INTERNATIONAL MONETARY FUND

BANGLADESH

TECHNICAL ASSISTANCE REPORT—RESIDENTIAL PROPERTY PRICE INDEX MISSION

August 2023

This Technical Assistance report on Bangladesh was prepared by a staff team of the International Monetary Fund. It is based on the information available at the time it was completed in March 2023.

Copies of this report are available to the public from

International Monetary Fund • Publication Services
PO Box 92780 • Washington, D.C. 20090
Telephone: (202) 623-7430 • Fax: (202) 623-7201
E-mail: publications@imf.org Web: http://www.imf.org
Price: $18.00 per printed copy

**International Monetary Fund
Washington, D.C.**

TECHNICAL REPORT

BANGLADESH
Report on Residential Property Price Index (RPPI) Mission (February 26–March 2, 2023

MARCH 2023

Prepared By
Barra Casey

Authoring Department:

Statistics Department

DISCLAIMER

Table of Contents

Acronyms and Abbreviations

BB   Bangladesh Bank

D4D   Data for Decisions Trust Fund

DBH   Delta Brac Housing Finance Corporation Ltd

RPPI   Residential Property Price Index

TA   Technical Assistance

Summary of Mission Outcomes and Priority Recommendations

1.   **A technical assistance mission was conducted from February 26 to March 2, 2023, to assist the Bangladesh Bank with the ongoing development of a Residential Property Price Index (RPPI).** The mission was funded by the Data for Decisions (D4D) Fund. A previous RPPI mission visited Bangladesh in December 2019 and the Bangladesh Bank have been working on developing the RPPI since 2017. The mission completed the following tasks: (i) increased the capacity and knowledge of staff on the methods for RPPI compilation, (ii) conducted an analysis of existing and potential data sources for property price statistics, (iii) identified improvements to the existing compilation methods, (iv) identified impediments to the implementation of the new reporting template for financial institutions and non-banks, and (v) recommended further improvements in the medium to long-term.

2.   **The BB is strongly committed to developing a publicly available RPPI for Bangladesh.** Reliable property price indexes and other indicators of real estate markets are essential for the assessment of developments and risks in property markets and understanding the linkages between property markets and financial soundness, as well as to IMF surveillance.

3.   **The authorities should compile an experimental RPPI for Dhaka using a single preferred method that follows international best practice.** The dataset currently available to BB is from Delta Brac Housing Finance Corporation Ltd (DBH). While the sample is limited to a single institution, the data covers a long time period (1998 to the present) with over 42,000 observations in total. The BB have compiled RPPIs, which are disseminated internally only, from this dataset using various different methods e.g., simple means and medians to hedonic methods. The BB requested advice from the IMF on the technical aspects of compilation.

4.   **The BB should implement the recommended improvements to the compilation methods for the experimental RPPI.** There include: (i) the use of regional stratification for the sample, (ii) the application of annually updated expenditure weights, (iii) the implementation of outlier and error detection by strata and quarter, (iv) the use of the rolling window time-dummy hedonic method and (v) the application of an updated model specification using floor area and location as the explanatory variables. The improved methods can be incorporated into the existing R code in the BB.

5.   **The BB should consider publishing the experimental RPPI on their website along with the sub-indices for the four regional strata.** Currently, the price indices compiled by the BB are disseminated internally. However, the benefits to users from wider publication of the experimental RPPI (with the improvements implemented) would be significant. In addition, the quality of the RPPI will be improved as the data from the new reporting template becomes available. The authorities should take a transparent approach by publishing accompanying metadata and methodology documents.

6.   **The authorities should provide additional human resources to the RPPI team for data collection, respondent management and data cleaning.** The response rate has been low for the new reporting template (see Appendix A). The impediments identified include the voluntary nature of the pilot survey and the staff resources assigned in BB. It is recommended to make the new reporting template mandatory and provide additional human resources to the RPPI team.

7.   **In the medium to long-term, the geographical coverage of the RPPI can be expanded to include areas adjacent to Dhaka and other parts of Bangladesh.** The new data collection from

financial institutions and non-banks will allow the experimental RPPI to be improved in the coming years. One area for development is expanding the geographical coverage. This can be achieved by adding additional strata to the aggregation.

8.   **The additional variables collected on the new reporting template can be used to improve the stratification and model specification.** There are 42 variables on the new reporting template. Many of the location and property attributes can be used to provide better mix-adjustment by updating the stratification and adding additional variables to the regression models. Comprehensive testing of new methods should be applied before implementation.

