MODELING URBAN HOUSE-RENT VARIATION IN BANGLADESH: A STUDY OF FOUR METROPOLITAN CITIES

by

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AUGUST, 2007

Thesis Acceptance Form

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It is hereby declared that this thesis or any part of it has not been submitted elsewhere for the award of any degree or diploma.

FARIYA SHARMEEN

Dedicated to

My Parents, My Mother-in-law

And

My Husband

ACKNOWLEDGEMENT

At first all praises belong to almighty Allah, the most merciful, benevolent to man and his action.

I would like to extend my profound respect and deepest gratitude to my thesis supervisor, Dr. Sarwar Jahan, Professor and Dean of the Faculty of Architecture and Planning, Bangladesh University of Engineering and Technology for his valuable guidance, thoughtful suggestions and continuous inspirations

I extend my sincere thanks to the office staff of the National Accounting Wing of Bangladesh Bureau of Statistics for providing information and support. I would like to specially thank Mr. Ashim Kumar Dey, Deputy Director, National Accounting Wing, Bangladesh Bureau of Statistics for his assistance in obtaining necessary data and information.

I would specially like to acknowledge the support and suggestions of Dr. Roxana Hafiz, Professor and Head, and Mr. A. S. M. Mahbub Un Nabi, Professor, Department of Urban and Regional Planning, Bangladesh University of Engineering and Technology to improve this report. I am thankful to Dr Md. Shakil Akhter for his suggestions in development of the model.

I express my heartfelt thanks to Dr Sushil Ranjan Howlader, Professor, Institute of Health Economics of the University of Dhaka for his valuable comments and suggestions to improve this study

I am ever grateful to my husband, Mr. Abu Toasin Md Oakil, Lecturer, Department of Urban and Regional Planning, Bangladesh University of Engineering and Technology for his support during methodological development and for his continuous encouragement and motivation throughout the study. I am also thankful to all my colleagues especially to Mr Suman Kumar Mitra, Mr. Md. Shakil Bin Kashem and Mr. Mamun Muntasir Rahman for their cordial support and inspiration

Finally, I would like to extend my thanks to my parents and my mother-in-law for their blessings and prayers have made my thesis complete successfully.

ABSTRACT

Regional variation is an obvious prevalence in almost every sector in Bangladesh. The phenomenon is one-step ahead leading to inter-societal variation in the housing sector. There have been limited studies (as well as inadequate scope for study) in this field in Bangladesh. However such analyses are crucial for devising any types of regulating mechanism and policy formulation. With this view in mind, this study focuses on the regional pattern of urban house rents in Bangladesh. The study analyzes the trends of house rent variation in last 15 years, identifies the pattern of such changes across the cities and develops a forecasting model to explain the probability of a year-on-year rent increase at different rates across the regions.

The study is confined with rent analyses of four metropolitan cities of Bangladesh. Dhaka, Chittagong, Rajshahi and Khulna. The dwellings are primarily divided into high, medium and low income categories. House-rents of all types of dwellings are the highest in Dhaka metropolitan area and lowest in Khulna, although the highest growth can be observed here. In case of low-income dwellings highest rent can be observed in Dhaka metropolitan city. The lowest rent of high-income dwellings can be found in Rajshahi metropolitan city. Rents of middle-income dwellings are higher in every city having the highest value in Dhaka.

Another important finding is that although house-rents are higher in the two bigger cities of Dhaka and Chittagong, the growth pattern of these two cities are more or less steady. In contrast, the lower house-rent areas of Khulna and Rajshahi pose an incremental growth pattern, much higher than Dhaka and Chittagong for all types of dwellings.

The model estimates suggest that 'type of structure' is the most influential variable in determining the rent increase pattern followed by the 'location' parameter. The model also suggests that the probability of a year-on-year rent-increase is higher for lower-middle and low-income dwellings at higher rates (i.e. at the rate of 6% - 15%).

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CHAPTER 1

BACKGROUND OF THE STUDY

1.1 Background of the Study

Rent is defined as payment, usually of an amount fixed by contract, made by a tenant at specified intervals in return for the right to occupy or use the property of another (Farlex, 2007). House rents in Bangladesh are increasing day by day to meet the growing housing demand of the vast majority of population. According to a survey conducted by the Consumers Association of Bangladesh (CAB), year-on-year increase in house rent in the Dhaka city was 17.40 per cent in 2001, 13.49 per cent in 2002, 8.40 per cent in 2003, 9.96 per cent in 2004 and 7.89 per cent in 2005. The CAB reports that although there is a law — Premises Rent Control Ordinance 1991 — to protect the tenancy rights, it is not time-bound and of no use (The daily New Age Metro, 2007).

Existing housing supply, on the other hand, has been characterized by 'a critical imbalance' between housing price to household income ratio that has been known to affect homeownership and rental housing. For the last two decades, poor families have watched their housing costs rise while their incomes shrank, producing a restriction that often forces a choice between necessities: housing or food, housing or medical care etc. The growing rents are of particular problem for the lower income groups, but the issue of rental housing policy is seldom addressed by the public authorities in Bangladesh.

Growing house rents is an obvious result of inflation and changing economic characteristics. But these growth are directly associated with the issue of housing affordability and raise specific problems when regional as well as social inequalities are observed. Affordability, generally involves the capacity of households to consume housing services; specifically it involves the relationship between household incomes and housing prices and rents. An often-quoted rule of thumb is that households should spend no more than 30 percent of their income on housing, unless they choose to do so. But this rule of thumb is criticized for not including the element of socio-economic class segregations. Upper income and smaller households can afford to spend much more than

30 percent of their incomes on housing and still have enough income left over to satisfy other basic needs, whereas extremely low income households that pay even 10 percent of their incomes on housing costs may be forced to forego essential medical care and healthy food (Stone, 1993).

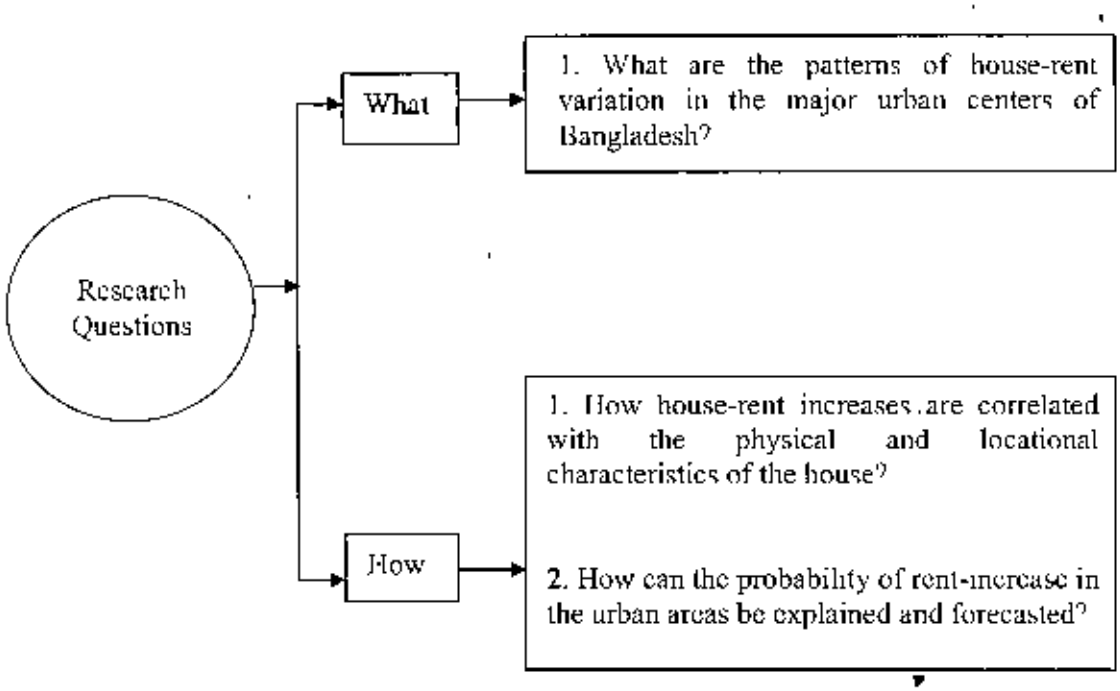
The public authorities formulate different policy measures, regulate rents, grant rental allowances, allow tax deduction for mortgage payment, or subsidize the construction of public housing to make housing affordable to all groups of the society. However, these policies are often misdirected due to the absence of reliable analyses on the changing processes of house rents. Detailed studies investigating the extent of social and regional disparities in house-rent changes are essential before devising any development and economic regulations. Such analyses are a requisite to formulate measures to introduce efficient rent policies and eventually to ensure rental affordability to the less earning members of the society. Thus to provide with a detailed understanding of rental structure, the study intends to model the changing process of house-rent in Bangladesh.

Several methods are used in order to recognize price-changes in residential property markets. Among these Multivariate Regression or Rosen's Hedonic approaches are widely used to examine the relationship between structural and location attributes and the value of properties (Gillard, 1981; Li & Brown, 1980; Sirpal, 1994; Walden, 1990). Most of these studies were inclined towards housing markets in the West, America and Europe in particular. Only a few were conducted in the East, such as in Hong Kong (Chau, Ma, & Ho, 2001; Mok, Chan, & Cho, 1995) Taiwan (Hsueh, 2000), and Japan (Edmonds, 1984). However, to date, no empirical work has been conducted to explain the changing process of house rent in Bangladesh using the methods of trend analysis and forecasting techniques. A few studies have been conducted in Bangladesh focusing individual urban centers, addressing house-rent variation in Dhaka (Asaduzzaman, 2007) and examining impacts of transportation on house-rent in Rajshahi (Habib, 2004). The study aims to address this literature gap.

1.2. Research Questions

What, why and how are three basic dimensions of queries of every kind of knowledge seeking process. This research would seek to answer the following queries under two of these dimensions. The study addresses specific questions, such as, what is the trend of house-rent change over the years (from 1991 to 2006) in Bangladesh, how rents vary across the regions and how rents are associated with the physical and locational attributes of the house?

Figure 1.1 Research Questions



1.3 Objectives of the study

The study intends to fulfill the following objectives:

1. To examine the spatial and temporal patterns of house-rent in the urban centers of Bangladesh.
2. To compare the rental variation among the cities.
3. To develop a model to forecast the probability of house-rent changes across the urban centers

1.4 Scope and Limitations of the Study

The scope of the study is confined to the analysis of the spatial and temporal variations of house rents in four metropolitan cities of Bangladesh. The study focuses on structural and locational parameters and draw the variation of house rents with different physical components of the house.

A study could be primarily of two types, namely, micro level or macro level. In a micro level study the components are either individual or household. Whereas, in macro level study group of individuals or households are considered. This study continues with a regional or macro level dimension, analyzing house-rent variation and trends across metropolitan areas of Bangladesh. Micro level studies have been conducted analyzing within-variation of house-rents of Rajshahi (Habib, 2004) and Dhaka (Asaduzzaman, 2006) cities.

Thus, though house rent is dependent on parameters other than the structural ones (e.g. locational, neighborhood and accessibility parameters), those were beyond the scope of the study. Socio-economic indicators could be incorporated but unavailability of data and resource limitations restricts the scope of the study. Further micro level studies may be conducted incorporating those parameters as a continuum of this study.

The study uses data of private residential house rents as collected by Bangladesh Bureau of Statistics (BBS). Again BBS only collects rent data of authorized urban settlements and thus urban slums and other illegal settlements are beyond the scope of the study.

Finally, there is no evidence of any analysis of house-rent trends and regional variation or the use of multinomial logistic regression models for forecasting house rent changes in Bangladesh. None of such examples were available in comparable contexts as well. Thus, based on empirical socio-economic researches and theories, the conceptual and methodological framework for this study has been developed.

1.5 Methodology of the Study

Resource availability limits to conduct a representatively sampled primary survey. Thus data has been collected from both published BBS reports and unpublished catalogs of the National Accounting Wing of BBS. By manipulating these data the rent structure over the years and across the regions of Bangladesh has been derived. The methodological framework is designed as follows.

Literature Review:

An extensive literature review should been conducted to develop a clear understanding of the concepts of housing affordability, housing supply and issues in Bangladesh and in comparable contexts as well. A thorough review and understanding of the economics of housing market and analytical tools has been conducted. Resources from the Bangladesh Bureau of Statistics, library of Dhaka University, NIPORT, Consumers Association of Bangladesh (CAB) and rent regulations from Ministry of Planning have been collected.

Formulation of objectives:

There is no unified document with an extensive analysis of the house rent variation of Bangladesh. To this end, the aforementioned objectives have been formulated.

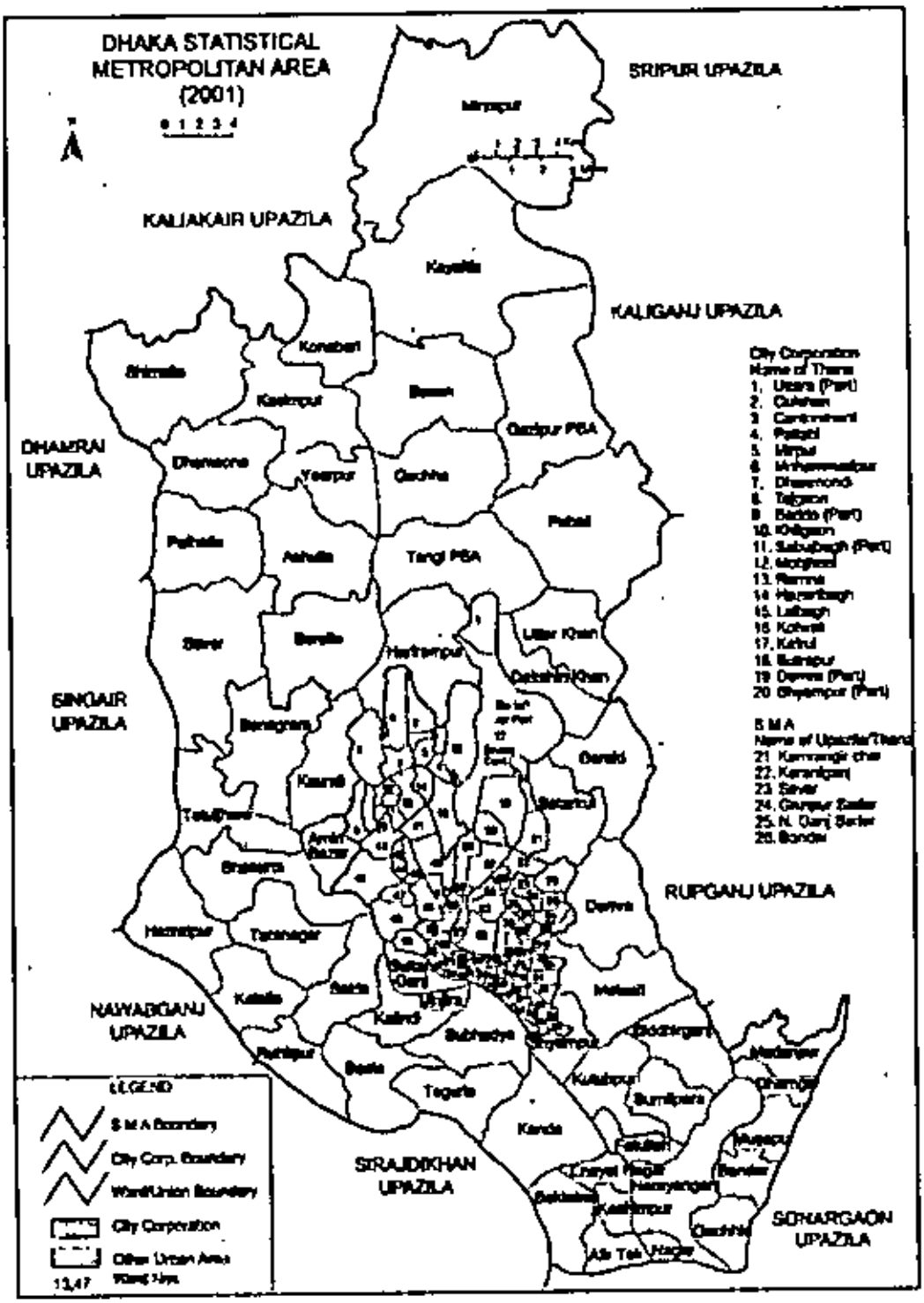
Selection of Study Area:

The four metropolitan cities of Bangladesh have been taken as study area, namely, Dhaka, Chittagong, Rajshahi and Khulna metropolitan areas (Map 1.1-1.5). Other urban centers could not be incorporated due to data unavailability. House-rents data of private residential houses have been collected from the National Accounting Wing of BBS.

Map 1.1: Location of Statistical Metropolitan Areas of Bangladesh.

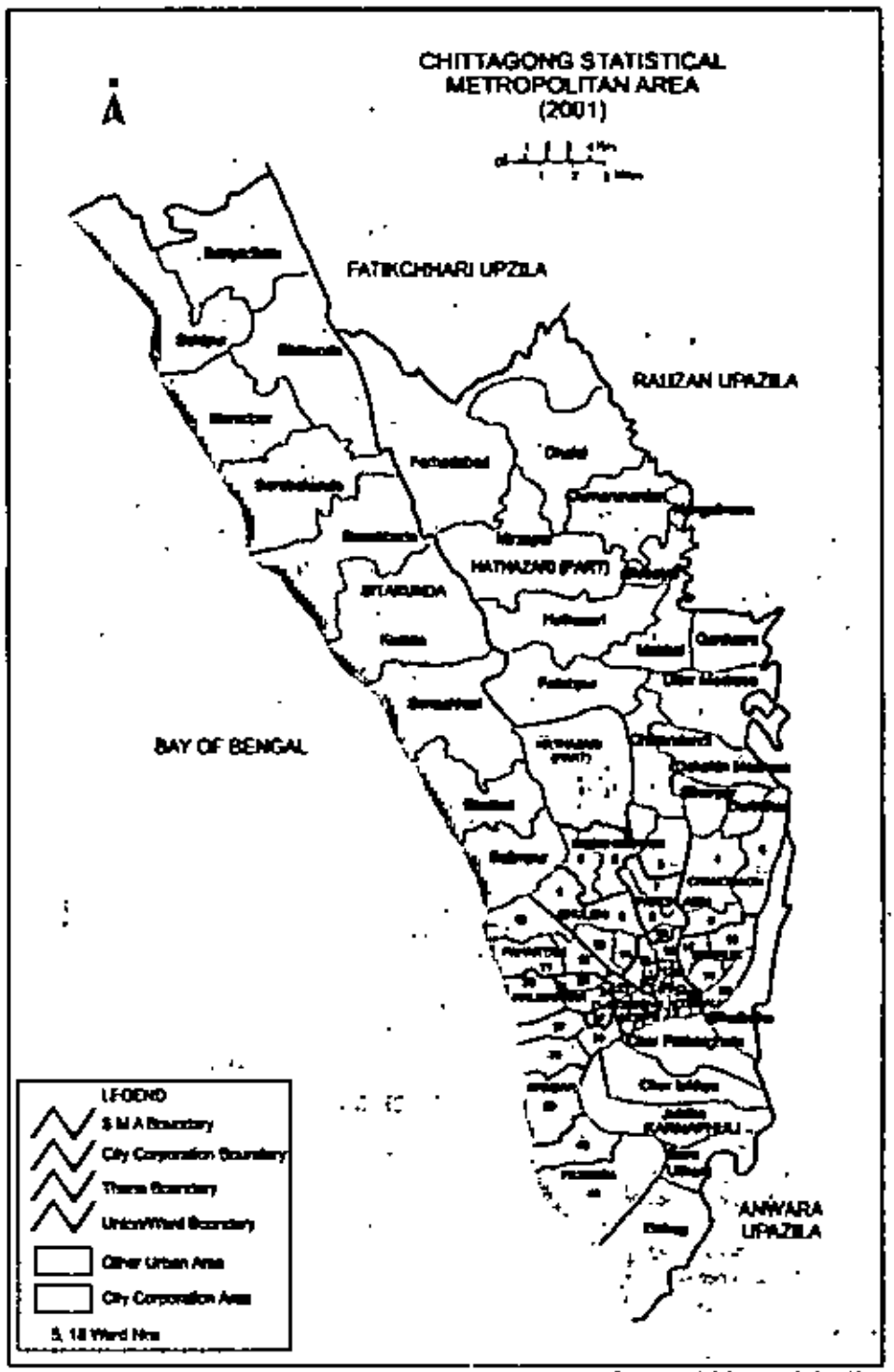
Source: http://www.virtualbangladesh.com

