

Estimating the Drivers of Urban Apartment Valuation by Using Hedonic Pricing Models: A Study on Dhaka City

Muhammad Intisar Alam¹ (Corresponding), Mahafizur Rahman Jim², Nawshin Nawar Ullah³

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Abstract

Considering the population and land scarcity of Dhaka city, understanding the accommodation preferences as per the price has become a complex issue. This study has tried to investigate the drivers that shape the valuation of apartments in Dhaka city. To do that, Numerous articles have been studied and the number of bedrooms, bathrooms, balconies, apartment size, land price, the proximity of the city center and green spaces are considered as the predictors. A structured questionnaire was generated and data were obtained from a convenience sample of 265 consumers living in various locations of Dhaka city. The Multiple Regression Analysis was performed to test the research hypotheses where the apartment size, land price, and proximity to green spaces were found as the key predictors and the rest were found to be insignificant. Guidelines for the stakeholders were also provided as per the research outputs. Finally, the limitations of the research and future research avenues have been discussed.

Keywords: Apartments, Valuation, Hedonic Pricing Models.

¹ Associate Professor, Department of Marketing, University of Dhaka, Dhaka-1000, Bangladesh, Mob: +8801819128538, Email: intisar_alam@du.ac.bd

² Department of Marketing, University of Dhaka, Dhaka-1000, Bangladesh, Mob: +8801770226911, Email: jim.mkt.du@gmail.com

³ Department of Marketing, University of Dhaka, Dhaka-1000, Bangladesh

Introduction

With the enhancement of the population, the real estate industry is becoming popular as the need for accommodation is becoming the talk of the town. “Real estate includes buying and selling of properties such as apartments, complexes, multi-family houses, and commercial and industrial infrastructure among others” (NMSC, 2022). According to FINMA, along with the growth of GDP, the housing industry is booming globally. Real estate companies have accumulated worth 9.5 billion U.S. Dollars in the year 2021 and is expected to experience growth of another 4.8 percent by 2030 (Statista Research Department, 2022). Research related to Asian real estate markets has gotten huge attention in the past three decades (Newell, 2020). The importance of Asian economies in recent years has contributed to this expansion in addition to the emergence of real estate as a new academic field (Newell, 2020). The growing Asian economies have attracted investors from all parts of the globe and demand for information and knowledge about these markets has increased (Isabela, 2022).

In the past decade, Bangladesh started becoming a significant player in the global economy (Chowdhury, 2022). Forecasts from many different international organizations predict Bangladesh to become the next frontier in Asia (Babu, 2021). The real estate scenery of Bangladesh has changed significantly, especially in the capital Dhaka city, over the past two decades (Alam, 2018). In the 2000s the city was home to 10,285,000 people which increased to 14,731,000 in 2010 and has flourished to 21,006,000 in 2020 although the percentage annual change has reduced from 4.31% to 3.62% to 3.56% respectively (Macrotrends, 2022). It is considerably a large number of people to accommodate in a city that contains only 306.4 sq. kilometers (Macrotrends, 2022). People who have been residing in Dhaka for more than two generations often are interested in setting their stability in the city by purchasing apartments rather than renting it out for a longer time (Noyon, 2019).

The current Dhaka is occupied by a large number of real estate development companies who sought after landlords to convert the old residences into modern high-rise apartments that can scale from anywhere from seven to fifteen floors (Noyon & Islam, 2022). Investing in real estate is seen as a very profitable option in the ever-growing metropolis of Dhaka (Karim, 2022) but real estate valuation is still a big issue for apartment buyers. With the advancement of technology and the economy, the real estate industry underwent radical change. Additionally, it is found that the dominating factors behind the price of apartments are not the same throughout the world. Consequently, marketers spent a huge amount of assets to determine the key variables behind the pricing of apartments in different regions of the world. Developers face difficulties in setting prices for apartments considering internal and external environmental factors. Overpricing causes apartments to remain unsold and underpricing causes developers to miss profitability. Although Bangladesh has grown economically and Dhaka city is getting more populous, adequate research on house pricing is scarce. Thus, it is evident to pay attention to it and find insightful theories that will aid practitioners in taking necessary actions. Considering the overall economic need researchers tried to identify the determinants of real estate assets valuation of Dhaka city customers.

