populations, especially in housing and living conditions, nutrition, education, and healthcare. However, our results also show that remittance impact on the housing sector in Bangladesh has an uneven effect across housing value quantiles upon which the impact of remittances is most protuberant.

Even though it is not a surprise that house prices are rapidly rising in Bangladesh and the government has enacted policies that support housing for all citizens, the effects of remittances highlight the spatial differences in the housing market in Bangladesh. Moreover, the quantile estimation results uncover the presence of significant spatial differences across regions and households at a different position in the housing value distribution. It is important to highlight that even though Dhaka is the densest district in Bangladesh, about 70% of the houses in our sample are located in rural areas and that location of the houses and their characteristics have significant impacts on the house prices, including neighborhood characteristics, accessibility, and proximity externalities. With expanding economic growth, rising population, and significant remittance income to households, the housing market has experienced a consistent rise in Bangladesh and its characteristics are more and more heterogeneous, and prices are hard to measure by using a single mean value regression.

References

Ahmad, S. (2012). Demand for Owner, Renter and Squatter Housing in Urban Bangladesh. Paper presented at 48th Congress of ISOCARP (*the International Society of City and Regional Planners*), Perm, Russia 10-13 September, 2012. Online: http://www.isocarp.net/Data/case_studies/2094.pdf, accessed September 27, 2013.

Arimah, B (1996). Willingness to Pay for Improved Environmental Sanitation in a Nigerian City. *Journal of Environmental Managemen*t 48, 127-138.

Basu, S. and Thibodeau, T. (1998). Analysis of Spatial Autocorrelation in House Prices. *Journal of Real Estate Finance and Economics*.17, 1, 61-85.

Boyle, M.A. and Katherine A.K. (2001). A Survey of House Price Hedonic Studies of the Impact of Environmental Externalities. *Journal of Real Estate Literature,* 9, 117–144.

Buchinsky, M. (1998). Recent Advances in Quantile Regression Models: A Practical Guideline for Empirical Research. *Journal of Human Resources*, 33, 1, 88-126.

Buchinsky, M. (2001). Quantile Regression with Sample Selection: Estimating Women's Return to Education in the U.S. *Empirical Economics*, 26, 87-113.

Deaton, A. (1997). *The Analysis of Household Surveys*. The Johns Hopkins, Baltimore.

Follain, J. and Jimenez, E. (1985). Estimating the Demand for Housing Characteristics: A Survey and Critique. *Regional Science and Urban Economics*, 15, 77-107.

Haines, M.R. and Goodman, A.C. (1992). Housing Demand in the United States in the Late Nineteenth Century: Evidence from the Commissioner of Labor Survey, 1889/1890. *Journal of Urban Economics*, 31, 1, 99-122.

Islam, N., Kitawaki, H. and Rahman, M.H. (1994). Willingness to Pay/Use for Water Supply and Sanitation. Affordable Water Supply And Sanitation, *20th WEDC Conference Colombo, Sri Lanka, 1994* (http://info.lboro.ac.uk/departments/cv/wedc/papers/islam.html - See more at: http://www.jyi.org/issue/valuation-of-clean-water-supply-by-willingness-to-pay-method-in-a-developing-nation-a-case-study-in-calcutta-india/#sthash.gl92erqM.dpuf

Jahan, S. and N. I. Nazem, Eds. (2011). *Urban Future of Bangladesh: Making Cities and Towns Works for All. A Special Publication*. Dhaka, Research and Publication Sub-Committee on behalf of Bangladesh Urban Forum.

Koenker, R. and Bassett, Jr G. (1978). Regression Quantiles. *Econometrica,* 46, 1, 33-50.

Koenker, R. and Hallock, K.F. (2001). Quantile Regression. *Journal of Economic Perspectives,* 15, 4, 143-156.

Lancaster, K.J (1966). A New Approach to Consumer Theory, *Journal of Political Economy*, 74, 3, 132–157.

Löchl, M (2010). Application of Spatial Analysis Methods for Understanding Geographic Variation of Prices, *Ph.D. Thesis, ETH Zurich*.

Malpezzi, S (2002). Hedonic Pricing Models: A Selective and Applied Review, in T. O'Sullivan and K. Gibb (eds.) *Housing Economics and Public Policy*, Blackwell Science, Oxford.

Malpezzi, S. and Mayo, S. (1987). Demand for Housing in Developing Countries: Empirical Estimates from Household Data. *Economic Development and Cultural Change*, 35, 4, 687-721.

Malpezzi, S (1996). Housing Prices, Externalities, and Regulation in U.S. Metropolitan Areas. *Journal of Housing Research,* 7, 2, 209-214.

Mayo, S.K (1981). Theory and Estimation in the Economics of Housing Demand. *Journal of Urban Economics,* 10, 1, 95-116.

Nenova, T. (2010). Expanding Housing Finance to the Underserved in South Asia*: Market Review and Forward Agenda.* Washington D.C.: The International Bank for Reconstruction and Development /The World Bank.

NHA (National Housing Authority) (2013). *National Housing Authority Bangladesh, Ministry of Housing and Public Works.* Dhaka: Grihayan Bhaban. Online: http://www.nha.gov.bd/pdf/organization_bushier.pdf, accessed September 27, 2013.

Noguchi, Y. and Poterba, J.M. (eds.) (1994). *Housing Market in the United States and Japan*, University of Chicago Press, Chicago, IL.

Ottensmann, J., Payton, S. and Man, J. (2008). Urban Location and Housing Prices within Hedonic Model. *Regional Analysis and Policy,* 38, 1, 19-35.

Rosen, S. (1974). Hedonic Prices and Implicit Markets. Product Differentiation in Pure Competition. *Journal of Political Economy*, 82, 1, 34-55.

Sarel, M. (1996). Growth in East Asia What We Can and What We Cannot Infer. IMF.

Singh R, Franceys, R. and Kumar, V. (2003). Water Supply Projects. A Case Study of Varanasi and Chandauli Districts. *The Journal of the Institution of India,* 84.

Sirmans, S., Macpherson, D.A. and Emily N.Z. (2005). The Composition of Hedonic Pricing Models, *Journal of Real Estate Literature*, 13, 3–43.

World Bank. (2012). *Bangladesh: Towards Accelerated, Inclusive and Sustainable Growth- Opportunities and Challenges*, *Volume II, Main Report, June.* Online: <https://openknowledge.worldbank.org/bitstream/handle/10986/12121/67991.pdf?sequence=1>

World Bank, (2013). *World Development Indicators 2013*. Online: http://data.worldbank.org/indicator/AG.LND.ARBL.HA.PC, accessed September 27, 2013.

World Bank (2014). Bangladesh Overview, World Bank country report, retrieved from http://www.worldbank.org/en/country/bangladesh/overview#1

Yamada, Y (1999). Affordability Crises in Housing in Britain and Japan. *Housing Studies*, 14, 1, 99-110.

Zietz, J. and Zietz, E. (2008). Determinants of House Prices: A Quantile Regression Approach. *Journal of Real Estate Finance and Economics* 37, 317-333.