Map 1.2: Map of Dhaka Statistical Metropolitan Area



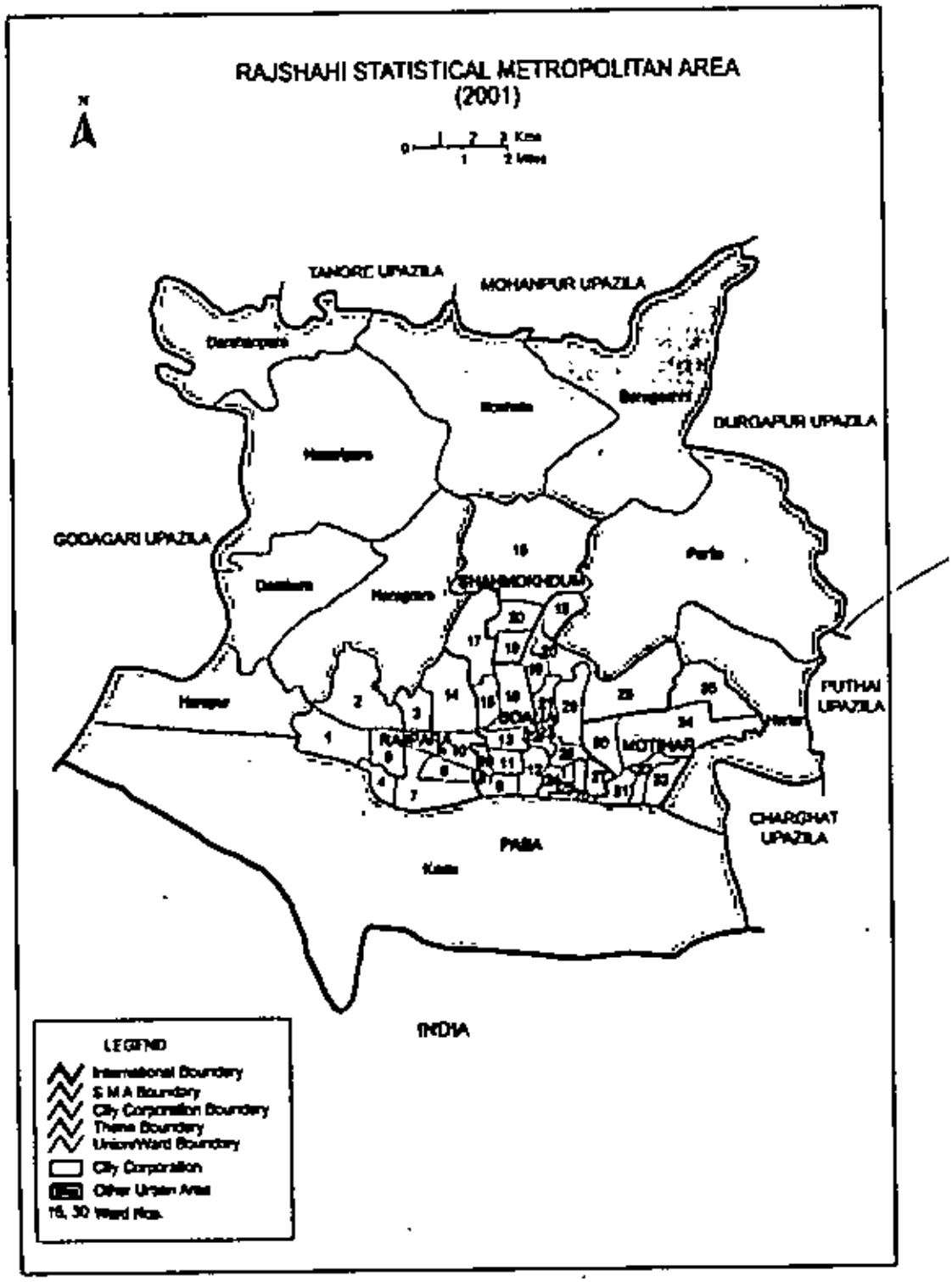
Source: BBS, 2003

Map 1.3: Map of Chittagong Statistical Metropolitan Area



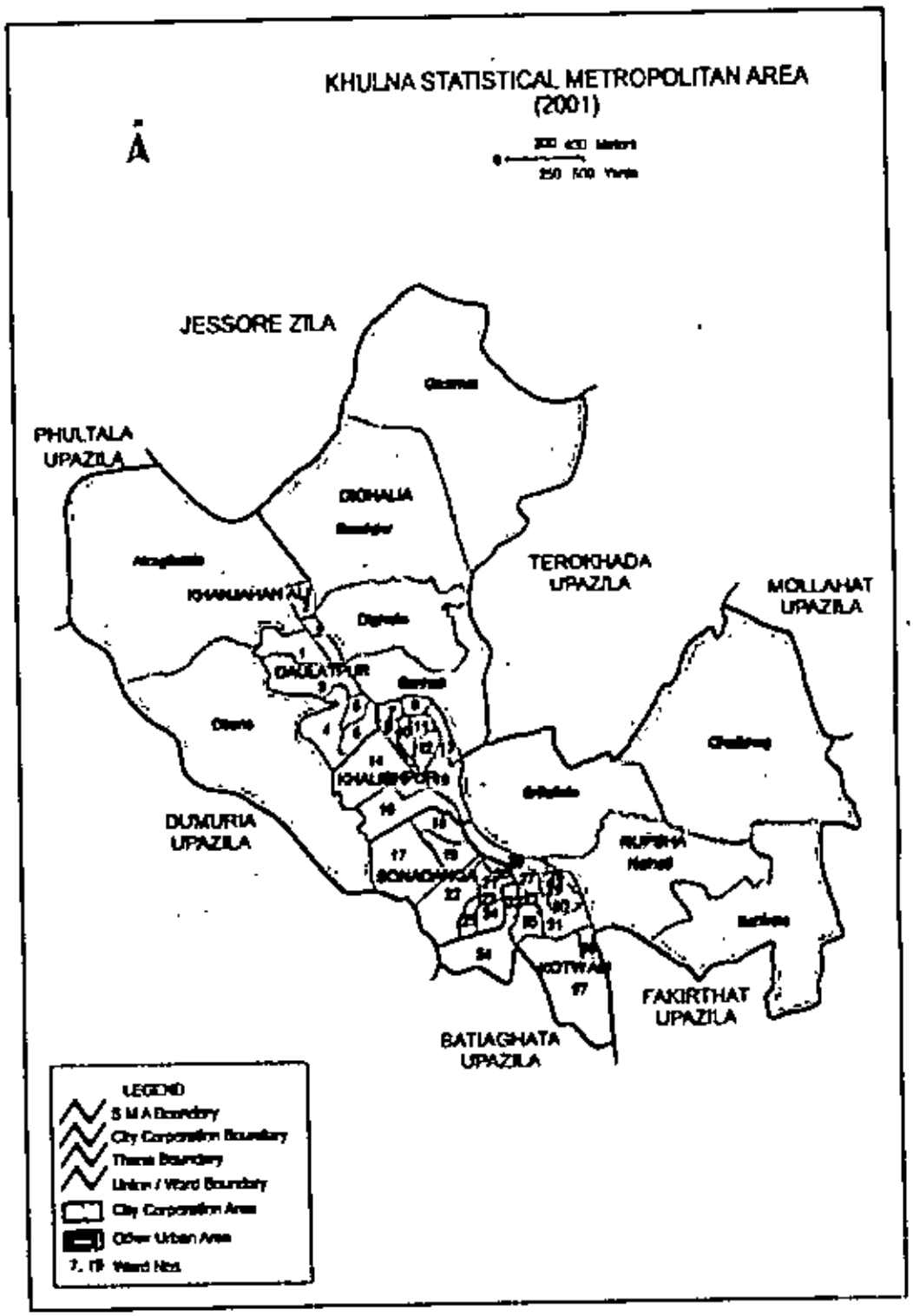
Source: BBS, 2003

Map 1.4: Map of Rajshahi Statistical Metropolitan Area



Source: BBS, 2003

Map 1.5: Map of Khulna Statistical Metropolitan Area



Source: BBS, 2003

Selection of Variables:

The response or dependent variable for this study is the year-on-year increase of house-rent. The variation of the response variable shall be explained with year for each of the four regions. Another explanation of the response variable has been denoted with changes in structural parameters of the house. The choice of parameters, however, is also restricted by data availability. Nine parameters have been selected, viz. type of structure (pucca, kutcha), usable living area (in sq. ft.), number of rooms (including bedrooms and living rooms), number of bathrooms, availability of kitchen/pantry, availability of storeroom, availability of garage, and availability of water-gas-electricity connection and location of the house. Detail definition and selection procedure of the selected variables are discussed in chapter 3 and 4.

Data collection:

Data have been collected from BBS libraries, National Accounting Wing of BBS and NIPORT. The monthly bulletins and statistical yearbooks published by BBS and data-books of National Accounting Wing of BBS were the primary source of data for this study.

Bangladesh Bureau of Statistics (BBS) regularly publishes Monthly Bulletin. In these bulletins house-rent indices of private houses are regularly published for the major urban centers of Bangladesh, namely, Dhaka, Chittagong, Khulna, Rajshahi, etc. BBS categorizes the houses into 14 classes, each having a specific structural characteristic. These indices have been collected for this study from 1991, since from 1991 data for the above four urban centers have been regularly published. And then the data-books of the National Accounting Wing of BBS office have been used to calculate the actual value of the indices. BBS surveyors and office staff have been interviewed to understand the actual meaning of the indices, data collection procedure and data reliability. There are selected dwellings in each of the urban centers from where rent data are collected. And the collected data are updated in every three months by the local surveyors. These data are then compiled and published in the monthly bulletins. The Bulletins can be found in the BBS libraries. The indices are also published in the Statistical Yearbooks of BBS.

Data Analysis:

The study employs multinomial logistic regression analysis to develop a probabilistic model of forecasting house-rent variation for urban Bangladesh. The best-fitted functional representation of the model has been derived defining the relationship of the response variable (house-rent) with the explanatory variables. Details about multinomial logistic regression analysis have been discussed in Chapter 3 and 4. The spatial and temporal variations of house rents have been described using graphs and bar charts (chapter 5 and 6).

Figure 1.2 provides with an overview of the methodological framework discussed above

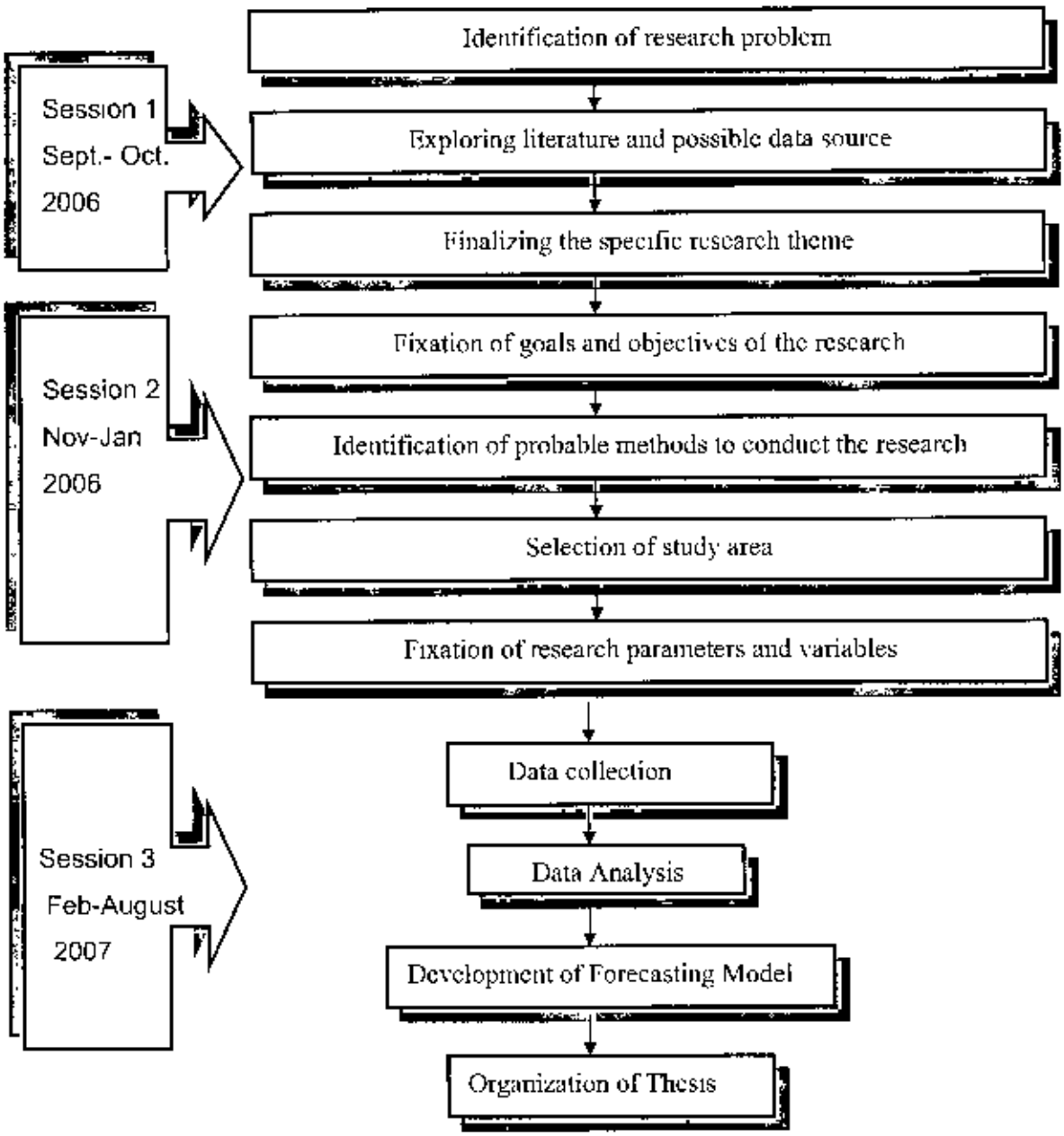
1.6 Organization of the thesis

The thesis is organized in eight chapters. The first four chapters constitute the background, literature review and development of conceptual framework and research design of the study. These give a clear picture of what the study intends to achieve using what kind of data and what methodological framework with a logical discussion behind the selection of variables and analytical tool.

The next three chapters are the analysis chapters organized in accordance with the three objectives of the study. Chapter five describes the within-region variation of house-rent and chapter six focuses on the between-region variation. The forecasting model is described in the seventh chapter with mathematical and logical interpretation of the model.

Finally chapter eight points out the concluding remarks with some recommendations and guidelines for further studies in this field.

Fig 1.2: Sequential steps and schedule to conduct the research



CHAPTER 2

LITERATURE REVIEW

2.1 Urban Areas of Bangladesh

Urban areas of Bangladesh are characterized by high incidence of poverty. Most of the 15 million urban poor, about a third of them in Dhaka, lack proper housing. Mainly the private and informal entrepreneurs supply scarce and costly housing resources to them. The government, unable to meet the huge housing demand on its own, is slowly espousing participatory approach involving the private sector, including the non-government organizations (NGOs), to deliver shelter-related services and credit to the poor, ensuring their accessibility to the benefits and sustainability of programs (Rahman, 2006)

Urban areas of Bangladesh have been classified as Megacity, Statistical Metropolitan Area (SMA), Paurashava and other urban centers. There are four SMAs in Bangladesh, namely, Dhaka, Chittagong, Rajshahi and Khulna. Dhaka is the only megacity of the country (BBS, 2001). These four urban centers have been selected for this study. The definition of megacity and SMA are given as follows.

Megacity:

Any metropolitan area having population more than 5.0 million is termed as megacity (BBS, 2001).

Statistical Metropolitan Area (SMA):

The city corporation of the country and the adjacent areas having urban characteristics have been termed as Statistical Metropolitan Area (BBS, 2001).

According to international estimates, Dhaka and Chittagong are among the 50 largest cities of the world (Table 2.1).

Table 2.1: Population and ranking of the SMAs of Bangladesh

SMA	Population	National Ranking	World Ranking
Dhaka	10712206	1	22 (largest city)
Chittagong	3385800	2	40 (largest city)
Rajshahi	700140	6	-
Khulna	1340826	4	-

Source: http://en.wikipedia.org, http://www.citymayors.com, BBS 2001, Monthly Bulletin 2006

2.2 Housing Industry of Bangladesh

Economists view housing as a bundle of services that people are willing to pay for. shelter certainly, but also proximity to other attractions, amenity, prestige, and access to public services. Because it is impossible to maximize all these services and simultaneously minimize costs, households must, and do, make tradeoffs (ECONorthwest, 1999).

Providing shelter to all the people is one of the fundamental responsibilities of the state. The UN Declaration on Fundamental Rights also reveals that every person has a right to an adequate standard of living, which includes housing.

The national population in Bangladesh has more than doubled between 1961 and 2001; it increased from 55.22 million to 129.24 million during this period (Ghafur, n.d.). In Bangladesh 25 percent of the population (some 35 million people) now live in urban areas, this proportion will be 34 per cent (75 million) by the year 2015. Dhaka, with a total population of 10 million, is now the 22nd largest city in the world (Karim & Islam, 2004).

Housing stock in Bangladesh has also been increasing steadily since 1960 side-by-side increase in the national population. This gross increase of housing stock is featured by the gradual increase in the share of urban housing stock in a context of high urban population growth, as a result of steady migration from villages to cities. The share of urban housing in the national housing stock has risen from 4.8 per cent in 1961 to 22.55 per cent in

2001. It is noticeable that the increase in urban population has mostly been taking place among the poorer section of society. Despite increase in housing stock over the years, there exists a huge housing deficit in Bangladesh. It was estimated in 1991 to be about 3.1 million units, of which 2.15 and 0.95 million units were in rural and urban areas respectively. A major share of this deficit had arisen due to backlog of *kutcha* (non-permanent perishable structure) unserviced units. The shelter deficit was forecasted to exceed 5 million units by 2000 (agreed by another study of Karim, 1993 summarized in Table 2.2). As a point of great concern the current housing stock is deteriorating (and decreasing) fast due to aging, general neglect by the dwellers, poverty and natural disasters (GOB, 1996, p. 13 *cited in* Ghafur, n.d.)

Table 2.2: Housing need assessment (1980-2000)

Location	Total Population 1981 *millions*	Total Housing Stock *millions*	Projected Population 2000 *millions*	Projected Housing Stock 2000 *millions*	New Housing Need 1980-2000 *millions*
Dhaka SMA	3.35	0.515	9.3	1.691	1.176
Chittagong SMA	1.43	0.220	4.0	0.727	0.507
Khulna SMA	0.70	0.108	2.3	0.418	0.310
Other cities	0.79	0.121	3.5	0.636	0.515
100,000-50,000 towns	1.03	0.158	3.7	0.672	0.514
Other urban	4.50	0.698	16.3	2.963	2.265
TOTAL	11.8	1.820	39.1	7.107	5.287

Source: Rafiul Karim. The journal of Local Government, vol 22, no 1, 1993

However, recent statistics show that Bangladesh will need to construct approximately 4 million new houses annually to meet the future demand of housing in the next twenty years. Estimates for annual requirements for housing in urban areas vary from 0.3 to 0.55 million units (Karim & Islam, 2004).

It has also been estimated that about 19 per cent of the dwelling units are located in urban areas. Per capita floor space in urban areas is only 62.3 sq ft. About 46.4 per cent of urban dwellings are made of brick/cement. From the early 1980s the business started to flourish

and showed robust growth. At present, more than 250 companies are active in the real estate business in the country (CPD, 2003). The poor economic situation and income inequality in the country is reflected in the quality of the housing stock. It was estimated that close to half of all housing units in the country (3.3 million in 1993) were made of temporary materials and needed replacement within a 1 to 5 year period. Approximately one third of all houses in urban areas were constructed outside of the formal regulatory system, mostly on land to which the homeowner does not have a formal title. A 1993 survey of Greater Dhaka showed that there were 2,100 slums, which comprised 3 million people (MHPW, 1993 *cited in* Hock-Smit, 1998). Some characteristics of the housing sector, compiled from different studies conducted by the Center for Urban Studies, are given as follows

Housing Sector Characteristics of Bangladesh

- ***Total number of dwelling units:***

  Bangladesh 19,020,489

  Rural 15,474,566

  Urban 3,545,923

- ***Per capita floor space.***

  Bangladesh 54.9 sq.ft

  Rural 53.5 sq.ft

  Urban 62.3 sq.ft

- ***Occupancy level in 1991.***

  5.48 pp/dwelling unit

- ***Proportion permanent structures in 1991:***

  Rural 21 percent

  Urban 46 percent

- ***Proportion of rental units in 1993:***

  Rural 5%

  Urban 40%

  Dhaka 65%

- ***Access to clean water:***

  Rural 78 percent

  Urban 42 percent

Source: Hock-Smit, 1998

Tragically, floods have destroyed more than 900,000 houses, mostly in rural areas, and another 1.3 million houses were seriously damaged (UNCHS, 1998 *cited in* Hoek-Smit, 1998). Of course, most of the affected houses were in the low-income category.

While comparing the growth of the real estate and housing and the construction sector with that of GDP, it was found that trend growth in the two sectors for the period 1992-2002 was 4.8 and 7.5 per cent respectively, which is much higher than the trend growth in GDP of 4.6 per cent for that period. The shares of the real estate and housing sector and the construction sector in the GDP were quite high in the year 2002 and accounted for 8.3 and 8.0 per cent respectively. However, the incremental contributions of these two sectors in the same year were also considerably high at 6.0 and 12.8 per cent respectively (CPD, 2003).

Recent information concerning investment in the housing sector shows steady growth both in absolute terms and as a percentage of total private investment and GDP. Private investment in housing and construction has more than doubled during the Fourth Five Year Plan period, from US$ 11.66 million in 1989-1990 to US$ 264.83 million in 1994-1995. During the first three years of the Fifth Five Year Plan period, the average investment in housing and construction was US$ 1273.65 million. As a share of total private investment, private investment in housing and construction in the 1997-1998 to 1998-1999 period accounted for 47.3 percent, which far exceeded the target of 16.35 per cent for this period. The proportion of investment in housing and construction in the national GDP increased from 3.4 percent in FY 1997 to 4.1 percent in 1999 (CPD, 2003).