Through a rigorous literature review, this study tries to identify the most suitable theories and constructs relevant to the study. Based on the theories, the conceptual framework is developed which has performed as a graphical model of the study. The methodology section has explained the research method undertaken and followed throughout the study. The analysis portion explains the research outputs and critical analysis is done in discussions. The shortcomings of the study and guidelines for future researchers to overcome this are discussed at the end.

Literature Review

The literature review section presents the theories underlying this research and potential constructs that may drive the dependent variable, urban apartment valuation. The previous study's findings were also discussed in this portion and hypotheses were developed to measure the impact of the constructs are significant or not.

Hedonic pricing models have been used extensively in the research of real estate markets (Wilhelmsson, 2000). Court's (1939) article is considered by many as the first attempt at hedonic modeling although his work was based on automobiles and not real estate (Wilhelmsson, 2000). Besides, seventeen years before Court's article publishing Haas had used hedonic modeling to estimate the price of land used for farming in the area of Minnesota (Haas, 1922). By the time Hedonic model gained popularity, it was possible to determine how each component adds to the overall worth of an object by breaking it down into its constituent parts and performing an ordinary least square regression analysis (Li & Li, 2017). The hedonic pricing model is used globally to determine which factors are determinants of house prices (Wilhelmsson, 2000; Babawale et al., 2012; Cebula, 2009; Karantonis & Ge, 2007; Li and Li, 2017; Mallick & Mahalik, 2014).

In Nigeria, the number of bathrooms, number of bedrooms, size of the bedrooms, access to pipe-fed water and state of the apartment are found significant factors for apartment pricing (Babawale et al., 2012). On the other hand, In Georgia closeness to city center and a house situated on a busy street is seen to negatively affect the price (Cebula, 2009). Moreover, Karantonis and Ge (2007) found that economic factors such as the income of the household, real interest rate, speculative investment and whether the house construction is complete or not play a significant role in a house pricing in New Zealand. Besides, In China, the supply of houses, foreign investment in the real estate sector and urbanization are all key factors affecting changes in house prices (Li and Li, 2017). Additionally, in India, stock prices, FDI and bank credit availability has a positive effect on house prices while inflation has a negative impact (Mallick and Mahalik, 2014). Moreover, the condition of an apartment plays a key role in house rent (Bashar, 2012). In Bangladesh, both domestic and foreign remittances have a positive impact on housing prices (Mottaleb et al., 2016) but asset valuation considering the hedonic value of the apartment is not well thought out to date.

Hypotheses and Research Framework

Based on the theoretical aspects and previous research findings, 7 factors (number of bedrooms, number of bathrooms, number of balconies, apartment size, land price, proximity to city center and proximity to green spaces) may be hypothesized to measure whether the impact is substantial or not.

The Number of Bedrooms

The number of bedrooms has a positive impact on the real estate market of the city of Savannah and Savannah historic landmark district located in the state of Georgia (Cebula, 2009). Nevertheless, Bedrooms have been seen to have a negative effect on the price of a house (Sirmans et al., 2005). As bedrooms are the primary living space for the residents of a home it may be an important consideration when evaluating a housing property.

H₁: The number of bedrooms has a significant impact on apartment prices.

The Number of Bathrooms

The number of bathrooms has a positive impact on the real estate market of the city of Savannah and Savannah historic landmark district located in the state of Georgia (Cebula, 2009). Unlike other utility features like kitchens or garages that do not vary significantly, the number of bathrooms is much more variable (Hagen, 2005). Thus, this variable was considered an independent variable.

H₂: The number of bathrooms has a significant impact on apartment prices.

The Number of Balconies

Beyond providing ventilation and bringing in more lights, balconies also provide space for residents to garden given sufficient space (Wing Chau et al., 2004). Their versatile nature and the many utilities they provide might mean the number of balconies available may be an important factor in the pricing of homes. The effect balconies have on prices is rarely studied due to the challenge of separating the benefits they provide from the security risks they pose (Wing Chau et al., 2004). However, researchers thought that it is rational to investigate the impact of this factor considering the exceptional nature of the Dhaka-based apartment customers.

H₃: The number of balconies has a significant effect on apartment prices.