TABLE 1. Priority Recommendations

Target Date	Priority Recommendation	Responsible Institution
Sep 2023	The BB should implement the recommended improvements to the compilation methods for the experimental RPPI using the DBH dataset	Bangladesh Bank
Oct 2023	The BB should consider publishing the experimental RPPI along with the sub-indices for the four regional strata	Bangladesh Bank
Dec 2023	The BB should make the new reporting template mandatory and provide additional human resources for data collection, respondent management and data cleaning.	Bangladesh Bank

9.   **Further details on the priority recommendations and the related actions/milestones can be found in the action plan under Detailed Technical Assessment and Recommendations.**

Section I. Detailed Technical Assessment and Recommendations

TABLE 2. Action Plan

Priority	Action/Milestone	Target Completion Date
Topic: Improved compilation methods for the experimental RPPI		
M	Carry out a detailed visual examination of the DBH dataset	Apr 30, 2023
M	Limit the scope of the index to dwellings in the city of Dhaka for the period from Q1 2007	Apr 30, 2023
M	Use four regional strata within Dhaka	Apr 30, 2023
M	Use expenditure weights (i.e., flow weights) for the strata	May 31,2023
M	Implement a system for outlier and error detection by quarter and strata, with reference to the floor area variable in particular	May 31, 2023
M	Use the rolling window time-dummy approach for quality adjustment within strata	Jun 30, 2023
M	Combine categories for location before including the variable in the models for the regional strata	Jul 31,2023
M	Finalize the specifications of the models e.g., whether or not to take log of floor area	Jul 31, 2023
M	Use an annually chained Laspeyres-type aggregation formula to calculate the headline RPPI	Aug 31, 2023
M	Update the R code to implement the improvements to the compilation methods	Sep 30, 2023
Topic: Publication of the experimental RPPI		
M	Consider publishing the experimental RPPI on the BB website along with the sub-indices for the four regional strata	Oct 31, 2023
M	Apply data smoothing to the indices as required	Nov 30, 2023
M	Draft a detailed methodological document	Dec 31, 2023
Topic: Data collection using the new reporting template		
H	Provide additional human resources for data collection, respondent management and data cleaning.	Sep 30, 2023
H	Provide training for new staff	Nov 30, 2023
H	Use targeted respondent management based on the market share of each financial institution and non-bank.	Nov 30, 2023
H	Make the new reporting template mandatory	Dec 31, 2023

A. INTRODUCTION

10.   A TA mission was conducted from February 26 to March 2, 2023, to assist the Bangladesh Bank (BB) with the ongoing development of their Residential Property Price Index (RPPI). The mission was conducted under the auspices of the Data for Decisions (D4D) Trust Fund. A previous RPPI mission visited Bangladesh in December 2019 and the BB have been working on developing the RPPI since 2017.

11.   A pre-mission meeting was held on October 18, 2022, attended by officials from the BB, the mission team, and the local IMF Resident Representative. The objectives for the mission were discussed and agreed. The BB also shared microdata and other related metadata to allow for advanced data analysis and preparation for the mission. This was very helpful for the success of the mission and ensured that the time spent on-site at the offices of the BB could be used as efficiently as possible.

12.   There was a focus on increasing the capacity and knowledge of staff on the methods for RPPI compilation. Due to staff turnover at the BB, the authorities requested that the mission provide training on all aspects of RPPI compilation. There are currently three members of the RPPI team, all of whom have joined recently. The RPPI team are supported by staff from other departments with more experience of RPPI compilation. The on-site meetings at BB were attended by approximately 20 staff to ensure wide dissemination of knowledge.

13.   The mission and the BB will continue to collaborate remotely as necessary as the authorities work towards finalizing an experimental RPPI. The mission will continue to support the BB as required as the recommendations are being implemented.

B. DATA SOURCES FOR THE RPPI

14.   Administrative data on property transfers in Bangladesh are unsuited as source data for the RPPI. There is a lack of acceptance among stakeholders about the accuracy of declared prices recorded for the purposes of taxation and property registration. Furthermore, administrative data sources are not accessible to the BB. In particular, the system for property registration has not yet been digitalized in a central database. In addition, there is no agreed mechanism for data sharing between the BB and the other public agencies.

15.   Currently, the BB receives quarterly data from Delta Brac Housing Finance Corporation, ltd (DBH) on home loans. DBH is a financial institution that specializes in housing loans. The DBH dataset contains details on (i) the date of disbursement of the loan, (ii) the valuation price, (iii) the size in square feet of the dwelling and (iv) the location of the dwelling. Data is available since 1998 with over 42,000 observations in total until Q2 2022. Experimental indices have been compiled by BB staff with various compilation methods from simple means and medians to hedonic methods. The mission focused on using this dataset to compile an experimental RPPI for Dhaka using a single preferred method that follows international best practice.