2.3 Housing Consumption and Expenditures

A survey by the Ministry of land shows that 56.63% of household in Dhaka lived as tenant in 1981, having no land in the city or in any other urban area. Population of household who did not own a piece of land in Dhaka would be over 70%. 2% of city's population who constitute the upper income group use about 15% of the residential land of the city, another 28% who form the middle-income group, occupy 65% of the residential land and the vast majority or the other 70% have access (mostly non-owned) to only about 20% of the residential land (Asaduzzaman, 2006).

The World Bank Household Survey Data (Bogra & Tangail, Bangladesh, 2000) shows that the share of housing expenditures shows a peculiar pattern in that the percentage devoted to housing does not increase with income. Those earning an average income of TK 5000 spend the same six percent of their income as those households with mean incomes of TK 25,000. The expenditure figures for the poor are consistent with the findings of the Urban Poverty Task Force. The report notes that the urban poor were paying an average of TK 366 at a national level and this increased to TK 432 in Dhaka

This unexpected pattern suggests two possible biases. First, the respondents reported contract rents. Since the majority of upper income households own their dwelling units, and few owners have access to housing finance, few incur monthly mortgage costs. Thus imputed rents would have given a true picture of housing consumption. Second, a large percentage of households who are renters in the middle-income categories construct dwelling units on an informal and incremental basis. Contract rents underestimate the true housing expenditures as an important share of expenditures is devoted to housing construction. Contract rents reported here are underestimating the true housing consumption for all but the lowest income group where the majority, though not all, are renters. Thus the demand elasticities for housing are low in both towns. So housing consumption should include contract rents plus expenditures for land and building materials incurred by households.

Yet even families of modest means could afford dwellings of substantial value. For example, a three-room apartment in 1996 was valued at TK 700,000 – a sum that could be afforded by only the top 5% of the income distribution. Yet housing of this type accounted for 66% of the growth in housing in the 1981-1991 period. For example, informal housing accommodated approximately 50% of the population of Dhaka and accounted for two thirds of the new growth between 1981-1991 (GOB-ADB, 1996).

2.4 Housing Providers of Bangladesh

Different institutions, both government and non – government are working in different aspects of housing in Bangladesh. Low-cost housing is a major objective of all the government commitments after liberation. In Bangladesh, lake of co–ordination among different organization is one of the major institutional weaknesses. Because institutions

responsible for policy formulation, planning, design, implementation, monitoring, management and evaluation of shelter, accommodation and services programs are fragmented and uncoordinated.

In the urban areas multiplicity of agencies in the field of housing and building and urban services located sector-wise under different ministries has led to a situation which is confusing, to say the least. Management of urban affairs in a fast growing metropolitan center is always an arduous challenge. Yet it is recognized that the system can better respond to public demand if it is unified and attempts, simple in nature, are to be made to bring the concerned ministries into a policy level. And a monitoring authority from where sectional polices and programs contributing to urban shelter, services and infrastructure can be periodically reviewed and synchronized to achieve maximum coordination.

Housing provision can be divided in two levels such as-

- National level, which is constituted by
  - -National Economic Council
  - -Planning Commission
  - -Urban Development Directorate
- Local level, which is constituted by
  - -RAJUK
  - -City Corporations
  - -RHD, WASA, DESA, PDB, TITAS, Bangladesh Railway, Biman Bangladesh, etc and all of the 42 autonomous or semi-autonomous organizations under 19 ministries.

Provision of different housing related functions has been distributed among different public and private institutions, such as,

- Approval of major public sector project: Planning Commission (PC), National Economic Council (NEC), National Housing Authority (NHA).
- Master plans and land use zoning RAJUK, KDA, CDA, RDA.
- Land acquisition: Ministry of Land Administration and Reform
- Survey of land, construction of road and drain: DLRS, SOB, RAJUK, City Corporations, PWD, RHD.

- Land development, distribution of plots: RAJUK, CDA, KDA, RDA
- Control of private development and building permission: RAJUK, CDA, KDA, RDA
- Slum clearance and rehabilitation: RAJUK, CDA. KDA, RDA
- Supply of gas. water and electricity: DESA, WASA, TITAS etc.
- Sanitation: City Corporations, Paurashava, DPHE
- Finance: House Building Finance Corporation (HBFC), Commercial banks, Grameen bank
- Low cost housing: Grameen Bank. NGOs.
- Estate management: PWD
- Design project planning. RAJUK, PWD, BIDS, NCST.
- Research: House and Building Research Institute, Dhaka University (DU).
- Building material production: Directorate of Supply, Trading Corporation of Bangladesh.
- Statistical information. BBS
- Environmental projection. PWD, House and Building Research Institute, NGOs.

The Government of Bangladesh is conscious of the enormity of the housing crisis in the country. The Government should ensure the provision of housing to every citizen of Bangladesh through measures, incentives, motivation, planning and management. Special housing schemes are needed to be prepared both in the public and private sector for the low-income groups. the disadvantaged, the destitute and the shelter less poor.

The provision of housing as made available by different sectors is described below.

2.4.1 Public Sector

Public housing has, in general, failed to strike a balance between proper housing designs, use of innovative building materials and affordable housing. In the public sector, less than 10 percent of the employees get residential accommodation (Asaduzzaman, 2006). A few sites and services scheme and low-income housing projects are demonstrated by the government actors (e.g RAJUK, CDA, KDA, RDA and City Corporations in major urban centers and Paurashava authorities in other urban centers), which are only a small portion of the existing housing supply

Several public agencies are, or have been involved in the financing and development of housing and residential infrastructure projects: the National housing Authority (NHA) and Public Works Department of the Ministry of Housing and Public Works, the Local Government Engineering Department of the MLGRDC, and the City Corporations of the four larger cities. Their funds come mostly from foreign aid and to a lesser extent from national revenues. Both City Corporations and the central government are developing residential subdivisions for lease to upper and upper middle-income households and resettlement programs and site-and-services schemes for lower to middle income groups. The tenant purchase and sales projects require large down payments (25 to 30 percent) and a small number of annual payments. Also, it has always been difficult to reach lower income households with the site-and-services projects and the size of the combined public housing programs has remained extremely small in relation to housing requirements and new construction. Altogether the public sector has only produced approximately one to two percent of total urban residential land and housing requirements (not more than 6000 units per annum) over the past years (Hock-Smit, 1998).

Under the public housing programme public agencies directly construct residential units for their employees in accordance with employment status and scale of grade. During last thirty years, this programme has not been able to accommodate as much as one fifth of the total Government employees (Asaduzzaman, 2006). The constructed houses are highly subsidized and also built on over generous standards. Rent paid by the allotees represent about 7.5% of their basic salary, and this does not even cover maintenance costs. Recently, the Government has begun a change of direction. Recognizing the impossibility of providing housing units to all of its employees it is now paying them a rent allowance. According to this policy public servants who are not accommodate in public housing are entitled to get rent allowance. The amount of allowance varies with the basic salary and employment status. The amount of allowance also varies from big cities (capital and divisional cities) and others areas.

2.4.2 The Formal Private and NGO Sector

In the private sector a number of housing units have been constructed by the developers mostly for higher income group. Private developers are increasingly important players in the urban land and housing markets, particularly in the market for apartment buildings. A 1995 study by REHAB showed that there were 142 real estate developers in Metropolitan

Dhaka, most of whom work in land and apartment development. This sector has produced close to 3 percent of the houses over the last few years, nearly all for the higher income segment of the market, and it is growing rapidly. Private landowners, using the land to finance new construction, are also developing multi-family housing units. They operate either as individuals, as businesses under the Companies Act, or form a housing cooperative, and jointly develop a housing project partly for owner-occupation and partly for rental or sale (Hoek-Smit, 1998).

Interestingly, private developers feel that the higher income apartment market is becoming saturated and attempt to move down-market. The most serious constraint in doing so is the lack of mortgage financing. Finding accessible and affordable land for middle-income housing construction is another challenge, particularly in Dhaka. One of the largest developers in Dhaka felt, however, that there was sufficient land available for the foreseeable future, but the lack of long-term finance for middle-income households would prevent them from expanding a middle-income line of housing production. Infrastructure provision is the third main concern hindering private sector production of middle-income houses. Services and infrastructure are the responsibility of the City Corporations and priority is given to their own land developments. It can take a long time for road networks and other services to be installed in new developments (Hoek-Smit, 1998).

The NGO sector has only been marginally involved in urban housing. The discrepancy between urban land and house prices, and income of below median income groups has made substantial housing solutions difficult to conceive for that income group. Recently, the larger micro finance institutions have shown interest in entering the multi family residential market for moderate and low-income households. Proshika and BRAC invested large-scale low-and moderate-income housing developments 30 to 40 km outside of Dhaka. Some projects will receive free government land. The plan is to develop hostel type rental housing for urban workers and small low-cost family apartments for tenant purchase. Grihayan Tohobil of Bangladesh provided a 100 million taka soft loan to BRAC.

Only a few third-sector organizations work in the area of housing. Data from the ADAB directory reveals that only 30 organizations (out of 1195) work in the area of housing for

the poor (both urban and rural) These organizations provide loan for construction of houses and, in some cases, provide low cost housing materials to their beneficiaries. Also some organizations help their beneficiaries to access to government housing program Apart from these, in time of natural disaster (major river-bank erosion, cyclone), many NGOs provide temporary shelter services to the victims. Total number of such organization is not known (ADAB, 2000).

2.4.3 Co-operative and credit Co-operative Societies

There are 145,000 co-operative societies in Bangladesh, of which 144 are housing cooperatives. The housing cooperatives are mostly set up by high middle-income households to allow them to jointly acquire land for the construction of housing units for their members. Less than 14,000 plots have been developed through the housing cooperatives (Hoek-Smit, 1998).

2.5 Legal Framework

The legal and regulatory framework concerning the housing and real estate development includes National Housing Policy (2003), Building Construction Act (1952), Town Improvement Act (1953), Dacca Master Plan (1959), Dhaka Metropolitan Development Plan (1995-2005) and Building Construction Rules (1984) These laws are inadequate to solve the housing problems. Other limitations of these rules included a lack of appreciation about the differences between planning and building rules, the outdated nature of such rules and the inability of the rules to address the demands of an expanding city and targeting only the middle and high-income groups. Land registration records are unreliable.

To protect tenancy rights the government enacted Premises Rent Control Ordinance (1991), which is rarely enforced. Real property is not well-protected. In spite of all this, the government encourages real estate investors to develop flats instead of individual houses, most especially in the city, because of scarcity of land (Global property guide, 2007)

2.5.1 The Five Year Plans

In the Five Year Plans, housing provision has been considered to a great extent. The allocated and spent money in housing and construction sector according to the five year plans are shown as follows.

- First Five Year Plan (1973-1978):

  Allocated money – tk. 2.5 billion.

  Spent money – tk. 2.41 billion (8456 housing units and 2000 plots were developed till'79/'80.)

The expenditure was mainly on construction of public servants housing, office, building etc. Under this project 150000 squatters were reallocated.

- Second Five Year Plan (1980-1985):

  Allocated money – tk 8 2 billion

  Spent money – tk. 7.39 billion

Tk 3.19 billion spent for development of infrastructure facilities like construction of office, residential buildings at Thana centers.

- Third Five Year Plan (1985-1990):

  Allocated money – tk. 9.27 billion

  Spent money – tk. 8.6 billion

Tk. 6.96 billion spent for development of infrastructure facilities at District and Thana centers.

- Fourth Five Year Plan (1990-1995):

  Allocated money – tk. 62.0 billion.

  Spent money – tk. 57.189 billion

Under this project 1000 families were reallocated and 5000 service plots in Dhaka and 9100 plots in Chittagong were developed. 3000 govt. quarters and 44 circuit houses created in 44 Districts and 3000 quarters in Dhaka were constructed

- Fifth Five Year Plan (1997-2002):

Housing is one of the most important basic needs of life. At present, there is an acute shortage of affordable housing both in urban and rural area A total of tk. 229.833 billion was allocated in the housing and construction sector. The objectives of fifth five-year plan related to housing sector, were:

- To encourage private sector.
- To construct low cost house by public sector
- To construct rural house following Grameen Bank Model.
- To construct flats on hire-purchase basis.
- To provide Credit for house building, especially for the low and middle income people will be extended; saving and loan association house banks as institutions and trust boards and financial instruments designed for increasing contractual saving for house building will be encouraged in the private sector.

2.5.2 The Premises Rent Control ordinance

Rent Control Legislation what is now in Bangladesh was initially introduced as a wartime emergency. The municipal authorities introduced "The Bengal House rent Control Order" which came into effect for the first time in the year 1942 It was a temporary measure, which imposed a prohibition on the increase of house rent, subject to provide renewal. In 1947, after the creation of Pakistan, the temporary Rent Control of 1942 was still in effect. It was superseded in 1951 by the" East Bengal Premises Rent Control Ordinance" (ordinance XXII of 1951) This ordinance was changed into a statute by enactment of the East Bengal Premise Rent Control Act, 1953 (E.B. Act XVI of 1953). It was, once again, replaced by an ordinance, the East Pakistan Premise Rent Control Ordinance (ordinance XXV of 1961) All of these measures were declared to be temporary in nature and had to be renewed from time to time. Indeed the past Rent Control Ordinance ran out of its life It had to be reviewed and was then the East Pakistan Premise Rent Control Ordinance (ordinance XX of 1963) was promulgated by the Government of East Pakistan It too, is a temporary measure, but it remains in effect today, almost forty years after being promulgated.

In 1971, when Bangladesh became an independent country, the ordinance was renamed "The Premises Rent' Control Ordinance". The enforceability of this ordinance has been extended up to the end of 1982 by the decision of parliament.

The 1963 Ordinance authorizes the Government to appoint Controllers, Additional and Deputy Controllers for any prescribed area. These officials are empowered to determine a "standard Rent" for any premises. They can act, however, only if either a landlord or a tenant makes an application to them to do so. Moreover with few exceptions, such an application can only be made within six months of the creation of tenancy.

The standard rent prescribed in the Ordinance is an annual rent equal to fifteen percent of the market value of the premises The Ordinance prohibits the eviction of any tenant who is willing to pay the standard rent, unless he has violated statutory or contractual provisions He is even protected after the expirations The only specified exception allowed is where the landlord requires the premises for his own use, and this must be proven.

There are a number of other provisions in the ordinance. They include prohibition against payment of salami or of advance rent of more than one month, except in cases of long-term leases and in consideration of an agreement on the part of the landlord to undertake certain improvements. They also include requirements upon the Controllers to complete hearings within three months and they authorize entry by the Controllers into premises. They provide for deposit of rent with the controllers in certain circumstances. And they prescribe various fines and penalties for noncompliance.

The administrative machinery, which is in effect to implement the Rent Control Ordinance in Dhaka. is quite inadequate. The Government by notification has appointed one Controller, one Additional Controller and one Deputy Controller for the whole Dhaka district. They are supported by staff consisting of one Clark and one bearer only. The Controllers, performs this function as an additional task. They are primarily judges of lower level civil court (District Level) of Dhaka district and are involved in general judicial duties (Asaduzzaman, 2006).

2.6 Empirical Studies

ECONorthwest (1999) prepared a report providing information about specific developments and trends in the Greater Wasatch Area. The report examines trends that will affect the future housing market in the Greater Wasatch Area It takes a long-run perspective on housing. It looks at long-run trends and tends to downplay short-run cycles The approach is shared by the Governor's Office of Planning and Budget when it prepares the official state and county population forecasts By using the official population forecasts as the basis for the analysis of housing demand, the study implicitly considered many of the key demographic and economic variables that influence those forecasts. The analysis leads to the development of two different simulations of the distribution of housing in 2020: a baseline simulation based on a continuation of trends in the 1990s, and an alternative simulation that reflects expectations about the way housing demand will shift in response to projected demographic shifts in the Greater Wasatch Area.

A community development report was prepared in 2005 presenting a housing-needs analysis for the City of Bend. The analysis is a requirement of state law to satisfy Statewide Planning Goal 10, Housing. Goal 10 is to provide for the housing needs of the state To satisfy Goal 10, cities must inventory buildable residential lands and develop plans that encourage adequate numbers of needed housing units at price ranges and rent levels commensurate with the financial capabilities of the community's households. An examination of demographic and economic trends shows a number of changes that may affect the 20-year forecast for housing. Median household income grew by 58% in Bend between 1990 and 2000. During this same period the median value of housing increased by 111%. median rent increased by 59 percent Among the primary factors that influenced the cost of housing are the sizes and amenities provided with housing units

Dokmeci, Önder and Yavas (n.d) examined how rents and values vary across districts of Istanbul city and find that rents are more sensitive than property values to the district. They use hedonic price model to relate housing rents and values to the structural characteristics of the house and the satisfaction level to different external factors (e g green area, shopping facilities etc.).

Moore (n.d.) in her study developed a logit model using 1985 American Housing Survey data to predict the probability of homeownership for a given household. The variables used as regressors describe demographic characteristics of householders as well as family income and location (urban or rural) of the housing unit. The probability of homeownership for householders with particular set of characteristics is forecasted using logistic regression analysis. The study shows that factors such as age of the householder and location of the housing unit have significant explanatory power.

Anas and Chu (1984) employed multinomial logistic and nested logit models to predict mode choice in travel to work and housing location choice from 1970 U.S. census data aggregated to small zones of the Chicago SMSA. The estimated models are then used to derive the house rent, travel time and travel cost elasticities of location demand. The elasticities are also compared and found to agree with those obtained from other discrete choice models and, in the case of "housing rent," with estimates obtained from models based on other theoretical structure.

Fallis and Smith (1984) examined the price of rental housing in the controlled and uncontrolled sectors using a rent-forecasting model. Analyzing data from 1969 to 1978, they find that rent controls in Los Angeles effectively lowered the rate at which rents rose in the controlled sector and increased the rate at which rents rose in the uncontrolled sector.

Somerville and Holmes (n.d.) used multinomial logit model to estimate the effects of unit, neighborhood and market characteristics and conditions on the status of a housing unit over time. To identify the factors that change the stock of market housing affordable to low-income households, they compared alternative outcomes for an affordable unit with outcomes for unaffordable rental stock.

Using 1984 to 1996 data from the American Housing Survey, Early and Phelps (n.d.) examined the role of rent controls in determining the variations in prices of uncontrolled rental housing across metropolitan areas. The results suggest a positive and statistically significant relationship between the introduction of rent control and price in the uncontrolled sector.

Park (1992) developed an analytic model of urban housing strata, which utilizes housing structure type, housing tenure type, floor size, physical quality, residential area, and number of rooms to calculate a housing deficit for each housing characteristic. The housing norm is subtracted from the actual housing conditions. The model is applied to empirical data for Seoul, Korea. The findings were that 66% of the family sample showed negative scores (unsatisfactory housing conditions).

Habib (2004) attempted to follow hedonic price model approach to provide empirical evidence regarding the nature and magnitude of accessibility impacts of transportation on asking rental price of residential properties in Rajshahi city. It also investigated and compared impacts of structural attributes and neighborhood parameters on residential property values using stepwise regression technique. The estimated model suggested that moving 0.5 mile closer to the major arterials adds 585.858 taka premiums, all else held equal, on residential asking price at Rajshahi city.

Asaduzzaman (2006) studied the spatial variation of house rents in Dhaka city. The study also focused on various aspects of the problem of house-rent and identified the important factors that contributed to spatial variation of house-rent in Dhaka city. Such factors include structural qualities of the house, distance from commercial areas, work places and community facilities from the housing unit. Analyzing the data collected from 200 household surveys the study identified the role of relevant factors in the variation of rent structures in Dhaka city.

CHAPTER 3

CONCEPTUAL FRAMEWORK

Selection of variables and analytical framework are the key features of a research. To select appropriate analytical technique and variables extensive literature reviews have been conducted. The selection procedure with specific reasoning has been briefly summarized in this chapter.

Residential properties are multidimensional commodities characterized by durability, structural inflexibility, and spatial fixity (Chau et al., 2001; So et al., 1996). Typically, the housing attributes are classified into structural attributes (S), locational attributes (L), and neighbourhood attributes (N). These attributes encompass both quantitative and qualitative attributes (Goodman, 1989; Williams, 1991).

The market prices (P) of the property can, therefore, be expressed as:

$$P = f(S, L, N)$$

Different combinations of structural, locational and neighbourhood attributes have been selected in previous housing studies. A brief discussion of those has been summarized as follows.

3.1 Structural Attributes

Prices of properties are frequently related to their structural attributes. As Ball (1973) pointed out, if a house had more desirable attributes than others, the valuation of these attributes would be reflected in higher market prices for this house. Kohlhase (1991) found that the significance of structural attributes can change over time, and may vary between regions. While attributes relating to the number of rooms and floor area are relatively important across regions, other attributes change with the tradition of building style or the climate

Numerous studies reveal that the number of rooms and bedrooms (Li & Brown, 1980), the number of bathrooms (Garrod & Willis, 1992; Linneman 1980), and the floor area

(Rodriguez & Sirmans, 1994) are positively related to the sale price of houses. This is because buyers or renters are willing to pay more for more space, especially functional space. Residential properties with bigger floor areas are desired by big families and buyers who can afford a better standard of living. For example, Garrod and Willis discovered that an additional room increases a property's value by about 7%, and an extra bathroom collecting twice that premium.