Apartment Size

Among the attributes that make up apartment pricing, size is a noteworthy attribute because it involves the analysis of consumption behavior (Li et al., 2014). Among a number of structural variables floor-to-area ratio plays a key role in apartment pricing (He et al., 2010). Thus, researchers thought to investigate the impact of this factor.

H₄: Apartment size has a significant impact on apartment prices.

Land Price

Land prices in Dhaka have increased radically in recent decades and activities of real-estate companies have pushed these prices even higher resulting in higher costs of apartments (Islam et al., 2007). Studies on land prices and housing have indicated the existence of a positive correlation but different opinions have been posed about the precise nature of the relationship between the two (He et al., 2010). Thus, it is evident to take land price as an assumption.

H₅: The land price has a significant impact on apartment prices.

Proximity to the City Center

Housing prices tend to be the highest closest to the city center as demand for housing is greatest in this area (Northam, 1975). Closeness to the city center is found as a determinant factor in a study by Islam et al. (2007). However, determining a city center is difficult for Dhaka since it was separated into two city corporations in 2011 namely, Dhaka North City Corporation (DNCC) and Dhaka South City Corporation (DSCC) (Akharuzzaman, 2016). Nevertheless, researchers thought to investigate the impact of proximity to the city center as it has found a determinant factor behind the apartment valuation.

H₆: Proximity to the city center has a significant effect on apartment prices.

Proximity to Green Spaces

Green spaces in urban areas provide many benefits to residents of a city such as aesthetics and recreation and people are willing to pay premium prices for housing that can enjoy the benefits of these green spaces (Liebelt et al., 2019). However, green spaces in Dhaka are very limited with only 2% area that can be classified as healthy green space (Nawar et al., 2022). Thus, it is evident whether the proximity to green spaces has a significant impact or not.

H₇: Proximity to green spaces has a significant effect on apartment prices.

Table 1: Hypothesis Summary

Hypothesis	Predictors	Description
1	Number of Bedrooms	The number of bedrooms has a significant impact on apartment prices.
2	Number of Bathrooms	The number of bathrooms has a significant impact on apartment prices.
3	Number of Balconies	The number of balconies has a significant effect on apartment prices.
4	Apartment Size	Apartment size has a significant impact on apartment prices.
5	Land Price	The land price has a significant impact on apartment prices.
6	Proximity to City Center	Proximity to the city center has a significant effect on apartment prices.

Research Framework

Using the above-mentioned seven independent variables that may affect apartment prices in Dhaka the theoretical framework of the study has been constructed. The framework is shown in Figure 1:

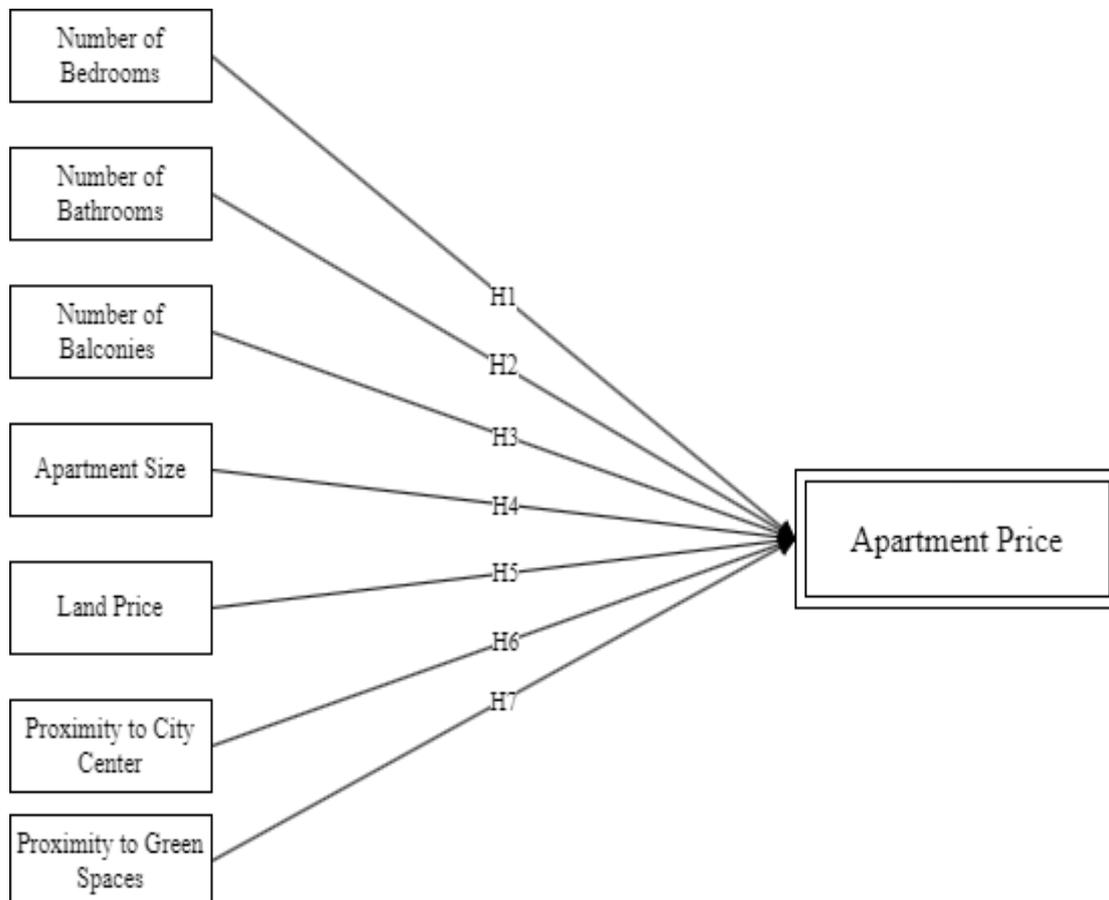


Figure 1: Conceptual Framework

Research Methodology

Sampling and Data Collection

The total population for this study includes all of the existing apartments in Dhaka city. Due to the difficulty in obtaining data about this population, the researcher only used data for apartments that were advertised for sale on a public domain. Convenience sampling was used in this research to collect the data. The total number of housing units in Dhaka in 2022 is around 2,319,207 (BBS, 2022). For the determination of sample size several approaches could have been taken. Criteria that need to be taken into account besides purpose of study and population size when measuring sample size are the mandatory level of accuracy, the confidence or risk level, and the degree of variability in the characteristics being obtained (Jim & Alam, 2023).

For determining the minimum sample size required to conduct the research, scholars have come up with numerous methods for different types of calculations. Khamis and Kepler (2010) provided $20+5k$ formula for conducting multiple regression where k is denoted as the number of explanatory variables included in the model. Here, 7 predictors are used to determine the apartment price. Therefore, the minimum sample required for the calculations is $(20+5*7) = 55$ responses. Here, Researchers conveniently collected 265 responses which satisfies the minimum requirements for the calculations. Because of the generalizability and representativeness of the population, researchers collected more than 4 times more responses than the minimum required responses for calculation covering all the areas of Dhaka's north and south city corporation area.

Data Analysis Tools and Methods

The independent variables are selected as per the literature review which leads the researcher to use the hedonic pricing model. The hypotheses are developed and tested by using a 5% significant level. All the data are collected and analyzed by using Microsoft word, Microsoft excel, and IBM SPSS 23.

Analysis and Findings

The regression model aims at explaining the dependence of one variable on other and in this case is being used to see the dependence of housing prices on the regressors: number of beds, number of bathrooms, apartment size, number of balconies, land price, proximity to city center and proximity to green spaces.

Table 2: Coefficients

Model	Unstandardized Coefficients		Standard ized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	.505	19.085		.026	.979	-37.078	38.088
bedrooms	-.798	6.202	-.008	-.129	.898	-13.010	11.415
number of bathrooms	6.409	7.127	.065	.899	.369	-7.625	20.444
1 Apartment size in sq feet	.058	.006	.570	9.758	.000	.046	.070
number of balconies	7.418	4.732	.062	1.568	.118	-1.901	16.737
proximity to city center	-.008	.009	-.025	-.823	.411	-.026	.011

proximity to green space	-.020	.005	-.129	-	.000	-.031	-.009
land price per katha	.181	.021	.292	8.831	.000	.141	.221

From the regression coefficients, it can be concluded that 1 unit increase in the number of bedrooms, proximity to city center and proximity to green spaces exhibit a decrease in the price of an apartment. The average decrease in apartment price (in 1,00,000) amounts to a 0.79, 0.008 and 0.02 respectively, holding all other covariates constant.