16.   While transaction prices remain the target price for the compilation of a RPPI, valuation prices can be used as a proxy for transaction prices. The authorities are aware of the challenges of using valuation prices. These include the tendency for valuation prices to lag transaction prices and the potential for the evolution of valuation prices to deviate from transaction prices over time.

17.   In January 2022, the BB initiated a pilot project with eight financial institutions and non-banks using a new reporting template to collect more detailed information on home loans. The

42 variables collected on the new reporting template are outlined in Appendix A. A robust database and data collection solution has already been developed by the RPPI team in BB using MS Access. Over time, the expanded data collection will (i) increase the sample of property transactions e.g., areas outside Dhaka and (ii) provide more details on the location and characteristics of the properties. This will allow the authorities to compile a higher quality RPPI.

18.   The authorities should provide additional human resources to the RPPI team for data collection, respondent management and data cleaning. The response rate for the financial institutions and non-banks using the new reporting template has been low. The impediments identified include the voluntary nature of the pilot survey and the staff resources assigned in BB. It is recommended to provide additional human resources in the RPPI team and make the new reporting template mandatory. This work is very time consuming and requires more than the existing three staff in the RPPI team. To ensure the efficient use of resources, it is recommended to use targeted respondent management based on the market share of each individual financial institution or non-bank. Market share can be calculated as the individual proportions of the overall value of properties transacted over a 12-month period, updated regularly. Sufficient training should be provided to new staff before making the new reporting template mandatory.

19.   In the medium to long term, the authorities should explore the potential of listings data from property websites to expand the coverage of property price indicators to include land and commercial property. The mission examined a number of websites (e.g., www.bproperty.com) where properties are advertised in Bangladesh. As well as containing extensive listings of residential property, these websites also had listings for land and commercial property. After the development of the RPPI, it is recommended to explore the potential of listings data to expand the scope of the property information available to BB. The information from the websites can be collected via webscraping or directly from the owners of the websites.

Recommended Actions:

- Use the DBH dataset to compile an experimental RPPI for Dhaka using a single preferred method that follows international best practice.
- Use valuation prices for the compilation of the index while being cognizant of the potential downsides.
- Make the new reporting template mandatory
- Provide additional human resources for data collection, respondent management and data cleaning.
- Use targeted respondent management based on the market share of each financial institution and non-bank.
- In the medium to long term, explore the potential of listings data from property websites to expand the coverage of property price indicators to include land and commercial property.

C.   METHODS FOR COMPILATION

20.   A visual examination of the DBH dataset was carried out. The mission created a series of graphs (e.g., frequency charts, histograms, and box & whisker plots) displaying the distribution of variables and to examine correlations and trends. This was an important first step to gain a better understanding of the data. A similar approach should be used with the data collected from the new reporting template.

21.   The BB have developed property price indices using the DBH dataset. BB staff have developed 10 price indices using various methods from simple means and medians to hedonic regressions such as the imputation approach and time dummy method. The focus of the mission was to

refine the methods used and compile a headline RPPI using a single approach that follows international best practice.

22.   The BB should compile an experimental RPPI for the city of Dhaka using data from Q1 2007. The number of observations for areas outside Dhaka and for periods before Q1 2007 is low and may not be a good representation of the property market in these regions / periods. Appendix C contains graphs with the number of observations in each quarter and the proportion of observations within Dhaka.

23.   The sample was stratified into four strata based on a regional decomposition in Dhaka. There was a detailed discussion on how to stratify the sample and a regional breakdown was preferred using the location variable in the DBH dataset. Key constraints include the number of observations and the lack of variables for stratification. A map of the proposed four strata is presented in Appendix B. The authorities should calculate an experimental index using these four strata initially and assess the volatility of the resulting sub-indices and headline index. It may be required to revisit the stratification if the indices are too volatile. The BB can investigate if a more detailed stratification is possible in future when the new reporting template is fully implemented.

24.   Expenditure weights should be used for the strata to compile an overall RPPI for Dhaka. The BB was using the number of observations for weighting purposes in their existing methods. This is not the correct approach. Expenditure weights (i.e., flow weights) can be calculated by summing the price information within each strata for a 12-month period. Appendix B presents the difference between the weights calculated using expenditures and number of observations for the year 2019. The expenditure weight for stratum 1, which contains the relatively more affluent areas of Gulshan and Dhanmondi, is 37.6 percent while the stratum contains 26.5 percent of total observations. In contrast, stratum 2 contains the most observations at 26.9 percent, while the expenditure weight is 17.4 percent.