Researchers also surmised that building age is negatively related to property prices (Kain & Quigley, 1970; Rodriguez & Sirmans, 1994). This is because *ceteris paribus*, older houses are worth less because they incur more costs in maintenance and repair, and also have decreased usefulness due to changes in design, electrical and mechanical systems (Clapp & Giaccotto, 1998). For example, Kain and Quigley's study showed that a new structure sold for $3,150 more than an identical unit that was 25 years old. However, Li and Brown's (1980) study found an opposite effect of age on some buildings. This increase in value was attributed to the historical significance or vintage effects of the buildings. This led Clapp and Giaccotto (1998) to conclude that there are two components to the age coefficient: a pure-cross sectional depreciation and obsolescence component, as well as a demand-side component that changes over time.

Other researchers claimed that lot size, the existence of a basement, garage (Forrest, Glen & Ward, 1996) are significantly related to the price of the dwelling (Garrod & Willis, 1992; Li & Brown, 1980). For example, Garrod and Willis noted that a single garage adds a 6.9% differential and a double garage three times this amount, while central heating adds about 6.5% to the price of the house.

Chau et al. (2001) classified the physical conditions of the property such as size, floor level, age, and so forth as tangible attributes, whereas attributes such as accessibility, sea-view, environmental quality, and developer's good will are regarded as intangible attributes. According to Chau et al., buyers are willing to pay about HK$416 more per square foot for properties constructed by large reputable developers. This is approximately 7% more than average housing prices.

3.2 Locational Attributes

The location of a property has been conceived in most studies in terms of fixed and relative locational attributes. The fixed locational attributes (Orford, 1988) are quantified with respect to the whole urban area, and pertain to some form of accessibility measure. Relative locational attributes are quantified through surrogate measures such as socio-economic class, racial composition, aesthetic attributes, pollution levels, and proximity to local amenities (Dubin & Sung, 1990).

In the traditional view of location, accessibility is measured in terms of access to the Central Business District (CBD). Accessibility, in whatever form it has been measured, has some influence on housing prices (McMillan, Jarmin, & Thorsnes, 1992; Palmquist, 1992; Habib, 2004). According to Habib, moving 0.5 mile closer to the major arterials adds 585 858 taka premiums, all else held equal, on residential asking price at Rajshahi city.

3.3 Neighbourhood Attributes

In previous researches, neighbourhood attributes have been variously classified as.

(i) Socio-economic variables (Garrod & Willis, 1992), e.g., social class of the neighbourhood (Richardson, Vipond, & Furbey, 1974) and the occupations of the inhabitants

(ii) Local government or municipal services, e g . schools (Clauretie & Neill, 2000; Kain & Quigley, 1970), hospitals (Huh & Kwak, 1997), and places of worship (Carroll et al., 1996)

(iii) Externalities such as crime rates (Thaler, 1978), traffic noise (Williams, 1991), airport noise (Espey & Lopez, 2000), and shopping centres (Des Rosiers, Lagana, Theriault, & Beaudoin, 1996).

Linneman found that between 15 and 50 percent of the standardised variation in site valuations is attributed to neighbourhood attributes, and for structurally identical sites, as much as 100 percent of the differential in site valuations is induced by neighbourhood attributes.

For the socio-economic variables, Richardson et al. (1974) found that the social class of the neighbourhood has an impact on property values, although there may be other determinants.

3.4 Selection of Variables

Based on the above discussion and data availability a total of nine variables have been selected for this study with eight structural variables and one locational parameter. The structural variables are plinth area (or total usable living space) of the house, type of the structure, number of bedrooms, number of bathrooms, garage, kitchen, store and in-house utility connection. Data on building age however was not available. Time series data of environmental qualities and accessibility parameters was also unavailable to incorporate in this study.

Being a macro level study, relative locational attribute has been considered here. Each of the urban center comprise of its own set of combination of surrogate variables, such as, socio-economic measures, racial composition, aesthetic attributes, pollution level, infrastructure services, population pressure, economic growth and so forth. Similar selection procedure for structural attributes can be observed in Reiff & Barbosa (2001).

Neighbourhood attributes can be effectively incorporated in micro-level studies and thus beyond the scope of this study. However variables like local government and municipal services (such as, number of schools and hospitals per '000 population), externalities (crime rate, environmental pollution, etc.) and other socio-economic indicators (per capita GDP, inflation rate, exchange rate, etc.) have been searched for to incorporate in this study. But time series data of these variables are unavailable. A few missing links could be interpolated but the extent of discontinuity was quite large and thus demanded significant time for analysis. Thus these variables could not be incorporated in this study.

Detail definition of the selected variables and methodological discussions have been included in the next chapter.

3.5 Analytical Framework

There are several frameworks for trend analysis and development of forecasting model. Among them Auto-Regressive Integrated Moving Average (ARIMA) model is widely used. It includes autoregressive as well as moving average parameters and explicitly includes differencing in the formulation of the model. One of the main requirements in ARIMA model is that input series need to be stationary. The model also assumes that the residuals are not auto-correlated and systematically distributed. This method could not be employed due to resource constraints.

Ordinary Least Square (OLS) regression is the most extensively used statistical tool in social analyses. This effectively explains the elasticity measures among the variables. However the OLS model would not generate the best fit model due to high collinearity between the selected variables.

Panel data analysis is another widely used tool for time series data analysis. But again it takes significant time for analysis and requires data for a larger time frame.

Logit and Probit models are among other options. But Probit model pose specific data requirement and thus data structure restricts the use of Probit model in this study. Logit models, on the other hand, are less data sensitive and identified as a prominent tool by social scientists for developing forecasting models. Multinomial Logit models have been successfully applied in forecasting house-rent data as well (discussed in Chapter 2). Data specification and resource availability also fits well for the application of the model. Again the model can be used for a mix of continuous and categorical variables and does not assume a linear relationship among the variables. Though having specific problems, for instance, an increase in bias and a decline in the degree of freedom can be observed with increase in the number of non-dichotomous variable this model is mostly preferred for forecasting analysis. Elasticity measures can also be incorporated in this study taking an anti log and then adding one to the final result. Thus this model finally has been selected as being the most appropriate one given the data and resource constraints.

CHAPTER 4

RESEARCH DESIGN

The study employs the logistic regression analysis to develop a forecasting model based on a probabilistic approach.

4.1 Logistic Regression Analysis

Logistic regression is part of a category of statistical models called generalized linear models Logistic regression allows one to predict a discrete outcome, such as group membership, from a set of variables that may be continuous, discrete, dichotomous, or a mix of any of these. Generally, the dependent or response variable is dichotomous, such as presence/absence or success/failure. Discriminant analysis is also used to predict group membership with only two groups. However, discriminant analysis can only be used with continuous independent variables. Thus, in instances where the independent variables are a categorical, or a mix of continuous and categorical, logistic regression is preferred A logistic regression model does not involve decision trees and is more akin to nonlinear regression such as fitting a polynomial to a set of data values (Agresti, 1996).

Let the probability that the random variable Y takes the value 1 be p, so that the probability that it takes the value 0 is 1-p = q. Then the mean value of Y, or the expected value, is

$$E(Y) = 1*p + 0*(1-p) = p$$

As in the case of binary or multinomial logistic regression, the aim is to express the expected value of Y as a function of the independent variables $X_1, X_2, X_3, X_4 \ldots \ldots X_k$, let this function be given by

$$E(Y) = p = 1/\{1+e^{-(\beta_0+\beta_1*X_1+\beta_2*X_2+\beta_3*X_3 \ldots -\beta_k*X_k)}\}$$

$$= 1/\{1+e^{-(\beta_0+\Sigma\beta_k*X_k)}\}$$

The model is derived from the mathematical function,

$f(T) = 1/\{1 + e^{-T}\}$, where $-\infty \leq T \leq \infty$.

This function f (T) increases monotonically as T varies from $-\infty$ to ∞ (Sufian, 1998).

Logistic regression can be used to predict a dependent variable on the basis of continuous and/or categorical independents and to determine the percent of variance in the dependent variable explained by the independents, to rank the relative importance of independents; to assess interaction effects; and to understand the impact of covariate control variables. Logistic regression applies maximum likelihood estimation after transforming the dependent into a logit variable (the natural log of the odds of the dependent occurring or not) In this way, logistic regression estimates the probability of a certain event occurring Logistic regression calculates changes in the log odds of the dependent, not changes in the dependent itself as Ordinary Least Square (OLS) regression does (Hosmer and Stanley, 1989).

Logistic regression has many analogies to OLS regression: logit coefficients correspond to b coefficients in the logistic regression equation, the standardized logit coefficients correspond to beta weights, and a pseudo R^2 statistic is available to summarize the strength of the relationship. Unlike OLS regression, however, logistic regression does not assume linearity of relationship between the independent variables and the dependent, does not require normally distributed variables, does not assume homoscedasticity, and in general has less stringent requirements. It does, however, require that observations are independent and that the independent variables be linearly related to the logit of the dependent. The success of the logistic regression can be assessed by looking at the classification table, showing correct and incorrect classifications of the dichotomous, ordinal, or polytomous dependent. Also, goodness-of-fit tests such as model chi-square are available as indicators of model appropriateness as is the Wald statistic to test the significance of individual independent variables

4.2 OLS vs. Logistic Regression Analysis

Logistic regression is popular in part because it enables the researcher to overcome many of the restrictive assumptions of OLS regression (however, other assumptions still apply):

1. Logistic regression does not assume a linear relationship between the dependents and the independents. It may handle nonlinear effects even when exponential and polynomial terms are not explicitly added as additional independents because the logit link function on the left-hand side of the logistic regression equation is non-linear. However, it is also possible and permitted to add explicit interaction and power terms as variables on the right-hand side of the logistic equation, as in OLS regression.
2. The dependent variable need not be normally distributed (but does assume its distribution is within the range of the exponential family of distributions, such as normal, Poisson, binomial, gamma).
3. The dependent variable need not be homoscedastic for each level of the independents; that is, there is no homogeneity of variance assumption.
4. Normally distributed error terms are not assumed.
5. Logistic regression does not require that the independents be interval.
6. Logistic regression does not require that the independents be unbounded.

4.3 Binary vs. Multinomial Logistic Regression

Binary or Dichotomous Logistic Regression (commonly termed as logistic regression) is a type of predictive model that can be used when the target variable is a categorical variable with two categories – for example live/die, has disease/doesn't have disease, purchases product/doesn't purchase, wins race/doesn't win, etc. Binary logistic regression is the more widely used than multinomial logistic regression.

Multinomial or Polychotomous Logistic Regression is useful for situations in which the researcher wants to be able to classify subjects based on values of a set of predictor variables. This type of regression is similar to logistic regression, but it is more general because the dependent variable is not restricted to two categories.

Thus, Binomial (or binary) logistic regression is a form of regression, which is used when the dependent is a dichotomy and the independents are of any type. Multinomial logistic regression exists to handle the case of dependents with more classes than two. Given only two categories in the dependent variable, Binary logistic regression produces very helpful plots. Given more than two categories in the dependent variable, binary logistic regression cannot be used. Multinomial logistic regression replaces binary logistic in this situation. However, the multinomial logistic analysis uses a different approach that does not generate plots.

In this study a multinomial logistic regression analysis has been applied to forecast the probability of a year-on-year house rent increase at different rates. The rates of rent-increase have been categorized into three groups, viz 1% - 5%, 6% - 10% and 11% - 15%. Generally, in multinomial logistic regression analysis the overall probability is estimated based on any one of the categories. For example, if the last category of rent-increase rate have been selected as reference category, then the probability of a year-on-year rent increase at the rate of 1% - 5% and 6% - 10% would have been calculated compared to the probability of rent-increase at the rate of 11% - 15%. But such estimation of probability could have been difficult to interpret Thus for better understanding the reference category in this case has been set to 0. As there were a significant number of cases where the year-on-year rent increase was 0, the model gives significant results. Thus the model generates a forecasting equation providing the probability of a year-on-year rent increase at the rate of 1% - 5% compared to 0%, at the rate of 6% - 10% compared to 0% and at the rate of 11% - 15% compared to 0% rent-increase. Or the relative probability of a year-on-year rent increase at different rates for a given physical and locational parameters of a house.

4.4 Definition of Variables:

Nine variables are incorporated in this study. Of them eight are structural variables and one is locational variable. The location of the house has been defined in terms of their setting in one of the metropolitan cities of Bangladesh

Logistic regression can be used with two types of variables:

1. A categorical variable.
2. A continuous variable.

So, the variables are classified as being 'categorical' or 'continuous'. The list of the variables is given in table 3.1 and followed by the definition of the variables.

Table 4.1: List of variables

Variable Name	Definition	Unit	Type of Variable
pl_area	Plinth area (or total usable living space) of the house	Square Feet	Categorical
st_type	Type of the structure	Pucca, Semi-pucca or Kutcha	Categorical
no_rooms	Number of bedrooms	Number	Continuous
no_bath	Number of bathrooms	Number	Continuous
garage	Availability of garage	'yes' or 'no'	Categorical
kitchen	Availability of kitchen	'yes' or 'no'	Categorical
utility	Availability of in-house utility connection	'yes' or 'no'	Categorical
store	Availability of store room	'yes' or 'no'	Categorical
location	Location of the house	Name of metropolitan cities (e.g Dhaka, Chittagong, Rajshahi or Khulna)	Categorical

a. Plinth area of the house:

Plinth area of the house represents the actual living area of the house. This has been measured in square feet unit divided into nine groups of houses (table 3.2). A further classification has been carried out, based on the quality of the houses, as being owned by high-income, middle-income and low-income group of the society. In this study these are referred to as high-income dwellings, middle-income dwellings and low-income dwellings

Table 4.2: Different categories of plinth areas

Sl. No.	Income Level*	Plinth Area of the house (sq. ft.)
1	Higher	2039 & above
2		1410-2038
3		841-1409
4		608-840
5	Middle	360-607
6		240-359
7		183-239
8	Lower	183-239
9		182 & below

*Income level has been sorted based on quality of the dwellings and not on actual income of the household.

Source: Compiled from BBS

b. Type of Structure:

Three types of structures have been considered in this study, namely, Pucca, Semi-pucca and Kutcha structures. The definitions of these structures are given below

Pucca House:

Foundation: Brick and concrete.

Walls: Brick or Concrete.

Roof: Reinforced concrete (RC).

Semi-Pucca House:

Foundation: Earthen plinth; Brick perimeter wall with earth infill; Brick and concrete.

Walls: Bamboo mats; CI sheet; Timber (sometimes split bamboo) framing. Earthen walls in some areas. Sometimes part or full brick.

Roof: CI sheet with timber framing (sometimes split bamboo).

Kutcha House:

Foundation: Earthen plinth with bamboo (sometimes timber) posts.

Walls: Organic materials - jutestick, catkin grass, straw, bamboo mats, etc. Split bamboo framing. Earthen walls in some areas.

Roof: Thatch - rice or wheat or maize straw, catkin grass, etc with split bamboo or sometimes reed stalk framing

c. Number of bedrooms:

The number of bedrooms has been taken as continuous variable ranging from 1 to 4.

d. Number of bathrooms:

The number of bathrooms is another continuous variable. This variable ranged between 1 and 3.

e. Garage, Kitchen, Storeroom and Utility services:

These are the dichotomous categorical variables saying the availability or unavailability (presence or absence) of the respective facilities (i.e garage, kitchen, store and utility provisions). The utility provisions include the availability or unavailability of in-house water, gas and electricity connection.

f. Location:

Location has been categorized as the house being located in one of the four metropolitan cities of Bangladesh, namely, Dhaka, Chittagong, Rajshahi or Khulna metropolitan area.

4.5 Dummy Variables

Dummy variables (also known as binary, indicator, dichotomous, discrete, or categorical variables) are a way of incorporating qualitative information into regression analysis. Qualitative data, unlike continuous data, explains simply whether the individual observation belongs to a particular category. If one or more of the independent variables are nominal, the dummy variable technique is used, especially in the case of multiple regression.

As both the structural and the locational variables are qualitative in nature, except 'no_rooms' and 'no_bath' all the variables are taken as dummy variables in this study. The following table describes the dummy variables selected in this study.

Table 4.3: List of dummy variables

Dummy Variables	Description
pl_area	1 if plinth area is ≥ 2039 sq. ft., 0 if not,
	1 if plinth area is between 1410-2038 sq. ft., 0 if not,
	.....
	.....
	1 if plinth area is ≤182 sq. ft., 0 if not.
st_type	1 if type of structure is 'pucca', 0 if not,
	1 if type of structure is 'semi-pucca', 0 if not,
	1 if type of structure is 'kutcha', 0 if not.
garage	1 if garage is available in the house, 0 if not.
kitchen	1 if kitchen is available in the house, 0 if not.
utility	1 if in-house utility provisions are available in the house, 0 if not.
store	1 if storeroom is available in the house, 0 if not.
location	1 if location is 'Dhaka', 0 if not,
	1 if location is 'Chittagong', 0 if not.
	1 if location is 'Rajshahi', 0 if not,
	1 if location is 'Khulna', 0 if not.

CHAPTER 5

INTRA-URBAN TREND ANALYSIS

The first objective of this study was to investigate the within-city variation of house rents, which has been summarized in this chapter. For this the dwellings are classified into 14 categories. For each of the four metropolitan cities of Bangladesh house rent variation over last 15 years have been analyzed using bar charts and key findings are discussed here

To analyze the intra-urban trend of house-rents, the categorization of dwellings done by BBS has been followed in this study. Houses are classified based on the usable living area or plinth area of the house (in sq. ft.), type of structure and availability of in-house utility connections. Then they are arranged as the dwellings of high, middle and low income group of the society based on the quality and standard of the dwellings. These will be referred to as high-income dwellings, middle-income dwellings and low-income dwellings henceforth in this report. A code for each of the dwelling group has been used (for example, T1 means Type 1 housing, T2 means Type 2 housing, etc.) in this chapter to refer to particular type of dwelling. Table 5.1 summarizes the classification applied in this study.

There are 14 types of dwellings in total. Of those first 4 types of dwelling are mentioned as high-income dwellings, the next 5 types as middle-income dwellings and the rest 5 as low-income dwellings. The patterns of house-rents in all these 14 types of dwellings within the metropolitan cities are summarized as follows

Table 5.1: Classification and codes of the dwellings

Income Level*	Code		Plinth Area of the house (sq. ft.)	Type of Structure	Availability of Utility Connection
	Code No.	Meaning			
Higher	T1	Type 1 dwelling	2039 & above	Pucca	Yes
	T2	Type 2 dwelling	1410-2038	Pucca	Yes
	T3	Type 3 dwelling	841-1409	Pucca	Yes
	T4	Type 4 dwelling	608-840	Pucca	Yes
Middle	T5	Type 5 dwelling	360-607	Pucca	Yes
	T6	Type 6 dwelling	240-359	Pucca	Yes
	T7	Type 7 dwelling	240-359	Semi-pucca	Yes
	T8	Type 8 dwelling	240-359	Semi-pucca	No
	T9	Type 9 dwelling	183-239	Semi-pucca	Yes
Lower	T10	Type 10 dwelling	183-239	Semi-pucca	No
	T11	Type 11 dwelling	183-239	Pucca	No
	T12	Type 12 dwelling	183-239	Kutcha	Yes
	T13	Type 13 dwelling	183-239	Kutcha	No
	T14	Type 14 dwelling	182 & below	Kutcha	No

*Income level has been sorted based on quality of the dwellings and not on actual income of the household

Source Modified from BBS

5.1 House-rent Trend of Dhaka Metropolitan Area

In Dhaka metropolitan area, the house rent (per sq. ft.) is the highest for the dwellings of middle-income people as can be seen from Figure 5.1, 5.2 and 5.3. In case of high-income dwellings it can be observed that rent is higher of type-1 dwellings, although the rent of type-2 dwellings increase at the highest rate (figure 5.1).