On the contrary, the model also suggests that for a 1 unit increase in the number of bathrooms, apartment size, number of balconies and land price, there is an average increase in the price of an apartment. For 1 unit increase in the number of bathrooms, the average increase in apartment price (in 1,00,000) is 6.41; for 1 sq. ft. increase in apartment size, the average increase in apartment price (in 1,00,000) is 0.058; for 1 unit increase in the number of balconies, the average increase in apartment price (in 1,00,000) is 7.42; and for 1 unit increase in land price the average increase in apartment price (in 1,00,000) is 0.18, holding all other covariates constant in each case.

Table 3: ANOVA

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	2840798.657	7	405828.380	157.159	.000 ^b
1 Residual	663647.352	257	2582.285		
Total	3504446.009	264			

After calculating the test of significance, we arrive at a calculated F value of 157.16 and a corresponding p-value of .000 at a 5% significance level. The p-value is less than 0.05, which indicates that among the drivers minimum of one predictor has an impact on the apartment valuation.

Table 4: Summary of the Model

Model	R	R Square	R Square (Adjusted)	Std. Error of the Estimate
1	.900 ^a	.811	.805	50.816

The value of multiple correlation (R) is .900 or 90% which is more than 75%. Thus, it can be said that there is a significant positive relation between the drivers and the dependent variable. The coefficient of determination for this regression model stands at 0.81 as exhibited by the R-square value of 0.81. This indicates that 81% of the variation in apartment prices can be explained by the explanatory variables in the model.

Table 5: Summary of the Results

Hypothesis	Variable	Regression Coefficient	P-value	Result
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1	Number of Bedrooms	-0.79	0.898	Rejected
2	Number of Bathrooms	6.41	0.369	Rejected
3	Apartment Size	0.058	0.000	Accepted
4	Number of Balconies	7.42	0.118	Rejected
5	Land Price	0.181	0.000	Accepted
6	Proximity to city center	-0.008	0.411	Rejected
7	Proximity to green spaces	-0.02	0.000	Accepted

The above table shows that among the seven predictors, Apartment size, Land price, Proximity to green spaces have a significant relationship with the dependent variable, price. Alternatively, Number of bedrooms, Number of bathrooms, Number of balconies, Proximity to city center do not have any significant association with the valuation of apartment price because the p-value of these four predictors is larger than the significance level 0.05 or 5%. Thus, the H1, H2, H4, H6 are rejected. A summary of the findings is presented in Figure 2 below:

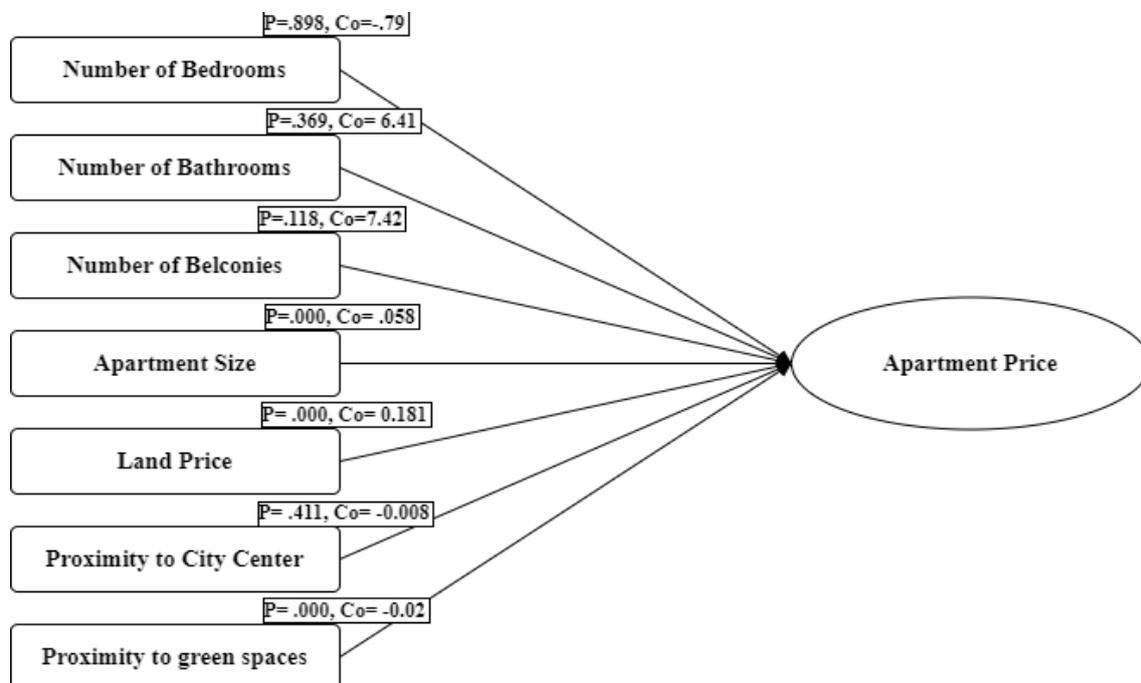


Figure 2: Summary of the Research Findings

Discussions and Implications for Practitioners

According to He et al. (2010), The driving force that affects most for residential housing prices in Beijing is apartment size which has also been found one of the key drivers of apartment valuation of Dhaka city. These two cities share many additional traits and are regarded as two of the world's most densely populated cities. (Cutmore, 2024). Besides, Islam et al. (2007) concluded that the land price in Dhaka has increased radically because of the intensified activities of real estate companies. This study has also found Land price as a determinant factor behind the apartment valuation of Dhaka city. Moreover, It was studied that Dhaka city is facilitated with only 2% healthy green spaces (Nawar et al., 2022) and people are willing to pay premium prices for aesthetic green views (Libbelt et al., 2019). Aligning with the prior research, this study found proximity to green spaces as a key factor for apartment valuation of Dhaka city.

Real estate developers often spend substantial amounts of money to add luxury features to apartments but this research shows that basic requirements such as the size of an apartment, premium land areas and closeness to nature are factors that are most important when it comes to apartment pricing. These three factors which are significant are in limited supply in a densely populated urban area such as Dhaka. A city with a large population living in a relatively small area consumers have to pay the highest for living space. Also, the significant positive relationship with the land price is an indication that people are willing to pay more to live in certain neighborhoods compared to others which means that real estate developers should attempt to identify areas that Dhaka city is growing into and invest in acquiring properties before its prices start rising which will lead to maximizing their profits. Furthermore, the significant negative coefficient of closeness to green spaces and apartment prices might seem a little mysterious at first. But a deeper look often reveals that green spaces in Dhaka are often associated with certain despicable activities. Also, there is a tendency among its citizens to pollute green spaces. Moreover, Closeness to green means closeness to nature and fresh air. But the air quality of Dhaka city is one of the worst in the world (Begum & Hopke, 2018). Thus, ensuring proper cleanliness of those areas and air quality are also sometimes a challenge to the property owners. Consequently, when real estate developers are developing near green areas, they should ensure there exists proper security and garbage management in such areas.

Limitations and Future Research Directions

As discussed earlier, non-probability sampling is the only method used to obtain primary data from a handy sample in Dhaka city. As a result, the results cannot be applied to other areas of Bangladesh. By considering probability sampling, more research may be done on a bigger sample of respondents that cover a broader geographic region. In addition, this research only included seven variables. Many other physical characteristics such as the age of the building, proximity to amenities, neighborhood walkability scores, etc. may have an impact on the price valuation. Future research could focus on such areas to gain more insights about the influencing factors behind apartment pricing. Furthermore, the population density and the number of apartments are different from area to area. Therefore, a quota sampling technique could bring more representative and insightful results. Thus, researchers should consider this issue in future research to ensure more representative sample.

Conclusions

This study was undertaken to gain insight into the influencing factors behind real estate apartment pricing in Dhaka city and it was found that apartment size, land price and proximity to green spaces are significant in apartment pricing. On the other hand, factors such as number of bedrooms, number of bathrooms, number of balconies and proximity to city center were found not to be significant in this study. In conclusion, this study has provided valuable insights into the factors contributing to the apartment prices in Dhaka city which may help practitioners to take rational decisions and enable future researchers to get a better understanding of the real estate markets specifically apartment markets in Bangladesh. Institutions like Bay, Rupayan, Sheltech, Concord, Bashundhara, etc. are considered conglomerates in this industry and may take aid from this research and expand the market competitiveness. By taking in account of the research findings, real estate competitors may gain more profit by strategic planning and pricing of the apartment based on apartment size, proximity to green spaces and land price.