25.   The BB should implement a system for outlier and error detection by strata and quarter. The outliers should also be checked regularly to ensure no market segment is being systematically excluded. A visual inspection of the floor area variable in the DBH dataset shows the number of outliers increased significantly from 2017. Appendix C presents the distribution of the log of the floor area by quarter. The authorities should investigate with the data providers the reason for the increase in the number of outliers. It was recommended that the authorities treat the floor area variable using an approach based on the interquartile range. The mission explored different thresholds that can be used. It was also recommended to use Cooke's Distance as part of the hedonic regression.

26.   The hedonic regression method used should be the rolling window time-dummy approach. Due to the low number of observations, the pooling of observations will improve the quality of the models and the stability of the coefficients. The models for dwellings should include adjustments for property-mix based on (i) floor area and (ii) location. Before the location variable is included in the models for the regional strata, detailed locations should be combined to ensure an adequate number of observations in each location category. For example, if there is only one observation in a particular location, this observation should be combined into another similar location category. The location variable provides good explanatory power in the models; therefore, a balance should be found between maintaining the detail and combining the location categories. Combining categories is most important for Strata 1 and Strata 4, while some combining can also be carried out for Strata 3. There are limited options for combining categories for Strata 2, as most properties are in Mirpur with no further detail provided.

27.   Both semi-log and log-log models were examined in response to the positive distribution of prices and in line with common practice for RPPI compilation internationally. Experimental

models were run in two stages, the first stage identified outlier observations using Cook's Distance and the second stage reran the models without outliers. Typically, around 5 to 10 percent of observations were identified as outliers. The regression models generally showed high explanatory power, and the explanatory variables were statistically significant and in line with a priori expectations (in respect of both sign and slope) over time. Sample regression diagnostics are presented for Stratum 3 in Appendix D. Staff should complete testing of alternative models. For example, the decision on whether to include the log of floor area in the model should be examined further. A key criterion for this decision is to analyze the stability of the coefficients over time.

28.   The BB should use an annually chained Laspeyres-type aggregation formula to calculate the headline RPPI. Using annually updated weights ensure that the weights remain representative of the structure of property transactions.

29.   The technical aspects of index compilation and aggregation were presented during the mission. There were varying levels of experience among the participants at the meetings. Therefore, detailed information was presented on specifying the models, interpreting the results of the regressions, calculating the price indices from the time-dummy coefficients and aggregated the sub-indices using annually updated weights. While the BB already had R code for the calculation of their experimental indices, additional R code was provided to assist with the required improvements to the compilation methods. It is intention of BB to continue to use R code for RPPI compilation.

Recommended Actions:

- Carry out a detailed visual examination of the DBH dataset.
- Limit the scope of the index to dwellings in the city of Dhaka for the period from Q1 2007.
- Use four regional strata within Dhaka and assess the volatility of the resulting sub-indices and headline index.
- Use expenditure weights (i.e., flow weights) for the strata.
- Implement a system for outlier and error detection by quarter and strata, with reference to the floor area variable in particular.
- Use the rolling window time-dummy approach for quality adjustment within strata.
- Combine categories for location before including the variable in the models for the regional strata
- Finalize the specifications of the models e.g., whether or not to take log of floor area.
- Use an annually chained Laspeyres-type aggregation formula to calculate the headline RPPI.
- Update the R code to implement the improvements to the compilation methods.

D. DISSEMINATION

30.   The BB should consider publishing the experimental RPPI on their website along with the sub-indices for the four regional strata. Currently, the price indices compiled by the BB are disseminated internally. However, the benefits to users from wider publication of the RPPI would be significant. The BB are concerned that the index may not be representative of the property market in Dhaka. However, if the authorities are transparent in their approach by publishing accompanying metadata and methodology documents, then this will mitigate the risks. In addition, the quality of the RPPI will be improved as the data from the new reporting template becomes available. The BB should get agreement from DBH in advance of wider publication and provide assurance that the confidentiality of the data will be maintained.

31.   The experimental RPPI and the sub-indices may benefit from smoothing. If the price indices suffer from volatility, as is common with RPPIs, then a method for smoothing can be applied. The simplest

method is a two-quarter moving average. Publication of the index should be accompanied by a short note explaining why volatility is present. Alternatively, the BB could decide to publish the headline index but not publish the sub-index for one or more of the strata. If the sub-index for a strata is not published, it should still be included in the calculation of the headline index.

32.   **A detailed methodological document should be drafted.** Regardless of whether the experimental RPPI is published on the BB website or used for internal purposes only, a methodological document is an important step for finalizing each step of the compilation, ensuring transparency for users, and solidifying the knowledge and understanding of BB staff. The mission presented an example of a methodological document from another country.