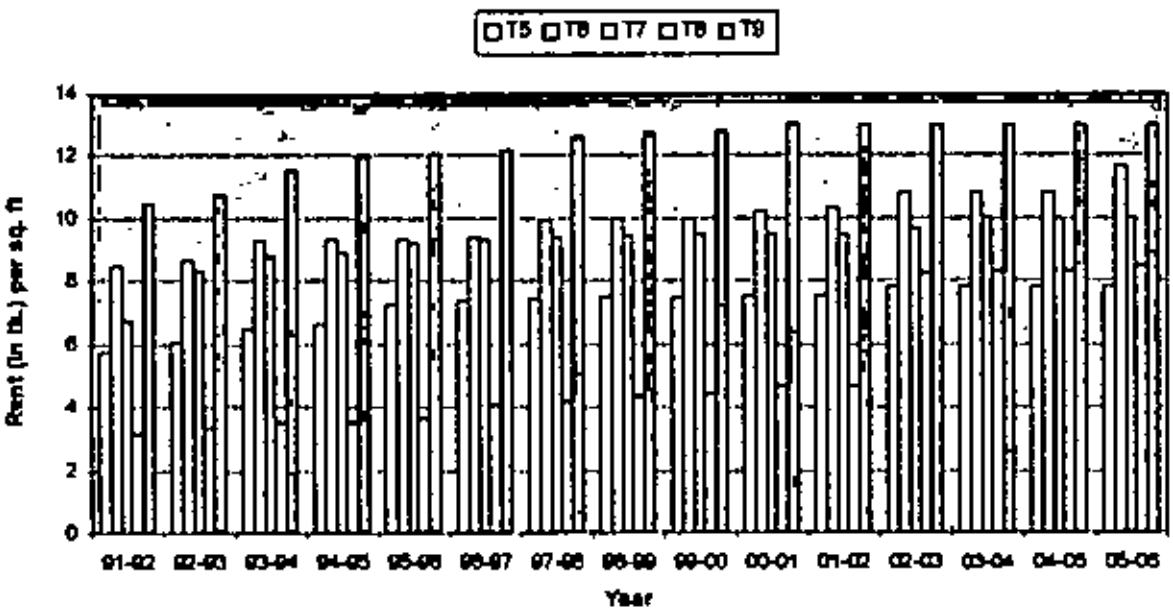
Interestingly the rents of type-9 dwellings is the highest though it has the lowest plinth area (183-239 sq. ft.). And the rent of type-8 dwellings is the lowest of all though its plinth area is more (240-359 sq. ft.). Both of the type-9 and type-8 dwellings are two-bedroom semi pucca structures. The only difference is that type-8 dwellings do not have in-house utility (water, gas and electricity) connection whereas these are all available in type-9 dwellings. It is remarkable that as we proceed from high quality to low quality dwellings the house-rent (per sq. ft.) increases (except for type-8 dwellings) (figure 5.2).

Rents of the dwellings of low-income people represent a rather uniform distribution (figure 5.3). Rents gradually decline as we proceed from relatively high quality to relatively low quality dwellings, although the deviation is substantial.

Figure 5.1: Trends of House-Rent Variation of High-Income Dwellings of Dhaka Metropolitan Area

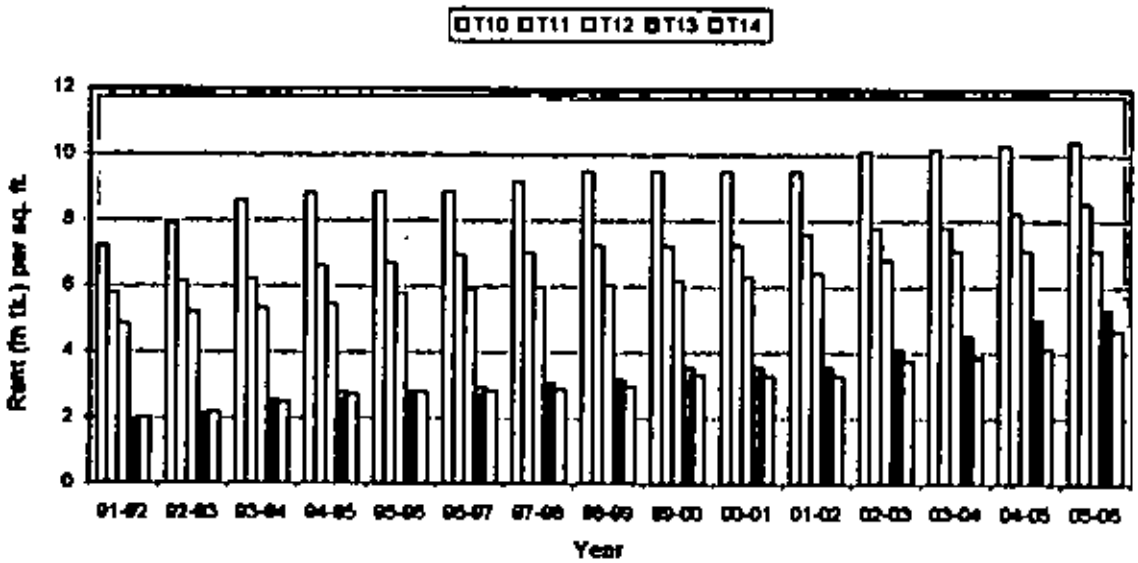
Source: Compiled and calculated from data of National Accounting Wing, BBS

Figure 5.2: Trends of House-Rent Variation of Middle-Income Dwellings of Dhaka Metropolitan Area



Source: Compiled and calculated from data of National Accounting Wing, BBS.

Figure 5.3: Trend of House-Rent Variation of Low-Income Dwellings of Dhaka Metropolitan Area



Source: Compiled and calculated from data of National Accounting Wing, BBS

5.2 House-rent Trend of Chittagong Metropolitan Area

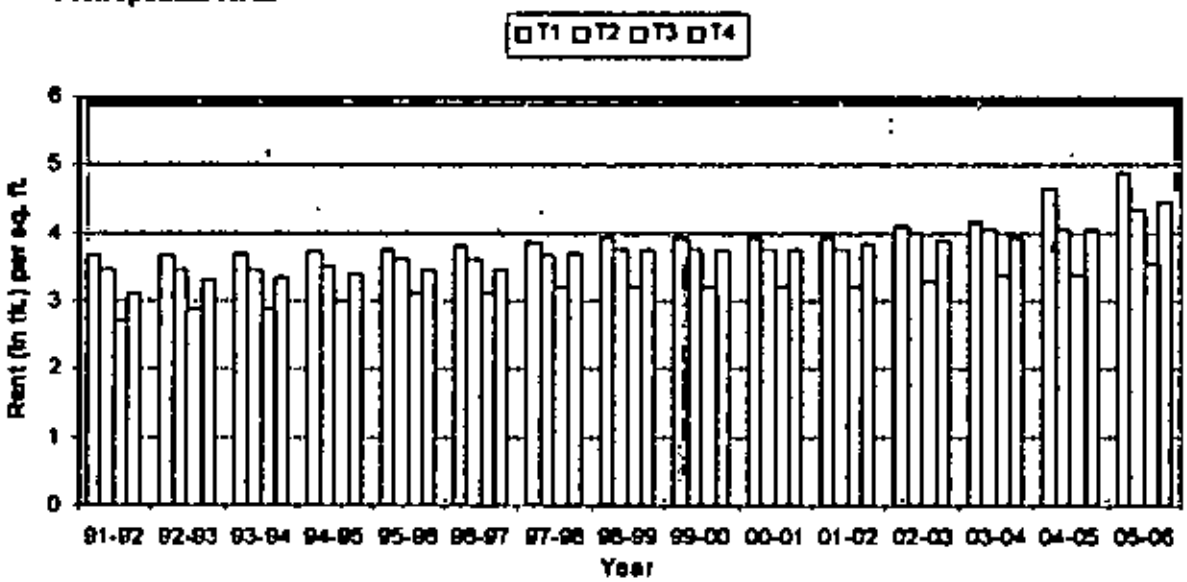
In Chittagong metropolitan area, again the house rents of the middle-income dwellings are the highest, almost double to the rent of high-income dwellings (figure 5.4 to 5.6). And the growth of house-rent of high-income dwellings is very marginal since 1991.

In case of middle-income dwellings the house-rents can be observed as low as tk.3.5 per sq. ft. to as high as tk 9 per sq. ft. A sudden rise in the house-rent of type-11 dwelling can be observed in the year 2004-05. This can be assumed as being cause by data noise or error.

Interestingly, house-rents of type-6 (240-359 sq. ft.) dwellings are significantly higher than that of type-5 (360-607 sq. ft.) dwellings. And similar to Dhaka city, house-rents of type-9 dwellings are the highest though its plinth area is the smallest of all of the middle-income dwellings (figure 5.5)

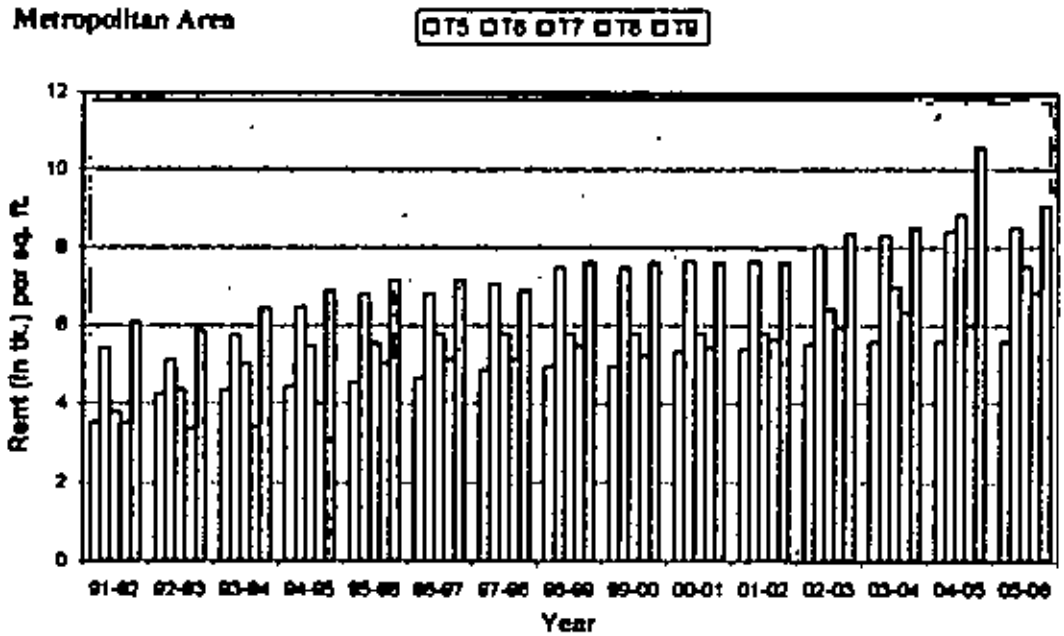
Rents of low-income dwellings are analogous to those of Dhaka. Rents tend to decrease from relatively good quality to inferior quality residences. Although the deviation among them is minor than Dhaka city dwellings (figure 5.6).

Figure 5.4: Trends of House Rent Variation of High-Income Dwellings of Chittagong Metropolitan Area



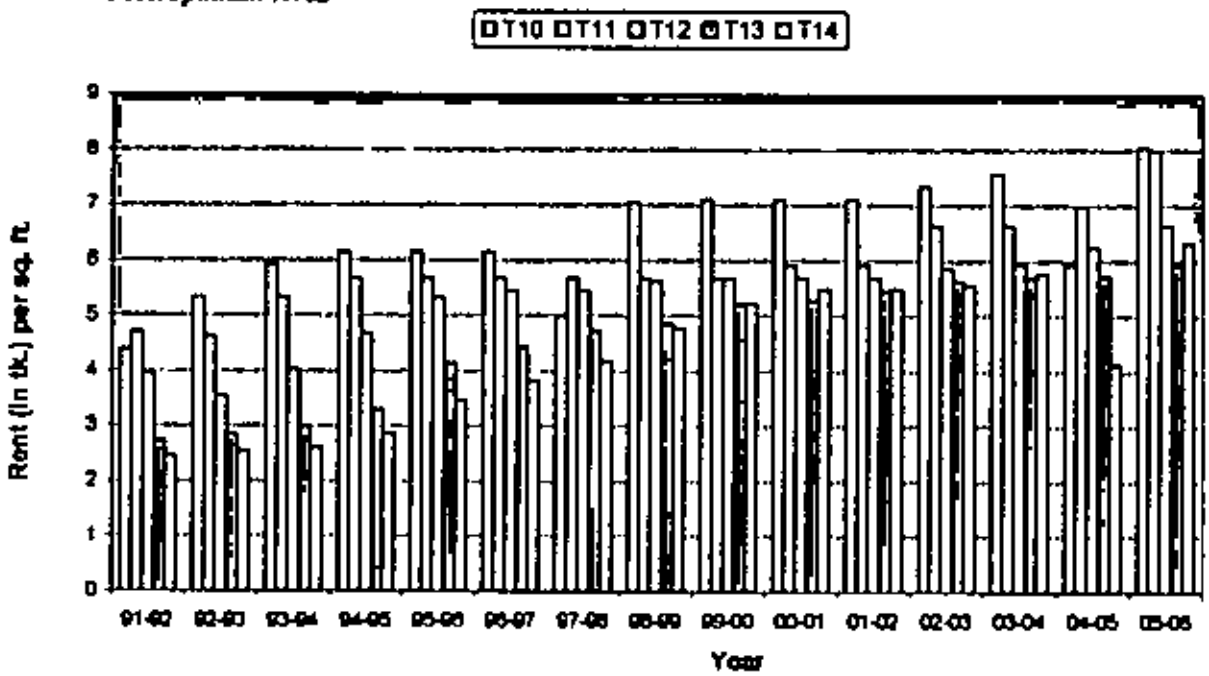
Source: Compiled and calculated from data of National Accounting Wing, BBS

Figure 5.5: Trends of House Rent Variation of Middle-Income Dwellings of Chittagong Metropolitan Area



Source: Compiled and calculated from data of National Accounting Wing, BBS

Figure 5.6: Trends of House Rent Variation of Low-Income Dwellings of Chittagong Metropolitan Area



Source: Compiled and calculated from data of National Accounting Wing, BBS

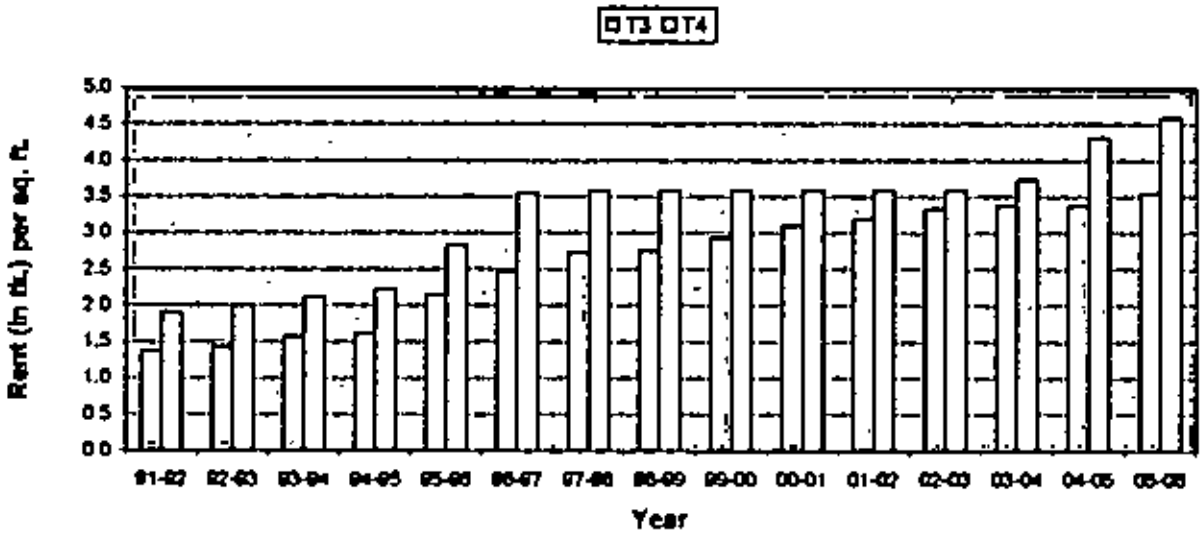
5.3 House-rent Trend of Rajshahi Metropolitan Area

One of the highest deviation in house-rents can be observed in Rajshahi metropolitan city ranging from as low as tk. 1.5 per sq. ft. to as high as tk. 9.5 per sq. ft (figure 5.7 to 5.9). The rent-growth trend also shows that the pace of rent-increase is among the highest in Rajshahi city (chapter 5).

As can be observed for figure 5.7, data for type-1 and type-2 dwellings are not available for Rajshahi city. The reason has been identified by the BBS surveyors, as bigger dwellings are less in demand in this city. Rents of high-income dwellings are significantly lower. This again is the result of low demand for bigger dwellings in Rajshahi city.

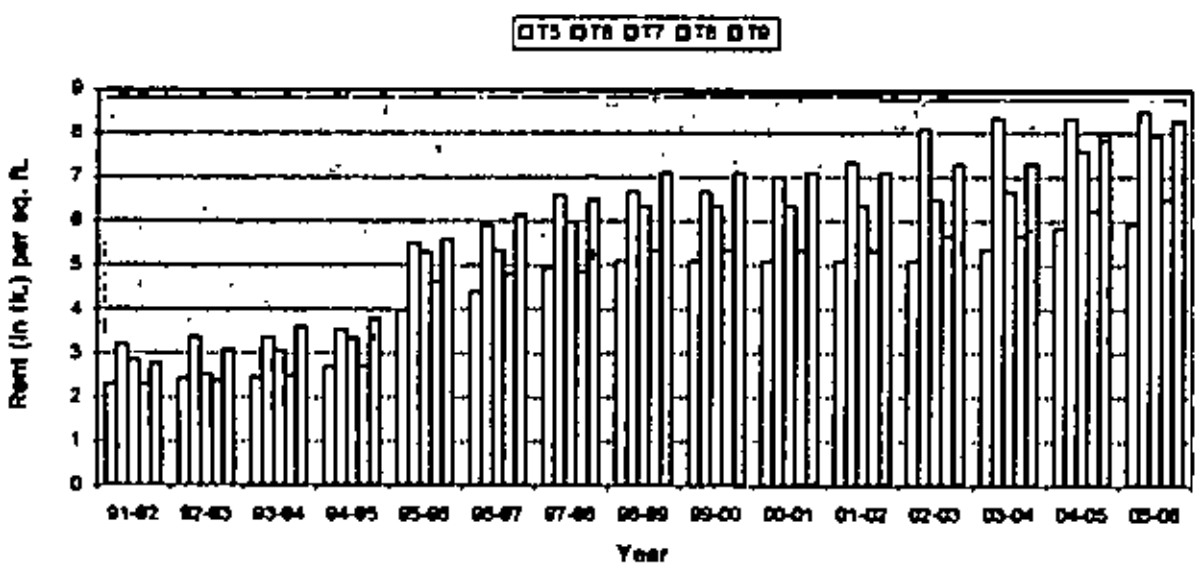
House-rents of middle-income dwellings are the highest similar to Dhaka and Chittagong. Although it can be noticed that rents of type-6 dwellings are the highest. Next highest rents are charged for type-9 dwellings.

Figure 5.7: Trend of House-Rent Variation of High-Income Dwellings of Rajshahi Metropolitan Area



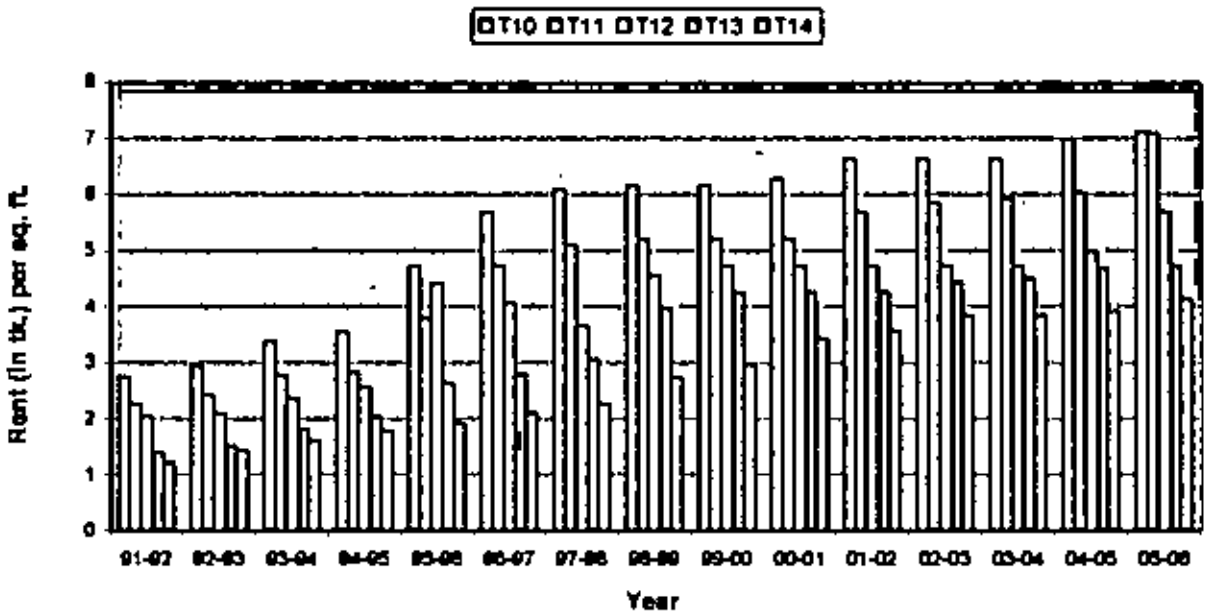
Source: Compiled and calculated from data of National Accounting Wing, BBS.

Figure 5.8: Trend of House-Rent Variation of Middle-Income Dwellings of Rajshahi Metropolitan Area



Source: Compiled and calculated from data of National Accounting Wing, BBS.

Figure 5.9: Trend of House-Rent Variation of Low-Income Dwellings of Rajshahi Metropolitan Area



Source: Compiled and calculated from data of National Accounting Wing, BBS.