References

- Akharuzzaman, M. (2016). Urbanization and Environmental Concept of Dhaka City Bangladesh. In *Urban Study Seminar*. Fukuoka Asian Urban Research Centre, Fukuoka, Japan. Available online: http://urc.or.jp/wpcontent/uploads/2014/06/0612_bangla_2.pdf (accessed on 31 October 2020).
- Alam, M. J. (2018). Rapid urbanization and changing land values in mega cities: Implications for housing development projects in Dhaka, Bangladesh. *Bandung: Journal of the Global South*, 5(1), 1–19. <https://doi.org/10.1186/s40728-018-0046-0>
- Babu, M. U. (2021, December 28). Asian frontier capital stands firm on Bangladesh Equities. *The Business Standard*. Retrieved November 5, 2022, from <https://www.tbsnews.net/economy/stocks/asian-frontier-capital-stands-firm-bangladesh-equities-350116>
- Babawale, G.K., Koleoso, H.A., & Otegbulu, A.C., (2012). A Hedonic Model for Apartment Rentals in Ikeja Area of Lagos Metropolis. *Mediterranean Journal of Social Sciences*, 3(3), 109–120.
- Bangladesh Bureau of Statistics, & BBS, ., Population and Housing Census 2021–102 (2022). Dhaka, Dhaka; BBS.
- Bashar, T., (2012). Structural, spatial and other attributes of house price: The case of Bangladesh. *Journal of Bangladesh Institute of Planners*, 5.
- Begum, B. A., & Hopke, P. K. (2018). Ambient air quality in Dhaka Bangladesh over two decades: Impacts of policy on air quality. *Aerosol and Air Quality Research*, 18(7), 1910-1920.
- Cebula, R. J. (2009). The hedonic pricing model applied to the housing market of the City of Savannah and its Savannah Historic Landmark District. *Review of Regional Studies*, 39(1). <https://doi.org/10.52324/001c.8197>
- Chowdhury, J. (2022, February 16). *Why Bangladesh is being called 'south asian economic miracle' – oped*. Eurasia Review. Retrieved November 5, 2022, from <https://www.eurasiareview.com/16022022-why-bangladesh-is-being-called-south-asian-economic-miracle-oped/>
- Cutmore, J. (2024) ‘Top 10: The largest cities in the world’, *BBC Science Focus*, 4 January. Available at: <https://www.sciencefocus.com/planet-earth/in-pictures-the-largest-cities-in-the-world> (Accessed: 06 February 2024).
- FINMA. (n.d.). The link between GDP growth and the real estate market. ASIAGREEN. Retrieved October 26, 2022, from <https://www.asiagreen.com/en/news-insights/the-link-between-gdp-growth-and-the-real-estate-market>