Recommended Actions:

- Consider publishing the experimental RPPI on the BB website along with the sub-indices for the four regional strata
- The experimental RPPI and the sub-indices may benefit from smoothing
- A detailed methodological document should be drafted

E. MEDIUM TO LONG-TERM DEVELOPMENT

33.   **Expand the geographical coverage of the RPPI to include areas adjacent to Dhaka and other parts of Bangladesh.** The new data collection from financial institutions and non-banks will allow the experimental RPPI to be improved in the coming years. One area for development is expanding the geographical coverage. This can be achieved by adding additional strata to the aggregation. When expanding the geographic coverage, the BB should consider different options for amending the aggregation and dissemination of the RPPI. One suggestion would be to maintain a long time series for the price index for Dhaka but publish a new aggregate index with wider geographical coverage but with a shorter time series.

34.   **The additional variables collected on the reporting template can be used to improve the stratification and model specification.** There are 42 variables on the new reporting template (see Appendix A). Many of the location and property attributes can be used to provide better mix-adjustment by updating the stratification or adding additional variables to the regression models. Comprehensive testing of new methods should be applied before implementation.

35.   **Expand the coverage of property price indicators to include land and commercial property**. The price developments of land and commercial property have been shown to be important for financial stability in other countries. As already mentioned, listings data is a potential data source for price information on land and commercial property.

Recommended actions:

- Expand the geographical coverage of the RPPI to include areas adjacent to Dhaka and other parts of Bangladesh.
- The additional variables collected on the reporting template can be used to improve the stratification and model specification.
- Expand the coverage of property price indicators to include land and commercial property.

F. OFFICIALS MET DURING THE MISSION

Name	Position	Department	Email
Abdur Rouf Talukder	Governor	Bangladesh Bank	governor@bb.org.bd, rouf.talukder@bb.org.bd
Ahmed Jamal	Deputy Governor	Bangladesh Bank	ahmed.jamal@bb.org.bd
Dr. Md. Habibur Rahman	Chief Economist	Chief Economist's Unit	drhabibur.rahman@bb.org.bd
Md. Julhas Uddin	Executive Director	Research Department	julhas.uddin@bb.org.bd
Dr. Sayera Younus	Director-1	Research Department, (RPPI Wing)	sayera.younus@bb.org.bd
Mst. Nurnaher Begum	Director-6	Research Department	nur.begum@bb.org.bd
Md. Ahsan Ullah	Joint Director	Monetary Policy Department	md.ahsan@bb.org.bd
Sadia Sultana	Joint Director	Monetary Policy Department	sadia.sultana@bb.org.bd
Mohammad Mazharul Islam	Deputy Director (Computer Operation Supervisor)	Monetary Policy Department	mazharul.islam@bb.org.bd
Ms. Zahira Hasin	Additional Director	Research Department, RPPI Wing	zahira.hasin@bb.org.bd
Md. Saiful Arefin	Assistant Director	Research Department, RPPI Wing	saiful.arefin@bb.org.bd
Tarek Aziz	Joint Director	Research Department	tarek.aziz@bb.org.bd
Alok Roy	Joint Director	Research Department	alok.roy@bb.org.bd
Ataur Rahaman	Joint Director	Policy Support Wing, Chief Economist´s Unit	a.rahman@bb.org.bd
Rupok Chad Das	Deputy Director	Research Department	rupok.chad@bb.org.bd
Md. Masudur rahman	Deputy Director	Research Department	masud.rahman@bb.org.bd
Mohammod Ullah	Assistant Director	Research Department	mohammod.ullah@bb.org.bd
Md. Tanzeer Alam	Assistant Director	Research Department	tanzeer.alam@bb.org.bd
Md. Al-Amin Parvez	Assistant Director	Chief Economist's Unit	alamin.parvez@bb.org.bd
Md. Nabir Hossain	Assistant Director	Research Department	nabir.hossain@bb.org.bd
Md. Mahmudul Hasan	Assistant Director	Research Department	mahmudul.hasan948@bb.org.bd
Md. Sajjad Hossain	Assistant Director	Research Department	msajjad.hossain@bb.org.bd
Rifat Ara Bindu	Assistant Director	Research Department	rifat.ara@bb.org.bd
Sahabuddin Ahmed Seikdear	Assistant Director	Monetary Policy Department	sahabuddin.ahmed@bb.org.bd