5.4 House-rent Trend of Khulna Metropolitan Area

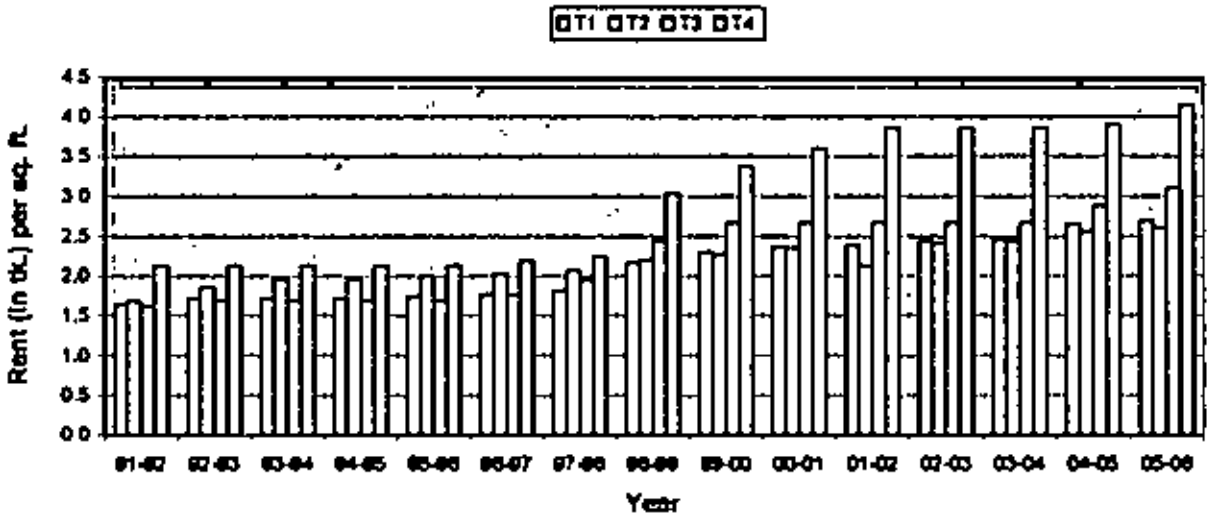
House-rents are the lowest in Khulna metropolitan city. Although, a sudden climb can be observed from 1999.

A significant exception of the house-rents of high-income dwellings can be observed that rents of type-4 dwellings are the highest, which have the lowest plinth area (608-840 sq ft.).

Rents of middle-income dwellings present similar characteristics to the other three cities. As can be observed from figure 5.11, rents are highest for middle-income renters and rents of type-9 dwellings are the highest here as well.

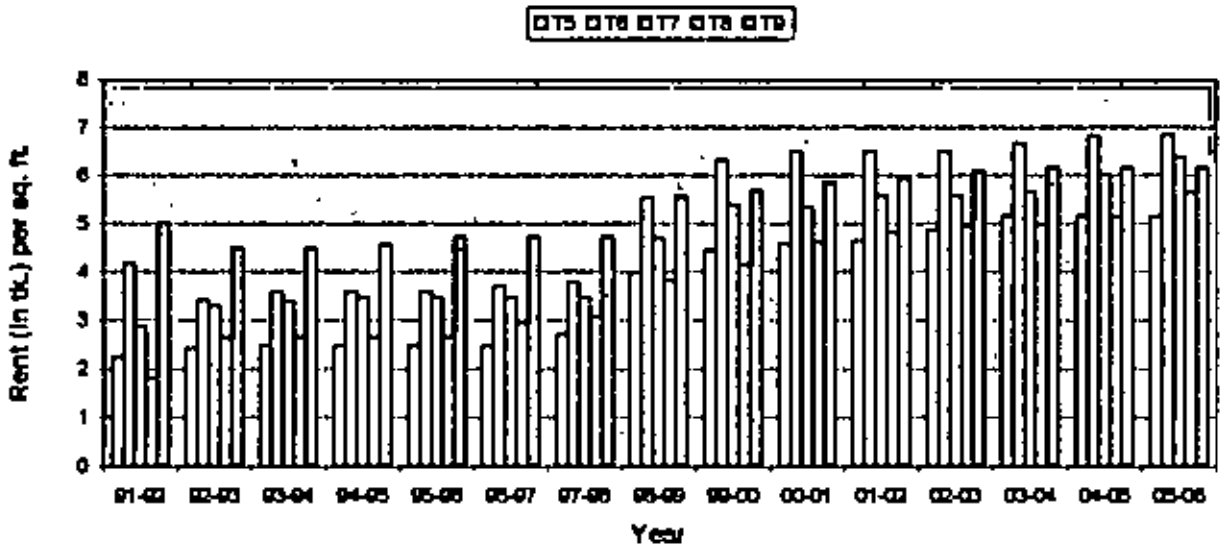
Rents of low-income dwellings have grown rapidly since 1991 and have almost been doubled by 2006.

Figure 5.10: Trend of House-Rent Variation of High-Income Dwellings of Khulna Metropolitan Area



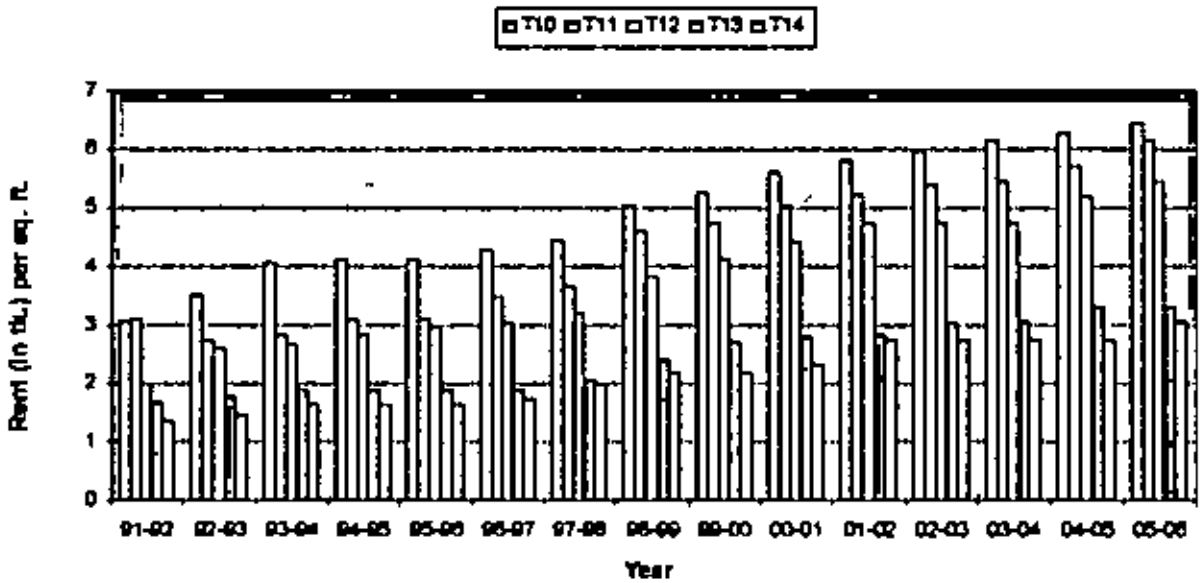
Source: Compiled and calculated from data of National Accounting Wing, BBS.

Figure 5.11: Trend of House-Rent Variation of Middle-Income Dwellings of Khulna Metropolitan Area



Source: Compiled and calculated from data of National Accounting Wing, BBS.

Figure 5.12: Trend of House-Rent Variation of Low-Income Dwellings of Khulna Metropolitan Area



Source: Compiled and calculated from data of National Accounting Wing, BBS.

To summarize, it can be said that house-rents of all types of dwellings are the highest in Dhaka metropolitan area and lowest in Khulna, although the highest growth can be observed here (rent growth patterns have been elaborately discussed in chapter 6).

The lowest rent of high-income dwellings can be found in Rajshahi metropolitan city. In case of low-income dwellings highest rent can be observed in Dhaka metropolitan city. Rents of middle-income dwellings are higher in every city having the highest value in Dhaka.

Dhaka, being the only mega city of Bangladesh, is facing a massive influx of migrated population. Especially the poor rural people migrate at a higher rate to Dhaka city for better income and employment opportunities. This creates an excessive demand for housing the obvious result of which is higher rents compared to other urban centers. The comparative analysis of house-rent among the urban centers has been presented in the next chapter.

CHAPTER 6

INTER-URBAN TREND ANALYSIS

Having observed the house-rent variation within the urban centers, the next step is to explore the comparative picture of house-rent variation among them. This was the second objective of this research. The comparative analysis has been organized in two sections in this chapter. At first the house-rent variation among the cities has been analyzed be means of linear trend lines. And then growth pattern among the urban areas are calculated and compared.

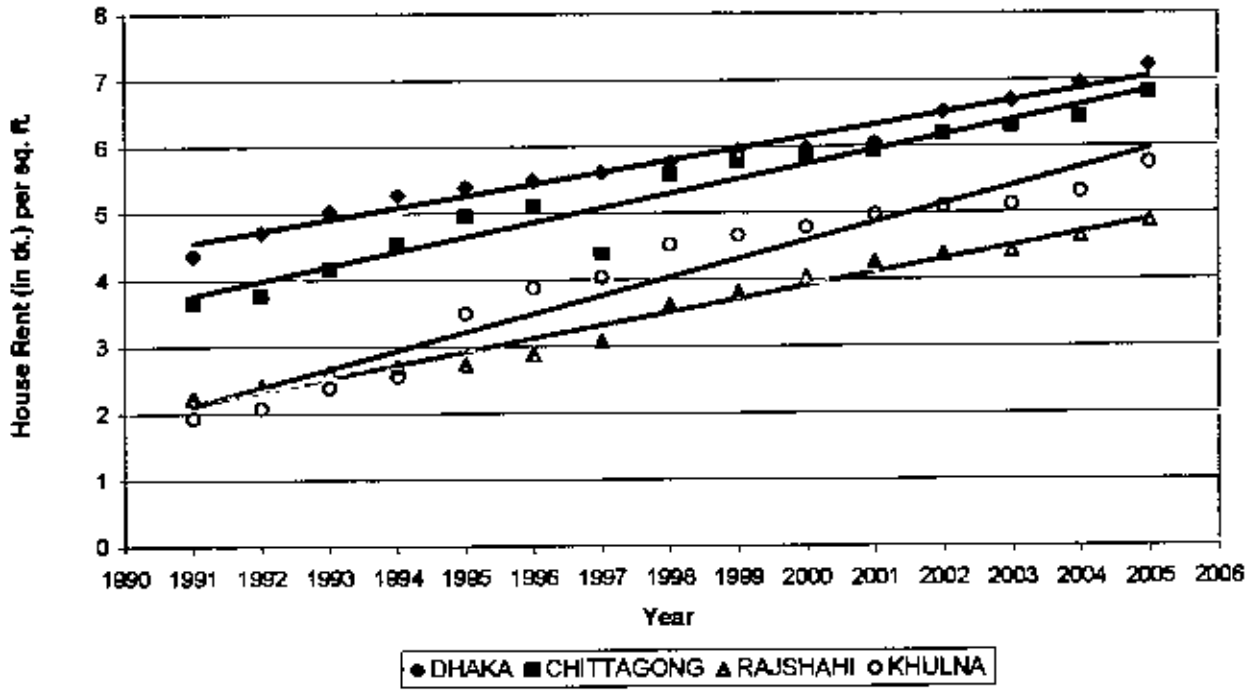
6.1 Inter-urban Trends of House-rent

The inter-urban trends of house-rent have been summarized in figure 6.1, 6.2 and 6.3. The figures represent the trends in house-rent growth of high, middle and low-income dwellings respectively.

The house-rents of high-income residences grew (on an average) from tk. 2 per sq ft. to about tk. 7 per sq.ft in past 15 years. Whereas. house rents of middle-income dwellings range from tk 2.5 per sq.ft.to tk. 9.5 per sq.ft. And for low-income dwellings house rent varies between tk. 1.8 per sq.ft and tk. 6.2 per sq ft.

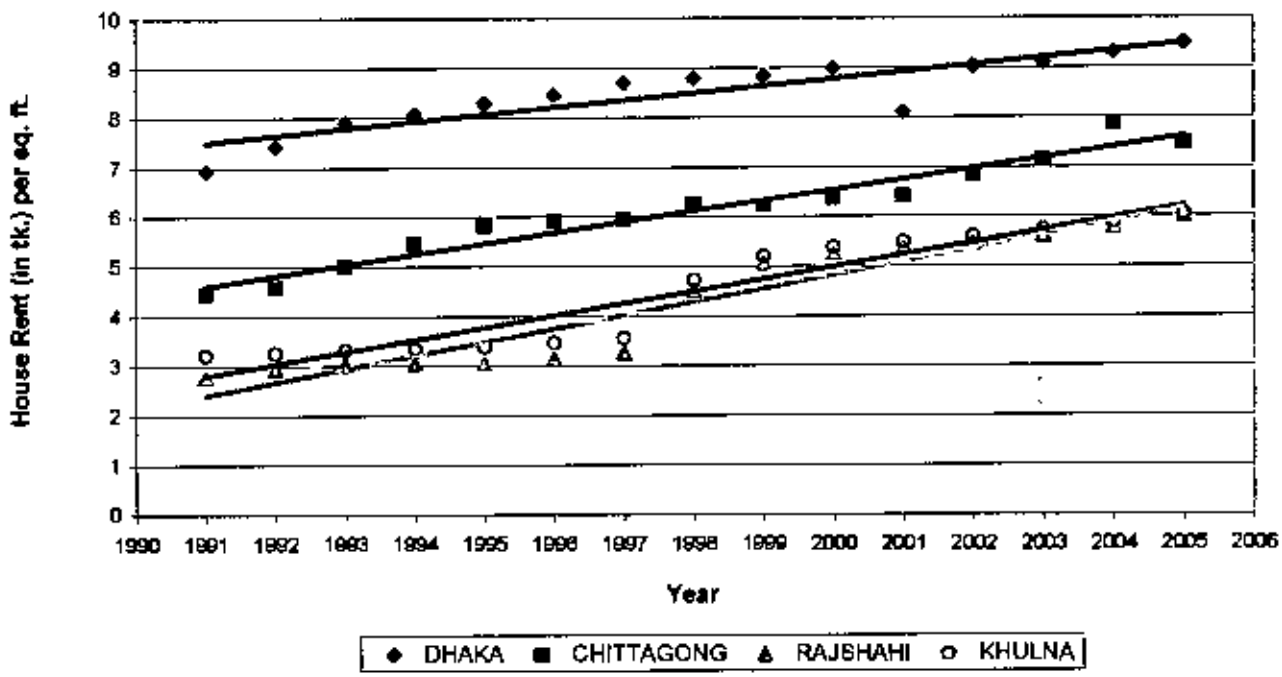
The following figures depict the obvious and predictable scenario of house-rent trend. The bigger two metropolitan cities, namely Dhaka and Chittagong maintain the higher house-rent patterns: Dhaka being the highest for all the three types of dwellings. However, the graphs of Rajshahi and Khulna city are rather steep compared to that of the other two cities.

Figure 6.1: Inter-urban comparisons of house-rent trends of high-income dwellings



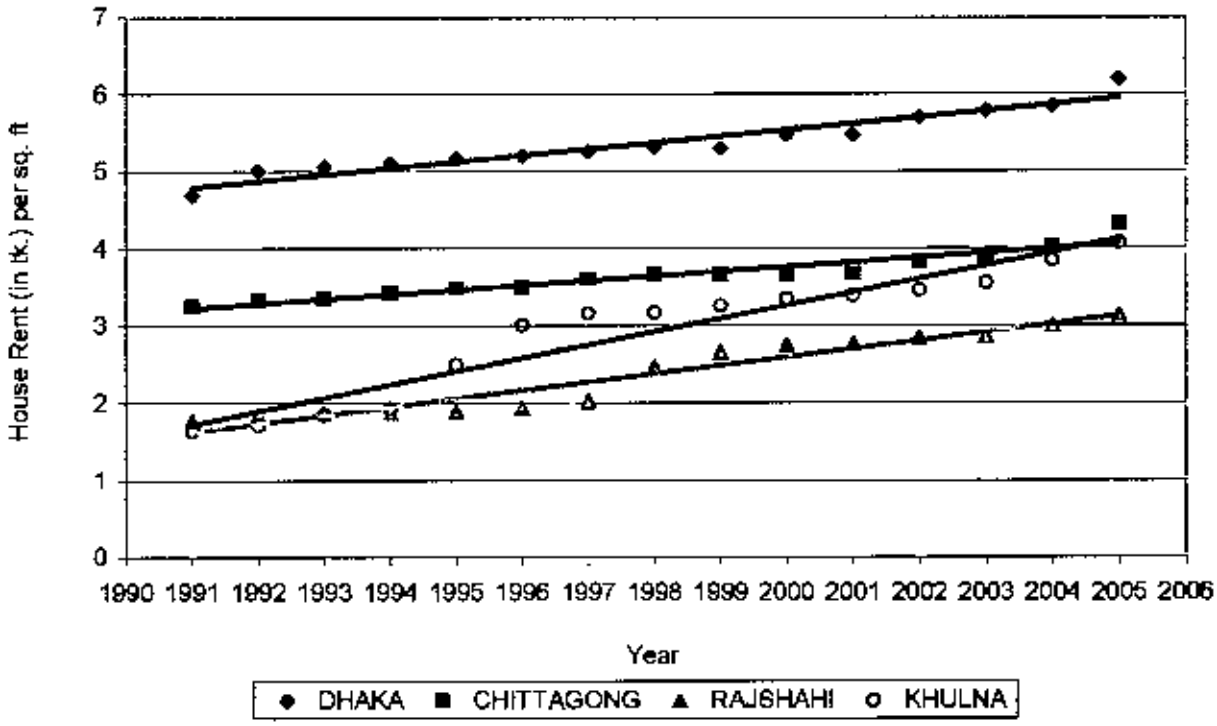
Source. Compiled and calculated from data of National Accounting Wing, BBS.

Figure 6.2: Inter-urban comparisons of house-rent trends of middle-income dwellings



Source Compiled and calculated from data of National Accounting Wing, BBS.

Figure 6.3: Inter-urban comparisons of house-rent trends of low-income dwellings



Source: Compiled and calculated from data of National Accounting Wing, BBS.

6.2 Inter-urban Trends of House-rent Growth

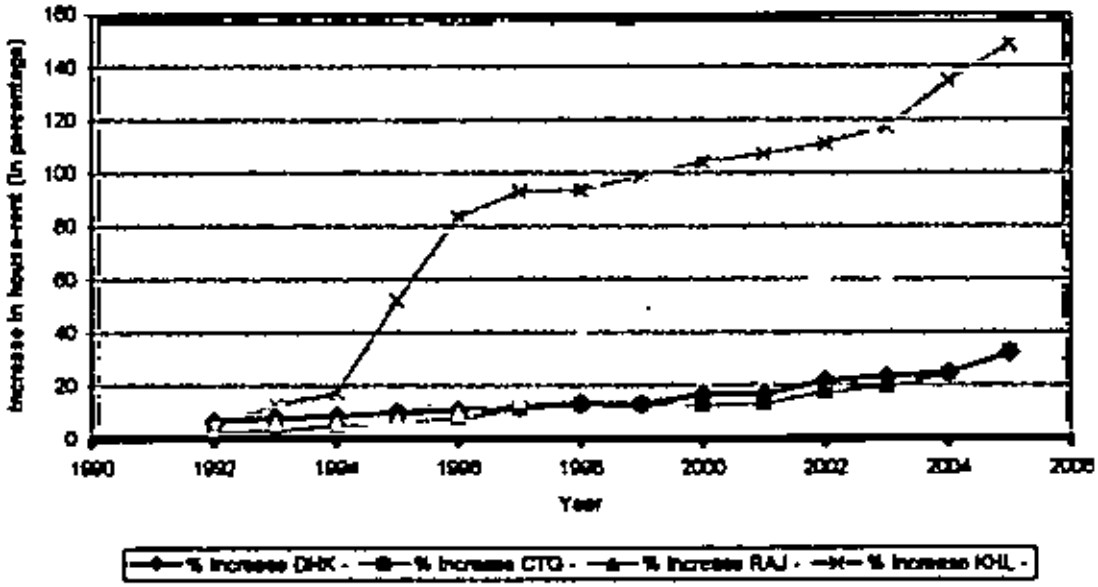
The inter-urban trends of house-rent growth have been organized separately for low, middle and high income dwellings. Each section comprises two types of graphs. The first one showing the incremental increase of house-rent trend from the base year 1991. And the second figure depicts a year-on-year increase graph, measuring the change in house rent with respect to the immediate preceding years.

6.2.1 Inter-urban house-rent growth of high-income residences

A steep growth in house rent of high-income dwellings can be observed in Khulna metropolitan area between 1994 and 1998 The city also presents the highest increase in house rent in last 15 years; at about 150%. The next elevated growth can be observed in the Rajshahi metropolitan city but at the rate of half of Khulna city (78%). A sudden rise can be observed here also, between 1997 and 1999.