- Haas, G.C., (1922). *A Statistical Analysis of Farm Sales in Blue Earth County, Minnesota, as a Basis for Farm Land Appraisal*. University of Minnesota Digital Conservancy. Available at: <https://hdl.handle.net/11299/179691>
- Hagen, D. (2005). Real Estate Prices: City Premiums and Neighborhood Effects. *Undergraduate Economic Review*, 1(1). <https://digitalcommons.iwu.edu/uer/vol1/iss1/9>
- He, C., Wang, Z., Guo, H., Sheng, H., Zhou, R., & Yang, Y. (2010). Driving forces analysis for residential housing price in Beijing. *Procedia Environmental Sciences*, 2, 925–936. <https://doi.org/10.1016/j.proenv.2010.10.104>
- Isabela. (2022, May 12). *Asia Pacific real estate investment surges 20% in Q1 2022: JLL Research*. RE Talk Asia. Retrieved November 5, 2022, from <https://www.retalkasia.com/news/2022/05/12/asia-pacific-real-estate-investment-surges-20-q1-2022-jll-research/1652324564>
- Islam, I., Mitra, S. K., Shohag, A. N., & Rahman, M. A. (2007). Land Price in Dhaka City: Distribution, Characteristics and Trend of Changes. In *Urbanization in bangladesh: Patterns, issues and approaches to planning* (pp. 25–35). essay, Bangladesh Institute of Planners.
- Jim, M. R., & Alam, M. I. (2023). Factors affecting adoption of TikTok among students in The Dhaka City Area. *Business Review*, 18(2), 51-69.
- Karantonis, A., & Ge, X.J., (2007). An empirical study of the determinants of Sydney's dwelling price. *Pacific Rim Property Research Journal*, 13(4), 493–509.
- Karim, R. (2022, September 21). *Foreign investors put tk30kcr in real estate – more to come*. The Business Standard. Retrieved November 13, 2022, from <https://www.tbsnews.net/economy/foreign-investors-put-tk30kcr-real-estate-more-come-500170>
- Khamis, H. J., & Kepler, M. (2010). Sample size in multiple regression: 20+ 5k. *Journal of Applied Statistical Science*, 17(4), 505.
- Liebelt, V., Bartke, S., & Schwarz, N. (2019). Urban Green Spaces and housing prices: An alternative perspective. *Sustainability*, 11(13), 3707. <https://doi.org/10.3390/su11133707>
- Li, L. H., Cheung, D., & Sun, H. (2014). Does size matter? the dynamics of housing sizes and prices in Hong Kong. *Journal of Housing and the Built Environment*, 30(1), 109–124. <https://doi.org/10.1007/s10901-014-9398-1>
- Li, T., & Li, P. (2017). Analysis on real estate price influence factors in China based on the multivariate linear regression model. *ICCREM* 2016. <https://doi.org/10.1061/9780784480274.122>

- MacroTrends. (2022). Dhaka, Bangladesh Metro Area Population 1950-2022. MacroTrends. Retrieved November 13, 2022, from <https://www.macrotrends.net/cities/20119/dhaka/population>
- Mallick, H., & Mahalik, M. K. (2014). Factors determining regional housing prices: Evidence from major cities in India. *Journal of Property Research*, 32(2), 123–146. <https://doi.org/10.1080/09599916.2014.963642>
- Mottaleb, K. A., Sene, S. O., & Mishra, A. K., (2016). Impact of Remittance Income on House Prices: Evidence from Bangladesh. *International Real Estate Review*, 19(1), 98-119.
- Nawar, N., Sorker, R., Chowdhury, F. J., & Mostafizur Rahman, M. (2022). Present status and historical changes of urban green space in Dhaka City, Bangladesh: A Remote Sensing Driven Approach. *Environmental Challenges*, 6, 100425. <https://doi.org/10.1016/j.envc.2021.100425>
- Newell, G. (2020). The need for more research on the Asian Real Estate Markets. *Journal of Property Investment & Finance*, 39(1), 3–8. <https://doi.org/10.1108/jpif-05-2020-0059>
- Northam, R. W. (1975). *Urban geography*. Wiley.
- Noyon, A. U., & Islam, M. J. (2022, October 3). *Up to 2700% land price hike in two decades makes owning home in Dhaka elusive*. The Business Standard. Retrieved November 13, 2022, from <https://www.tbsnews.net/economy/2700-land-price-hike-two-decades-makes-owning-home-dhaka-elusive-507510>
- Noyon, A. U. (2019, December 26). *Dream of owning a home still elusive for many*. The Business Standard. Retrieved November 13, 2022, from <https://www.tbsnews.net/bangladesh/dream-owning-home-still-elusive-many>
- Sirmans, S., Macpherson, D., & Zietz, E. (2005). The composition of hedonic pricing models. *Journal of Real Estate Literature*, 13(1), 1–44. <https://doi.org/10.1080/10835547.2005.12090154>
- Statista Research Department, A. (2022, August 15). *Real estate market size 2030*. Statista. Retrieved November 5, 2022, from <https://www.statista.com/statistics/1289905/global-real-estate-market-size/#:~:text=The%20revenue%20of%20real%20estate,report%20by%20Next%20M ove%20Strategy>.
- Wilhelmsson, M. (2000). The impact of traffic noise on the values of single-family houses. *Journal of Environmental Planning and Management*, 43(6), 799–815. <https://doi.org/10.1080/09640560020001692>
- Wing Chau, K., Kei Wong, S., & Yim Yiu, C. (2004). The value of the provision of a balcony in apartments in Hong Kong. *Property Management*, 22(3), 250–264. <https://doi.org/10.1108/02637470410545020>