Appendices

APPENDIX A. NEW REPORTING TEMPLATE FOR PILOT SURVEY

1.   Data Structure of New Reporting Template

No.	Variable name	Description	Type
	Financial information		
1.	Name of Bank/FI		Categorical
2.	Date of application	Date of inception of loan processing	Date
3.	Date of first disbursement		Date
4.	Monthly income	Appraised monthly income of applicant	Numerical
5.	Purchase Price	As per document(agreement/deed) excluding reg. costs	Numerical
6.	Sanctioned loan amount	In BDT	Numerical
7.	Valuation price	In BDT (valuation/forced sale value)	Numerical
8.	Interest rate	% per annum at the time of first disbursement	Numerical
	Geographic information		
9.	Division		Categorical
10.	District		Categorical
11.	Whether located in City Corporation	Y/N	Categorical
12.	Name of City Corporation	If Y in 11; otherwise left blank	Categorical
13.	Whether located in Municipal Corporation	Y/N	Categorical
14.	Name of Municipal Corporation	If Y in 13; otherwise left blank	Categorical
15.	Upazila /Thana	(Mandatory field)	Categorical
16.	Union	If "No" in both 11 and 13	Categorical
17.	Ward number		Categorical
18.	Village/mohalla name		Categorical
19	Street address	Holding number with Street name	Text
20	Geographic coordinates	If available/ optional	Categorical
	Property characteristics and other information		
21.	Type of plot	Lease-hold/free-hold	Categorical
22.	Resale	Re-registration from previous owner: Y/N	Categorical
23.	Type of establishment	Condominium / single building project by developer company with additional amenities/ single building project by developer company/ pvt. owned building/ duplex/ township etc.	Categorical
24.	Total number of floors	As per approved plan	Numerical

No.	Variable name	Description	Type
25.	Flat location (floor)	Floor number (UK style) at which the flat is situated	Numerical
26.	Total size of the flat	In sq. feet according to approved plan/agreement/deed- whichever used for credit appraisal	Numerical
27.	Number bedrooms	Number	Numerical
28.	Number bathrooms	Number	Numerical
29.	Lift	Y/N	Categorical
30.	Parking	Particular flat includes parking: Y/N	Categorical
31.	Width of the access road	In feet	Numerical
32.	Pipeline gas connection	Natural gas connection: Y/N	Categorical
33.	Park	Within 10 min walking: Y/N	Categorical
34.	Hospitals	Within 10 min walking: Y/N	Categorical
35.	Schools	Within 10 min walking: Y/N	Categorical
36.	Public transports	Within 10 min walking: Y/N	Categorical
37.	Construction year	Inception of construction/ year of plan approval	Year
38.	Year of handover	Proposed year for under construction; current year for resale and ready flat	Year
39.	Name of Plan Approval Authority		Categorical
40.	Reference number of dev. authority's approval	Reference number in sanctioned plan (Bangla Unicode/English)	Not to be used in analysis
41	Type of real estate project ownership	Individual/ Group/ Developer Company/ Gov. Organization	Categorical
42.	Name of developer	If "Developer Company" in (41)	Text

APPENDIX B. PROPOSED REGIONAL STRATIFICATION IN DHAKA AND RELATED EXPENDITURE WEIGHTS

Created with Datawrapper

TABLE 1. Expenditure Weights By strata for 2019

Stratum Name	Weights (Expenditure)	No. of observations (% of Total)
Stratum 1	37.6%	26.5%
Stratum 2	17.4%	26.9%
Stratum 3	25.8%	23.1%
Stratum 4	19.2%	23.5%