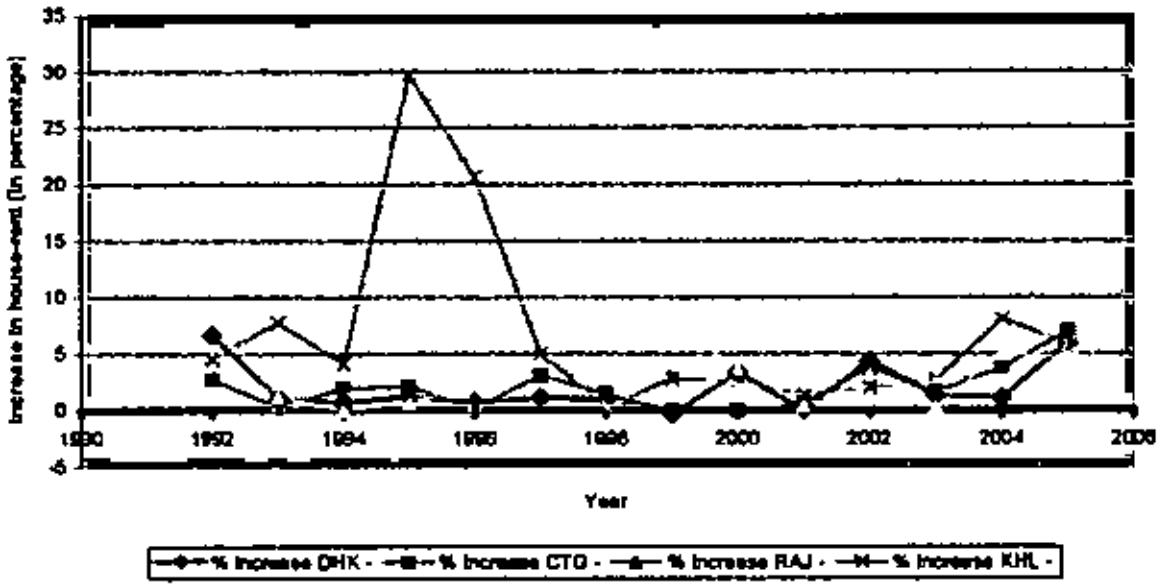
Dhaka and Chittagong metropolitan cities faced rather even growth. However, the year-on-year increase rate of Dhaka city is characterized with regular ups and downs.

Figure 6.4: Inter-urban growth trend of house-rent of high-income residences



Source: Compiled and calculated from data of National Accounting Wing, BBS

Figure 6.5: Inter-urban comparison of year-on-year growth of house-rent of high-income residences

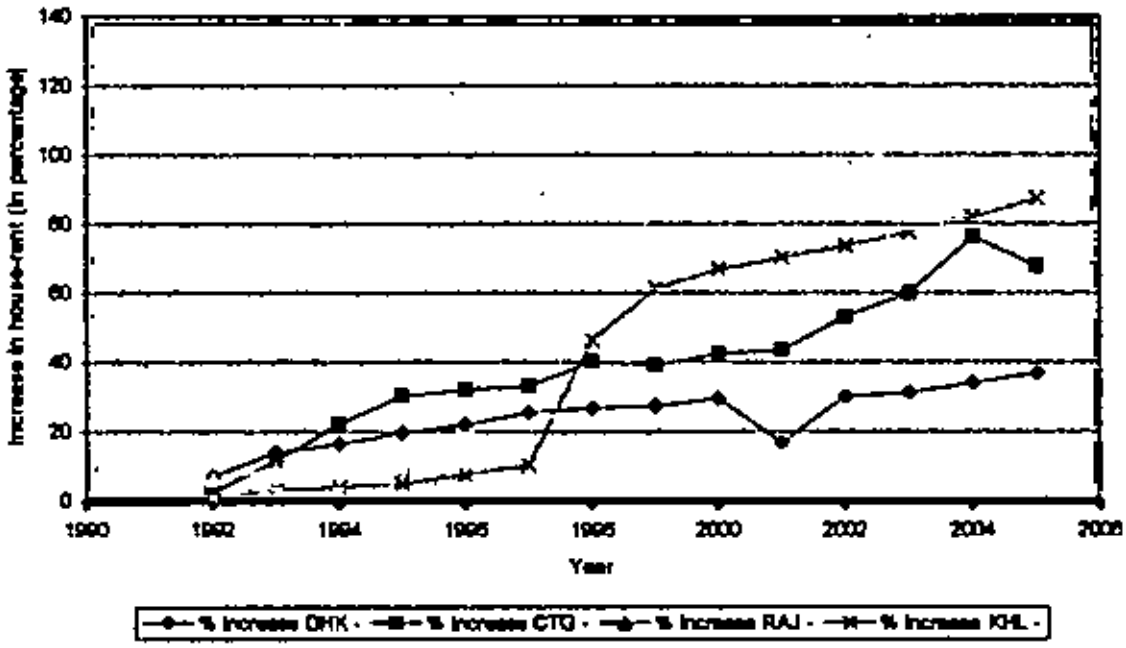


Source: Compiled and calculated from data of National Accounting Wing, BBS

6.2.2 Inter-urban in house-rent growth of middle-income residences

In all the metropolitan cities, an incremental boost in house-rent of middle-income dwellings can be witnessed after 1997. In Rajshahi and Khulna the graph steadily head upwards reaching about 118% range in Rajshahi. However, middle-income dwellings' house-rent increased the least in last 15 years, compared to a 150% increase for high-income dwellings and 200% for low-income dwellings.

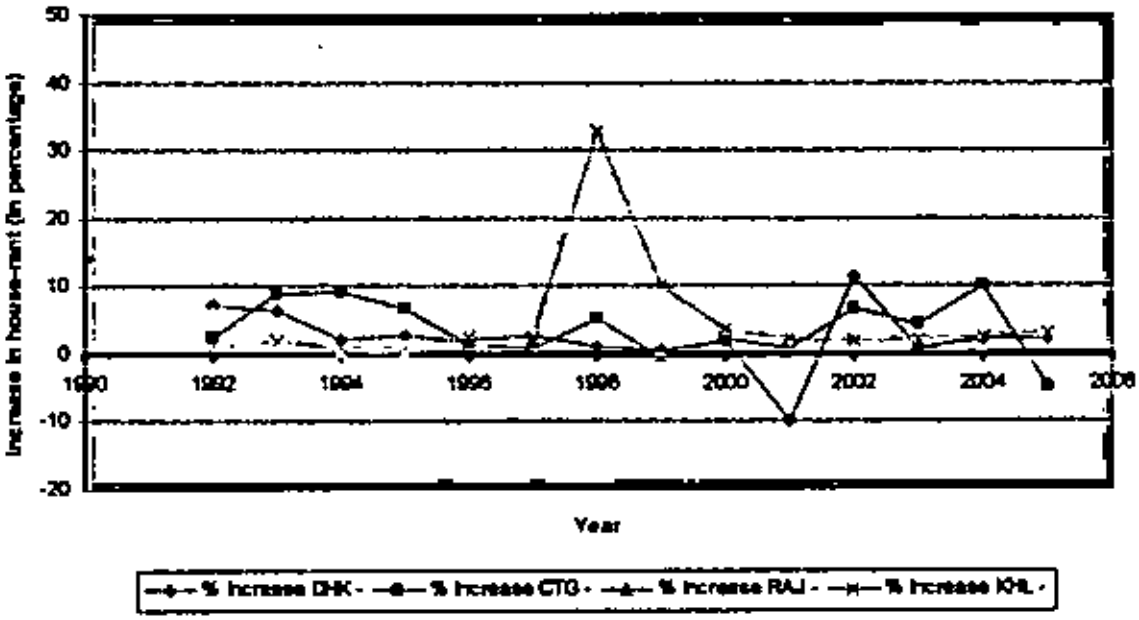
Figure 6.6: Inter-urban growth trend of house-rent of middle-income residences



Source: Compiled and calculated from data of National Accounting Wing, BBS.

Chittagong and Dhaka poses a rather lower level escalation. Interestingly these two major cities always maintained a lower gradient compared to Rajshahi and Khulna city. The following graph shows the year-on-year increase pattern. Here also Dhaka city maintains a disinclined growth. The negative growth however may be the result of data error. Again a steep inclination can be observed between 1997 and 1999 in Rajshahi and Khulna cities.

Figure 6.7: Inter-urban comparison of year-on-year growth of house-rent of middle-income residences



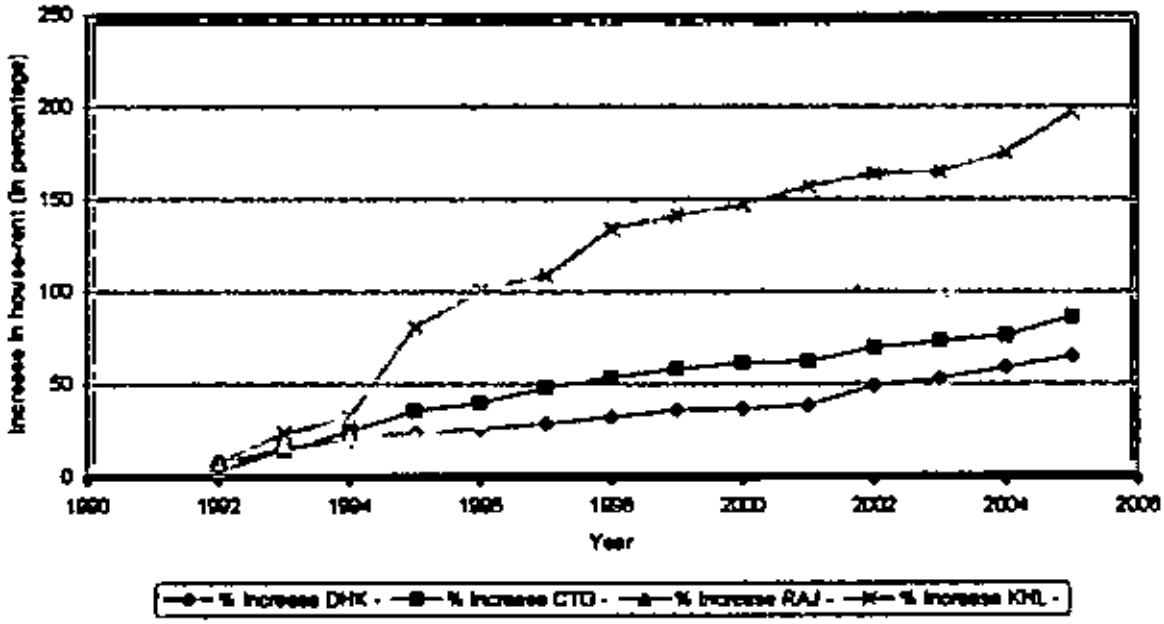
Source: Compiled and calculated from data of National Accounting Wing, BBS.

6.2.3 Inter-urban in house-rent growth of low-income residences

In case of low-income dwellings the highest growth of house-rents can be observed, at about 200% increase in Khulna city. However, in the other cities, the low-income residents experience an incremental growth in house-rents, reaching more or less 100% increase in 2005.

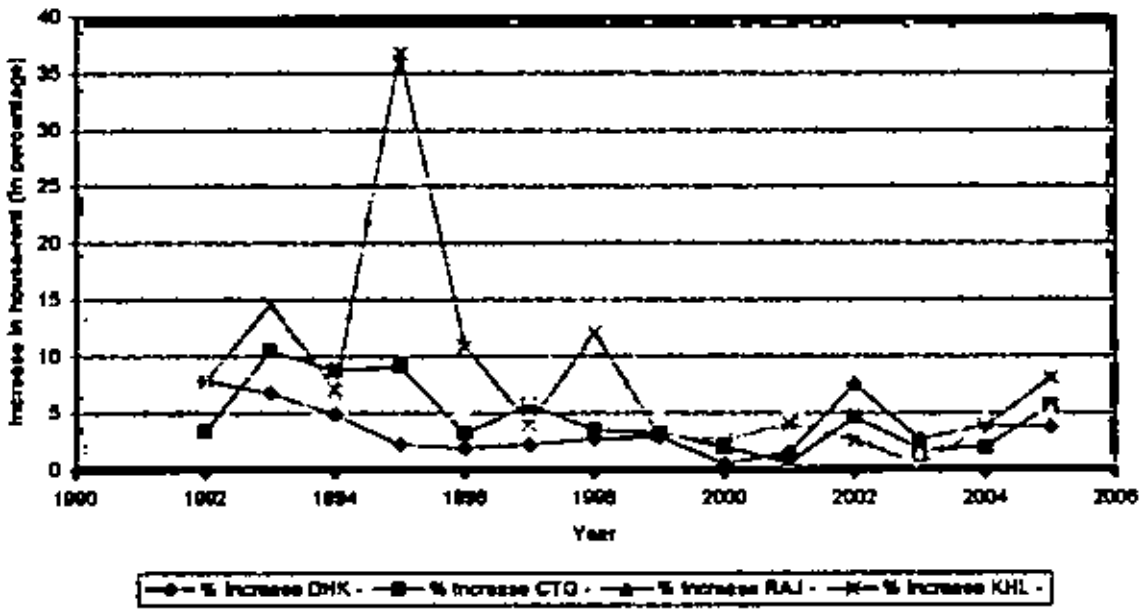
The growth trend of Dhaka, Chittagong and Rajshahi are analogous as opposed to the rather sharp growth of Khulna city. Figure 6.9 shows a sudden increase in Khulna again between 1994 and 1996 and between 1997 and 1999. A higher growth pattern can be observed, in Rajshahi between 1997 and 1999, in Chittagong between 1992 and 1996 and in Dhaka between 1999 and 2003.

Figure 6.8: Inter-urban growth trend of house-rent of low-income residences



Source: Compiled and calculated from data of National Accounting Wing, BBS.

Figure 6.9: Inter-urban comparison of year-on-year growth of house-rent of low-income residences



Source: Compiled and calculated from data of National Accounting Wing, BBS

It can be observed that although house-rents are higher in the two bigger cities of Dhaka and Chittagong (fig. 6.1 to 6.3), the growth pattern of these two cities are more or less steady (fig. 6.4 to 6.9). In contrast, the lower house-rent areas of Khulna and Rajshahi pose an incremental growth pattern; much higher than Dhaka and Chittagong for all the three types of dwellings in past 15 years. And a sudden climb can be observed in general from 1997, especially in Rajshahi city.

Thus it can be summarized as house-rent patterns of Dhaka and Chittagong metropolitan city are of similar nature as having the higher values and lower growth trends. And nature of rents in Rajshahi and Khulna are comparable to each other posing lower prices but higher rises.

Trend analysis, however, is rather incomplete unless incorporated with a possible forecast analysis. With the growing economy and inflation prices will increase. As can be observed from the intra-urban and inter urban house rent analysis, house rents are also increasing at different rates for changing size, quality and location of the houses. But how these increases are associated with the characteristics of the house and how far these changes can be controlled and kept within the affordable limits understanding those relationships is subject to detailed analysis. One way of achieving that is forecasting analysis. If the future changing process of house rents with the changing structural, locational characteristics of houses could be described with an effective functional form that would contribute significantly to the policy formulation to reduce the regional and social disparities in receiving affordable housing. This analysis has been conducted by developing a probabilistic forecasting model in the next chapter.

CHAPTER 7

DEVELOPMENT OF FORECASTING MODEL

The third objective of this study was to develop a forecasting model to predict the possible changes if house-rent in the coming years. The model will also help in developing an understanding of how the structural and locational attributes are going to affect the house-rent patterns in future. This can provide significant input in policy formulation for efficient management of housing market in the urban centers of Bangladesh. This chapter describes the sequential steps of the development of the forecasting model to arrive at the best-fitted one. The logical interpretation of the model has been described and hypothetical examples are also discussed.

7.1 Correlation Analysis

Correlation analysis is the initial step of model development and regression analysis. The analysis represents the degrees of correlation between the dependent and the independent variables and among the independent variables as well. Although correlation analysis is not indicative in logistic regression analysis, the analysis have been undertaken to develop a general understanding of the variables as associated with each other. Table 7.1 represents the correlation statistics of the variables.

It can be observed that almost all the independent variables are correlated to the dependent variable. Among these, the variable 'location' has the strongest positive correlation with the dependent variable 'year-on-year rent increase'. Then the 'number of bedrooms', 'utility connection' and 'type of structure' are highly correlated with the rent increase variable.

Again 'number of bedrooms', 'number of bathrooms', 'utility connection', 'garage' and 'kitchen' are negatively correlated and 'location', 'type of structure' and 'plinth area' are positively related with the dependent variable. This indicates that with increasing number of bedrooms, bathrooms, availability of garage and utility connection rent would increase in a rather lower rate.

Although all the variables are more or less correlated with each other. Specially 'number of bedrooms', 'number of bathrooms' and 'plinth area' possess the strongest positive correlation with each other, which is quite obvious. Interestingly the location variable does not have any correlation with other independent variables.

Table 7.1: Correlation coefficients of variables

	Year-on-year Rent Increase	Plinth Area (sq. ft.)	Type of structure	No. of bedrooms	No. of bathrooms	Kitchen	Store	Garage	Utility Connection	Location
Year-on-year Rent Increase	1	.517[b]	.558[b]	-.608[b]	-.521[b]	-.511	-.122	-.541[b]	-.591[b]	.677[b]
Plinth Area (sq. ft.)	.517[b]	1	.683[b]	-.927[b]	-.917[b]	-.346[b]	-.731[b]	-.469[b]	-.568[b]	.000
Type of structure	.558[b]	.683[b]	1	-.450[b]	-.524[b]	-.504[b]	-.632[b]	-.468[b]	-.478[b]	.000
Number of rooms	-.608[b]	-.927[b]	-.450[b]	1	.932[b]	.510[b]	.560[b]	.482[b]	.417[b]	.000
Number of bathrooms	-.521[b]	-.917[b]	-.524[b]	.932[b]	1	.162	.507[b]	.835[b]	.436[b]	.000
Kitchen	-.511	-.346[b]	-.504[b]	.510[b]	.162	1	.320[a]	.145	.372[b]	.000
Store	-.122	-.731[b]	-.632[b]	.560[b]	.507[b]	.320[a]	1	.452[b]	.559[b]	.000
Garage	-.541[b]	-.469[b]	-.468[b]	.482[b]	.835[b]	.145	.452[b]	1	.389[b]	.000
Utility Connection	-.591[b]	-.468[b]	-.578[b]	.417[b]	.436[b]	.372[b]	.559[b]	.389[b]	1	.000
Location	.677[b]	.000	.000	.000	.000	.000	.000	.000	.000	1

[b] Correlation is significant at the 0.01 level (2-tailed).

[a] Correlation is significant at the 0.05 level (2-tailed).

7.2 Determination of the best-reduced model

Regression analysis is a widely used tool for socio-economic researches and logistic regression approach is popular for probabilistic analysis and modeling. This study also employs logistic regression technique to formulate a probabilistic forecast model of house-rent increase in the metropolitan cities of Bangladesh.

From the data set it has been observed that house-rent in metropolitan centers of Bangladesh increase with different rates. These are categorized into three levels as 1% - 5% being the lowest level, 6% - 10% as the intermediate, and 11% - 15% being the highest level of rent increase. The study applies multinomial logistic regression analysis to model the rent-increase in the imminent years, with a view to incorporate all three levels of rent-increase in the same model. The reference category is set to '0'. Thus the model determines the probability of rent increase at the specified rate as opposed to no increase of house-rent in the year concerned.

To obtain the best-reduced model, a stepwise analysis technique has been followed. The likelihood ratio test analysis has been employed to eliminate least significant variables at each step. At first all the variables are incorporated to obtain the –2 Log likelihood of the reduced model.

The likelihood-ratio test uses the ratio of the maximized value of the likelihood function for the full model (L_1) over the maximized value of the likelihood function for the simpler/null model (L_0). The null model is defined by the intercept only when effects of all the independent variables are set to zero. The likelihood-ratio test statistic equals:

$$-2\log\left(\frac{L_0}{L_1}\right) = -2[\log(L_0) - \log(L_1)] = -2(L_0 - L_1)$$

This log transformation of the likelihood functions yields a chi-squared statistic. This is the statistically recommended test statistic to use when building a model through stepwise elimination. The likelihood ratio test can be used to drop one variable from the model to create a nested reduced model. A non-significant likelihood ratio test indicates no difference between the full and the reduced models, hence justifying dropping the given variable so as to have a more parsimonious model that works just as well. The following table represents the summary of likelihood statistics of the stepwise approach.