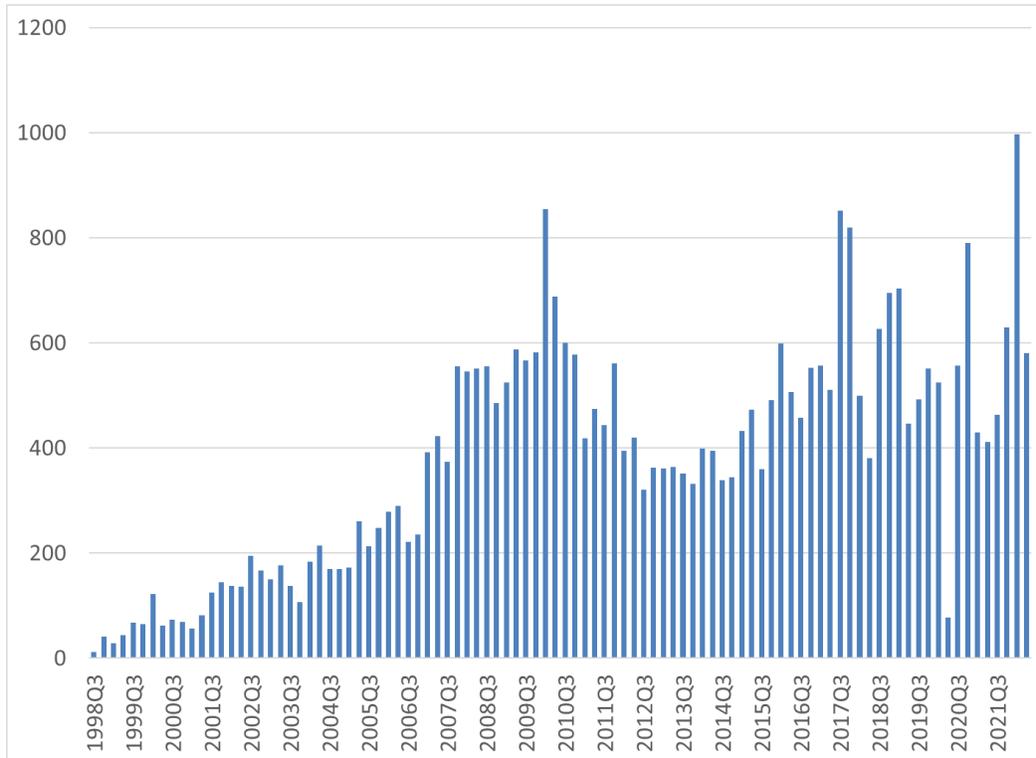**Figure 1. Number Of Observations Per Quarter For Dhaka, 1998 to 2022**
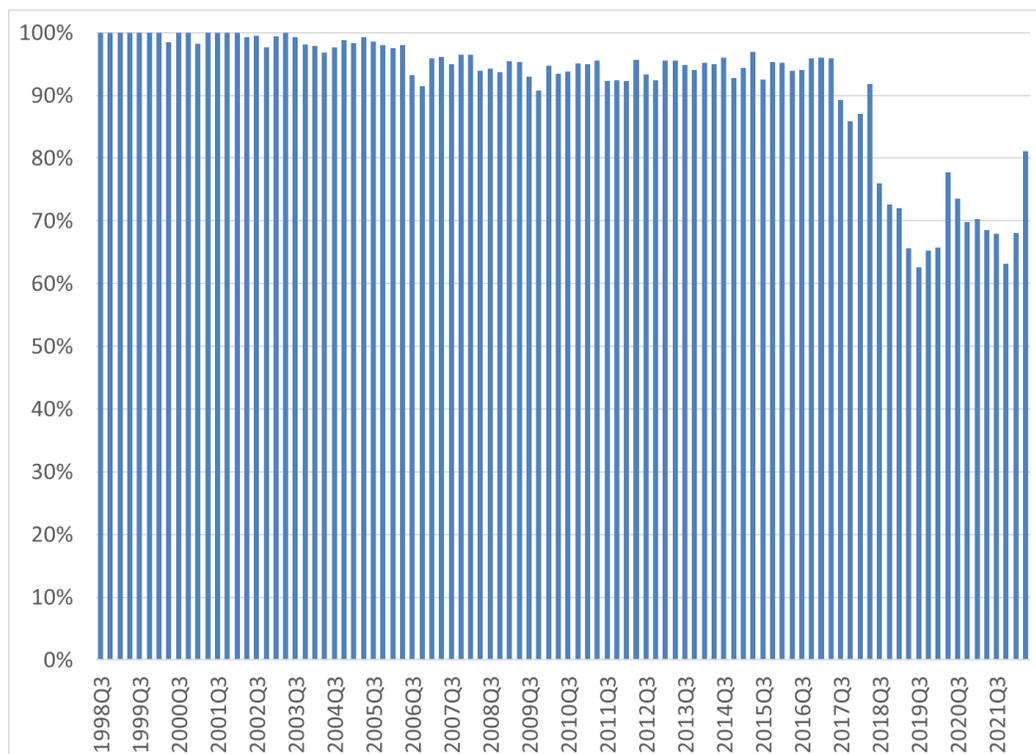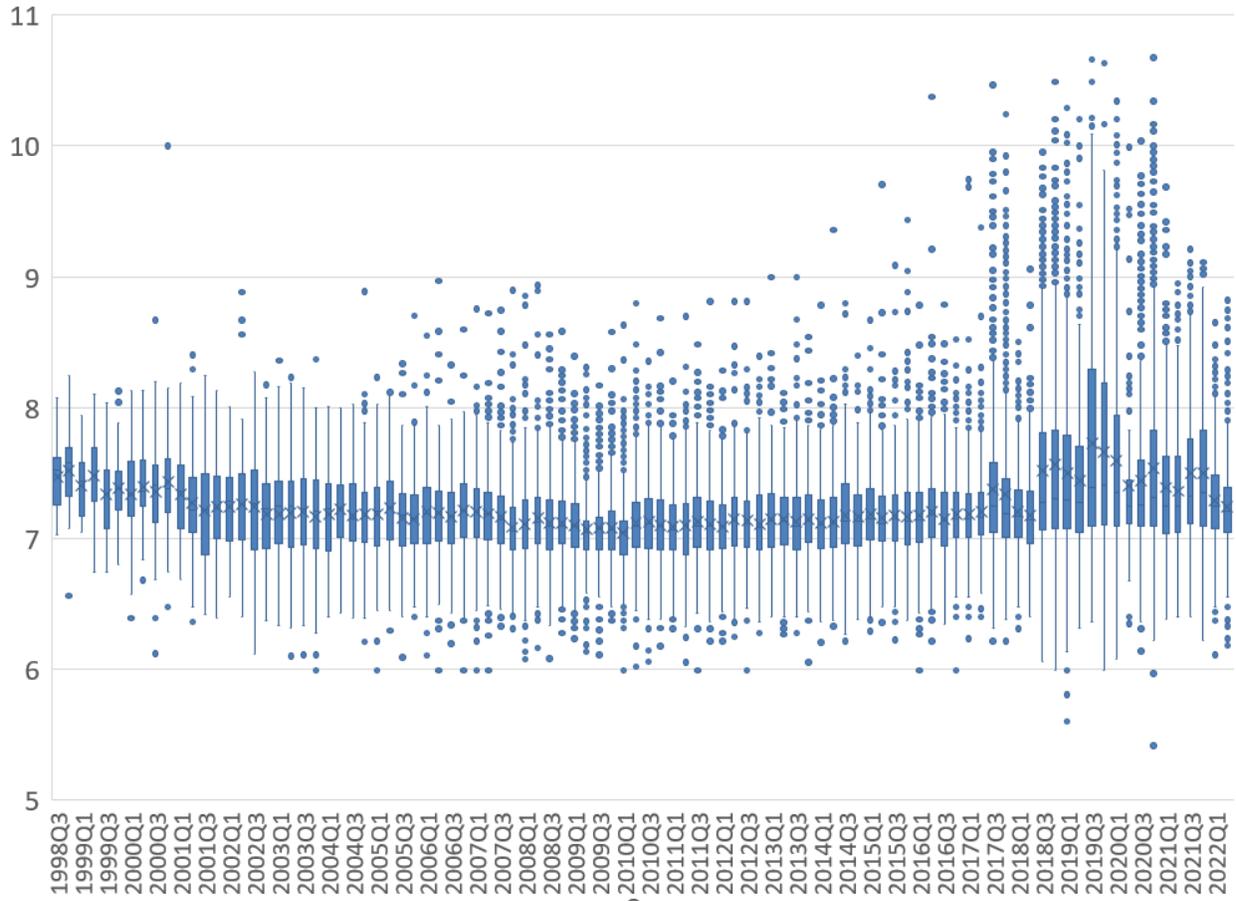

Figure 2. Proportion (%) Of Total Observations Per Quarter in Dhaka, 1898 to 2022

2.
3.   Figure 3. Distribution Of Log of Floor Area By Quarter, 1998 to 2022
4.

TABLE 2. Sample Regression Output for Strata 3 in Dhaka, 2021

Term	Estimate	Std Error	Statistic	P-value
(Intercept)	8.360	0.214	39.099	0.000 ***
log_area	1.036	0.029	35.838	0.000 ***
Uttara (reference)	0.000	0.000	0.000	0.000
Basundhara	0.077	0.027	2.867	0.004 **
Bhatara	-0.449	0.072	-6.245	0.000 ***
Cantonment	-0.332	0.165	-2.007	0.045 *
Dakkhinkhan	-0.386	0.032	-12.143	0.000 ***
Dhaka_cantonment	-0.393	0.069	-5.692	0.000 ***
Hajipara	-0.333	0.165	-2.026	0.043 *
Joar_shahara	-0.394	0.072	-5.469	0.000 ***
Khilkhet	-0.506	0.084	-6.016	0.000 ***
Nadda	-0.368	0.232	-1.583	0.114
Shahjadpur	-0.158	0.135	-1.173	0.241
Uttarkhan	-0.283	0.055	-5.175	0.000 ***
2021 Q1 (reference)	0.000	0.000	0.000	0.000
2021 Q2	0.030	0.033	0.918	0.359
2021 Q3	0.005	0.032	0.170	0.865
2021 Q4	0.037	0.030	1.255	0.210
Residual standard error: 0.2312 on 464 degrees of freedom				
Multiple R-squared: 0.8203 Adjusted R-squared: 0.8145				
F-statistic: 141.2 on 15 and 464 DF, p-value: < 2.2e-16				
Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1				