Table 7.2: Identification of best-reduced model by stepwise elimination method

Initial Models	Likelihood Ratio Tests				
MODEL 1	Effect	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig
	Intercept	508 931	000	0	
	no_rooms	508 931	000	0	
	no_bath	508 931	000	0	
	pl_area	514 053	5 122	18	.999
	st_type	508 931	000	0	.
	kitchen	508.931	.000	0	
	store	508 931	.000	0	
	garage	508 931	000	0	
	utility	508 931	000	0	
	location	539 960	31.029	9	000
MODEL 2	Effect	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig
	Intercept	430.543	.000	0	
	no_rooms	430 543	000	0	
	no_bath	430 543	000	0	.
	st_type	437.308	9.765	6	.153
	garage	431.728	3 185	3	.282
	utility	435 422	4 879	3	.181
	location	461 780	31 237	9	.000
	kitchen	430 543	000	0	
	store	430 793	250	3	969
MODEL 3	Effect	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig
	Intercept	371.830	000	0	
	no_rooms	371.830	.000	0	.
	no_bath	371.830	.000	0	.
	st_type	378.756	15.927	6	021
	kitchen	371 830	.000	0	.
	garage	373.005	6 175	3	.129
	utility	377.316	8.486	3	039
	location	403.072	31.242	9	.000
MODEL 4	Effect	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
	Intercept	371 830	000	0	
	garage	378 005	6 175	3	129
	no_rooms	378 598	6 768	3	.082
	kitchen	378 827	6 997	3	077
	utility	380 316	8 486	3	039
	st_type	387.757	15 927	6	.021
	location	403.072	31.242	9	.000

It can be seen that model 1 represents a rather disappointing picture where the effect of all the independent variables do no influence the final model except the 'location_cd' and 'pl_area' variables. The significance level of the later variable is not acceptable. So the next model generates eliminating the variable. Again the variable of 'store' is eliminated due to least effect on the model and poor significance level. Now in the model 4 the elimination of the 'no_bath' or number of bathroom variable gives the best result of all. The significance levels of all the variables are acceptable except for the variable 'garage'. But keeping this variable increases the degree of freedom in the final model and model fits at a good significance level. Thus model 4 has been selected as the final model.

7.3 Best Reduced Model

The final model has been obtained omitting the least significant variables. The correlation table and the likelihood ratio tests are used to obtain the best-reduced model. The following variables are included in the final model:

Table 7.3: Variables of the best-reduced model

Variable Name	Definition	Type of Variable
garage	Availability of garage	Categorical
no_rooms	Number of bedrooms	Continuous
kitchen	Availability of kitchen	Categorical
utility	Availability of in-house utility connection	Categorical
st_type	Type of structure	Categorical
location	Location of the house	Categorical

The following tables indicate the case-processing summary and the model fitting information of the final reduced model.

Table 7.4: Case Processing Summary of the best-reduced model

Variables		N	Marginal Percentage
Year-on-year Rent Increase	0	253	33.5%
	1% - 5%	248	32.8%
	6% - 10%	132	17.5%
	11% - 15%	123	16.3%
Type of structure	Pucca	364	48.1%
	Semi-pucca	280	37.0%
	Kutcha	112	14.8%
Availability of Kitchen	no	56	7.4%
	yes	700	92.6%
Availability of garage	no	616	81.5%
	yes	140	18.5%
Utility Connection	no	280	37.0%
	yes	476	63.0%
Area	Dhaka	196	25.9%
	Chittagong	196	25.9%
	Rajshahi	168	22.2%
	Khulna	196	25.9%
Valid		756	100.0%
Missing		0	
Total		756	
Subpopulation		35	

The case-processing summary indicates that there were a significant number of cases with no year-on-year increase in house rent. The location distribution of the cases is even to the four metropolitan cities of Bangladesh. In most cases the type of structure was pucca. Among the 756 cases, kitchen is available with a 92.6 marginal percentage. Utility connection is also available in 63% cases. Alternatively garage is unavailable in most cases. It can also be observed that the problem of missing cases was not an issue in this model.

Table 7.5: Model Fitting Information of the best-reduced model

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	451.880			
Final	371.830	80.050	27	.000

The model fitting information shows a decent chi-square statistic at a nearly 100% confidence level. Thus without doubt, the model fits the best for the probabilistic forecasting of house-rent increase. The result shows that the chi-square value of 80.050 with 27 degrees of freedom is highly significant. This means that the null hypothesis that all effects of the independent variable are zero can be rejected.

Table 7.6: Pseudo R-Square of the best-reduced model

Cox and Snell	0.588
Nagelkerke	0.790
McFadden	0.650

Pseudo R-square statistics of logistic regression analysis is analogous to the OLS analysis. The value varies in between 0 to 1. The R^2 measures in logistic regression are not goodness-of-fit tests but rather attempt to measure strength of association. It does not pose the same significance as the OLS models. Thus, social researchers suggest to interpret the pseudo R-squared statistics with great caution in logistic regression analysis.

The pseudo R-square measures indicate that the model performs fairly well. The Nagelkerke R^2 value will usually be the most relevant value to report (which is 0.790 in this case). It corrects the Cox and Snell value so that it can theoretically achieve a value of 1.

Table 7.7: Likelihood Ratio Tests of the best-reduced model

Effect	-2 Log Likelihood of Reduced Model	Chi-Square	df	Sig.
Intercept	371.830	000	0	.
garage	378.005	6.175	3	129
no_bedrooms	378.598	6.768	3	.082
kitchen	378.827	6.997	3	.077
utility	380.316	8.486	3	.039
st_type	387.757	15.927	6	.021
location	403.072	31.242	9	.000

The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model

The null hypothesis is that all parameters of that effect are 0

The –2 Log Likelihood statistics is within the acceptable limit. Although the significance levels of the first three variables are within 90%, the model has been selected considering the significance level (i.e. nearly100%) of the overall model (table 7 5)

Table 7.8: Best-reduced model to forecast the probability of house-rent increase

Year-on-year Rent Increase[a]	Variables	Coefficients		Std. Error	Wald	df	Sig.	Odd Ratio
		β_i	β					
1%-5%	Intercept	β_0	.348	1.012	.118	1	.031	
	no_bedrooms	β_1	-.039	.274	.020	1	.088	.962
	[st_type=Pucca]	β_2	-.079	.464	.029	1	.085	.924
	[st_type=Semi-pucca]	β_3	-.162	.445	.132	1	.026	.851
	[st_type=Kutcha*]	-	-	.	.	0	.	.
	[kitchen=no]	β_4	-.413	.641	.416	1	.019	.662
	[kitchen=yes]	-	-	.	.	0	.	
	[garage=no]	β_5	-.356	.379	.885	1	.013	.700
	[garage=yes*]	-	-	.	.	0	.	
	[utility=no]	β_6	.492	.241	4.161	1	.004	1.636
	[utility=yes*]	-	-	.	.	0	.	
	[location = Dhaka]	β_7	.007	.242	.001	1	.087	1.007
	[location =Chittagong]	β_8	-.196	.248	.623	1	.016	.822
	[location =Rajshahi]	β_9	.106	.283	.142	1	.022	1.112
	[location =Khulna*]	-	-	.	.	0	.	.
6%-10%	Intercept	β_0	1.483	1.393	1.133	1	.087	
	no_bedrooms	β_1	-.501	.405	1.531	1	.016	.606
	[st_type=Pucca]	β_2	-.772	.490	2.488	1	.006	.462
	[st_type=Semi-pucca]	β_3	-.877	.464	3.574	1	.003	.416
	[st_type=Kutcha*]	-	-	.	.	0		
	[kitchen=no]	β_4	-.610	.690	.782	1	.014	.543
	[kitchen=yes]		-	.	.	0		
	[garage=no]	β_5	-.445	.539	.682	1	.016	.641
	[garage=yes*]	-	-	.	.	0		
	[utility=no]	β_6	.518	.291	3.163	1	.005	1.679
	[utility=yes*]	-	-	.	.	0	.	.
	[location = Dhaka]	β_7	-.459	.310	2.198	1	.008	.632
	[location =Chittagong]	β_8	-.391	.308	1.615	1	.014	.676
	[location =Rajshahi]	β_9	.469	.313	2.245	1	.008	1.598
	[location =Khulna*]	-	-			0		
11%-15%	Intercept	β_0	.361	1.447	.062	1	.077	
	no_bedrooms	β_1	-.189	.418	.205	1	.030	.828
	[st_type=Pucca]	β_2	-.837	.533	2.467	1	.006	.433
	[st_type=Semi-pucca]	β_3	-.500	.495	1.024	1	.018	.606
	[st_type=Kutcha*]	-	-	.		0	.	.
	[kitchen=no]	β_4	.299	.709	.177	1	.022	1.348
	[kitchen=yes]		-	.	.	0	.	
	[garage=no]	β_5	-.231	.568	.165	1	.023	.794
	[garage=yes*]	-	-		.	0	.	
	[utility=no]	β_6	.440	.301	2.135	1	.009	1.553
	[utility=yes*]	-	-	.	.	0	.	
	[location = Dhaka]	β_7	-.939	.355	6.996	1	.002	.391
	[location =Chittagong]	β_8	-.237	.309	.591	1	.017	.789
	[location =Rajshahi]	β_9	.656	.314	4.357	1	.004	1.926
	[location =Khulna*]	-	-	.	.	0	.	

[a] The reference category for the model is 0%. * The Reference Category for each of the independent variable

The coefficients denote that, for all rates of rent-increase, the most important variable is the type of structure in influencing year-on rent increase when all other variables are held constant, as can be seen from the table However, at the rate of 1%- 5% rent increase on a year-on-year basis, a noteworthy exception can be observed, as the availability of utility is the most influencing factor. Surprisingly, the odds of rent increase are considerably higher for dwellings with no utility facilities relative to the dwellings with utility service provisions. This is true for all the three segments above, having the highest odds ratio at the rate of 6% - 10%. This confirms the generally known fact that the probability of rent increase is higher for the low-income peoples' housing than for the dwellings of high and middle income groups. Because in the data set it has been observed that primarily the lower-middle and low-income dwellings lack utility services.

The type of structure of the dwellings also substantiates this argument. Again other than the lowest increase rate (i.e. 1% - 5%), at all the higher rates the odds ratio of rent increase is significantly lower for pucca and semi pucca structures. It can be observed from the table that the odds of rent increase at the rate of 6% - 10% is 0.462 and 0.416 lower for pucca and semi-pucca structures, respectively, than that of the kutcha structures. And with the probability of rent increase at the rate of 11% - 15%, the odds for pucca and semi pucca structures are 0.433 and 0.606 lower than that of kutcha structures. The odds being lower at the lowest segment of rent increase validates the fact even more that the low-income people suffer from greater rent increase than the other income groups.

Location is the most significant independent variable as can be seen from table 01. Interestingly the odds of rent-increase are higher for Rajshahi and lower for Dhaka with respect to Khulna city. The odd ratio is the lowest for Dhaka at the highest rate of rent-increase, i.e. 11% - 15% with respect to Khulna. This indicates that for the dwellings at Rajshahi, Khulna and Chittagong, there is a higher likelihood of rent-increase at the rate of 11% - 15%. And for Dhaka city dwellings possibility is greater that rents will increase at a lower rate i.e. at the rate of 1% - 5%.

For the variables of 'availability of garage' (which serves as a proxy to car ownership), and 'availability of kitchen', the results depict the obvious picture. The odds for houses with no garage (or car) and no kitchen are lower than that for the dwellings with garage and kitchen.

The coefficient of number of bedrooms is lowest at the rate of 1% - 5%. This implies that the odds are higher that with ascending number of bedrooms rent would increase at the rate of 1% - 5%.

7.4 Estimated Final Model

The estimated logistic regression model is.

$$\log [p/q] = \beta_0 + \sum \beta_i * X_i$$

$$= \beta_0 + \beta_1 * X_1 + \beta_2 * X_2 + \beta_3 * X_3 + \beta_4 * X_4 + \beta_5 * X_5 + \beta_6 * X_6 + \beta_7 * X_7 + \beta_8 * X_8 + \beta_9 * X_9$$

Here,

X_1 =	Number of bedrooms
X_2 =	1, if the type of the structure is 'pucca', 0 otherwise.
X_3 =	1, if the type of the structure is 'semi-pucca', 0 otherwise
X_4 =	1, if there is no kitchen, 0 otherwise.
X_5 =	1, if there is no garage. 0 otherwise
X_6 =	1, if there is utility connection is not available, 0 otherwise.
X_7 =	1, if the location is 'Dhaka', 0 otherwise.
X_8 =	1, if the location is 'Chittagong', 0 otherwise.
X_9 =	1, if the location is 'Rajshahi', 0 otherwise.

So, the odds ratio of rent increase of a house with given physical and locational attributes is,

i. at the rate of 1% - 5%

$$\log [p/q] = 0.348 - 0.039 * X_1 - 0.079 * X_2 - 0.162 * X_3 - 0.413 * X_4 - 0.356 * X_5 + 0.492 * X_6 + 0.007 * X_7 - 0.196 * X_8 + 0.106 * X_9$$

ii. at the rate of 6% - 10%

$$\log [p/q] = 1.483 - 0.501 * X_1 - 0.772 * X_2 - 0.877 * X_3 - 0.610 * X_4 - 0.445 * X_5 + 0.518 * X_6 - 0.459 * X_7 - 0.391 * X_8 + 0.469 * X_9$$

iii. at the rate of 11% - 15%

$$\log [p/q] = 0.361 - 0.189 * X_1 - 0.837 * X_2 - 0.5 * X_3 + 0.299 * X_4 - 0.231 * X_5 + 0.440 * X_6 - 0.939 * X_7 - 0.237 * X_8 + 0.656 * X_9$$

Thus the odds ratio of increase of rent at the rate of 11% - 15% of a three-bedroom compared to a one-bedroom dwelling, adjusted for all other independent variables, is.

$$\hat{R} = e^{\beta_1 (J-I)}$$

$$= e^{-0.189 * 2}$$

$$= e^{-0.378}$$

$$= 0.6852305$$

Similarly, the odds ratio of rent increase at the rate of 6% -10% of a dwelling located in Chittagong compared to a dwelling located in Khulna, adjusted for all other independent variables, is

$$\acute{R} = e^{\beta_0(1-0)}$$

$$= e^{\beta_0}$$

$$= e^{-0.391}$$

$$= 0.676380156$$

Now, for a dwelling with a pucca structure, two bedrooms, having all the basic utility services, kitchen and garage and which is located in Rajshahi, we have,

$$\beta_0 + \sum \beta_i * X_i = \beta_0 + \beta_1 * X_1 + \beta_2 * X_2 + \beta_9 * X_9$$

And the estimated probability of a year-on rent increase,

$$p = 1/ \{ 1 + e^{-(\beta_0 + \beta_1 * X_1 + \beta_2 * X_2 + \beta_9 * X_9)} \}$$

Thus the estimated relative (relative to the reference variables, e.g relative to dwellings located at 'Khulna' with a 'Kutcha' structure) probability of a year-on rent increase, at the rate of 1%-5% is

$$p = 1/ \{1 + e^{-(-0.348 - 0.039*2 - 0.079 + 0.106)}\}$$

$$= 0.4015$$

Similarly the estimated relative probability of a year-on rent increase, at the rate of 6%-10% is

$$p = 1/ \{1 + e^{-(1.483 - 0.504*2 - 0.772 + 0.469)}\}$$

$$= 0.557$$

So, using the above model the probability of a year-on rent increase, at different rates, of dwellings with different physical and locational parameters can be calculated. The results do not necessarily imply that the remaining probability stands for rent increase with other

rates. It indicates that there is a remaining probability of a year-on-year rent increase. that will not happen at the mentioned rate.

So, it implies that the relative probability of a year-on rent increase of a dwelling with the above stated values of independent variables, at the rate of 6% - 10% is 0.557 Also,

$q = 1 - p = 1 - 0.557 = 0.443$

thus the probability of not an increase at the rate of 6% - 10% is 0.443.

and therefore, for a dwelling with the specified values of independent variables, the odds of a year-on rent increase at the rate of 6% - 10% is,

$p/q = 0.557 / 0.443 = 1.26$ (approximately).

The model forecasts indicate that there is a greater likelihood of rent increase of low-income dwellings as opposed to the high and middle-income dwellings. Another significant finding is that house-rents in Rajshahi pose a greater probability of increase than other cities. Such findings could be positively analyzed and further studied to formulate effective policies to minimize social and regional disparities. A few of such policies are recommended in the next chapter.

CHAPTER 8

CONCLUSION AND RECOMMENDATION

The complexity of a housing market is a reality, particularly the rental housing market of Bangladesh. To develop a comprehensive understanding of market operations it is necessary to investigate the past trends and patterns and to develop a forecasting mechanism. Such assessment has useful implications in developing public policy, rent control regulations, subsidy allowances and tax structure. That is the perspective that this report takes.

As can be seen from the trend analysis of house–rents across the metropolitan areas, rents are higher in Dhaka and Chittagong metropolitan areas, though rent growth is higher in Khulna and Rajshahi cities. It can be concluded that house rents in Dhaka and Chittagong have approached the plateau and there is not much scope remained to increase. Whereas in Khulna and Rajshahi rents are still within affordable ranges but headed towards the plateau. Thus government should facilitate and execute housing projects in Khulna and Rajshahi alongside development and rent controls to avoid another exorbitant rental markets.

The model estimates suggest that rents of lower-middle and low-income dwellings are likely to increase at higher rates (6% - 15%). The trend analysis verifies this forecast as rents of high-income dwellings show a steady growth as compared to middle-income and low-income residences. This disparity can be minimized through the mechanism of subsidy and taxation.

Housing market inefficiency occurs when there exists an imbalance between demand and supply. Rents go high when either the demand curve shifts towards the left or the supply curve shifts towards the right. Thus by ensuring a balance between supply and demand irregular price hikes can be minimized. From the trend analysis it is readily observed that rents do not increase proportionately with the size of the dwellings. Interestingly rents for small size dwellings are higher in all the cities. This indicates that the demand distribution is not uniform for all type of dwellings. Evidently there is a high demand for low and

lower middle-income dwellings, which should be positively dealt with by increasing the supply of this type of housing. Thus it is strongly recommended that government should focus on the supply side of the housing industry and execute low-cost housing projects to meet up the demand of the low-income group of the society

There are several ways to increase the supply of low-income housing First small sized plots should be created through Sites and Services Schema, already applied in Mirpur at Dhaka and in Baikalyadham at Chittagong. These already executed projects however are often not allocated to the target group and could meet only a fraction of the greater demand side. Such projects are also difficult to implement because of the high scarcity of land in big cities like Dhaka and Chittagong but could positively take place in cities of Rajshahi and Khulna.

Construction of small size housing for the low-income people could be another option as the *Bhasantek Punarbasan Prokolpo* already being executed at Dhaka. Slum Improvement Programs and Slum Upgrading should be taken up in big cities with a large number of slums as in Dhaka and Chittagong Metropolitan areas.

The government should also encourage the real estate developers to design and allocate a percentage of their constructed housing to the low-income people through the mechanisms of tax holidays and tax deductions. This is a popular approach now-a-days for increasing the supply of low-income and deprived housing in the USA. A significant number of the low-income people are employed in the big industries of the cities. Government should also take steps to motivate the owners of the industries to provide housing to their workers

Rent Control is another tool widely used in the developed world to minimize social inequalities in housing market. Rent controls, designed to lower the cost of housing for renters, can be area specific. There can be designated areas where rent control measures are effective with strict evaluation and monitoring called the 'regulated zones or areas' and there can also be 'free sectors' with no rent regulations.

However, rent controls may have the perverse effect of increasing rents for tenants in the unregulated sector. Also, if controls reduce landlord maintenance, total housing supply in

a market will fall. Rent control can influence the price of housing in the uncontrolled sector by altering the supply of and demand for rental housing service in a metropolitan area. Hubert (1993) examines the role of rationing in the controlled sector and its effect on prices in the free sector. Tenants unable to obtain controlled housing must find housing in the free sector. If the free sector has higher than average demands for housing, prices in that sector will rise Hubert (1993) concludes that prices in the free sector vary according to the method used to ration units of controlled housing. Thus it is strongly recommended to maintain caution in choosing and applying rent control measures in Bangladesh An extensive analysis of rent control measures and their applicability in Bangladesh should be studied with careful consideration of upcoming consequences.

The Premise Rent Control Ordinance should be revised and area specific recommendations should be incorporated. The existing provisions are not enforced properly as well Thus proper enforcement and monitoring should be ensured. Development and tax regulations should be in conformity with the act.

The study points out some potential fields of further investigations, which are seldom addressed in our country. They are suggested as follows.

First of all, a continuum of this study is suggested to identify the determinants of rent variation across the cities. A further study could incorporate socio-economic indicator analysis using Ordinary Least Square regression method.

A more significant and ironically least addressed issue in housing sector in Bangladesh is affordability analysis. The rent characteristics alone are insufficient to device appropriate pricing policies. Incorporation of income and affordability level is a necessary requirement. But this needs development of a strong and detailed database. Thus national and international organizations should come forth to provide for the resource required to develop a comprehensive affordability index for rental or owner occupied housing in Bangladesh. An extensive analysis of the inherent causes of social and regional disparities in rent increase may incorporate this study.

Another analysis could lead the way to prepare a Construction Development Index, commonly known as CDI. If one looks at the rent structure, there are two basic reasons of

rent increase, land price and construction cost. Land price data are not available across regions. But the BBS bulletin regularly published the construction cost data. Using these data a construction trend analysis can be conducted which can then be compared with the rent-trend to relate their level of association. Again the CDI can be developed using the year-wise GDP data, which is also available in BBS.

Auto-Regressive Integrated Moving Average (ARIMA) model could be used to analyze the trend and patterns of house-rent deviation. This would reduce the effect of data errors and more accurate results can be derived. Panel data analysis could also be conducted. Unavailability of data and model specification restricted their use in this study.

In conclusion, it is suggested to take cautions in applying the results of the model in practical fields. The study was based on secondary data and further systematic analysis is required to reduce the degree of uncertainty. Moreover it is a macro level analysis. Thus before its application in micro level pilot projects should be conducted analyzing area specific problems and prospects.

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