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HEDONIC ANALYSIS OF HELSINKI RESIDENTIAL PROPERTY MARKET

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ABSTRACT

Hedonic price model has been widely used to demonstrate the importance of housing attributes in different studies of urban housing.

The complexity of housing nature and characteristics in its heterogeneity, non-liquidity and even globalization, have made the study in housing appealing to researchers, investors and policy makers.

This thesis explores the importance of housing attributes such as physical characteristics, location, and neighbourhood to arrive at the influence it may have on prices. This is necessary because house price varies frequently in the same neighbourhood and location over different seasons as well as period of purchase.

In order to get a grasp of what is happening in the Helsinki housing market, the thesis adopted 9 important attributes as independent variables in explaining their impacts on house price using a pool of raw date from statistics Finland

These influencing factors shape home owners decision in making choice of where to live, time to make purchase and the age of building to buy, thus these factors were critically analysed in this thesis

Conclusion is drawn based on the coefficient of multiple regression model outcomes on these attributes against log of price. Among other interesting result in the thesis is the building age, season and household income.

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1 INTRODUCTION

The intrinsic nature of housing has made it a special good that brings satisfaction to human basic needs. Although it is fixed in location, it has other important uniqueness accounting for variation in the way that it is priced. Due to the heterogeneity of housing, a better way of pricing it is by the use of hedonic model.

Hedonic pricing method treats the price of a good as the dependent variable and the characteristics of that good as independent variable. The hedonic model is commonly used to model the demand of goods (in a second stage analysis) that do not have traditional economic market (e.g., air quality or water clarity) using the prices of goods determined in other markets e.g., (the price of housing). The hedonic housing approach regresses housing prices against various housing characteristics to determine the importance of specific characteristics (such as number of rooms, bathrooms and etc.) to explain house prices.

Review of related literature (Chang and Lee, 1999; Chau, Ng, and Hung, 2001; Chin and Chau, 2003; Maand Li, 2003; Palmquist, 1984; Wen, 2004) showed that housing characteristics can be generally divided into three types: structure characteristics, neighbourhood characteristics and location characteristics. These characteristics influences the decision of choice in housing, in order words, household decision begins from choosing a town to live in , neighbourhood to live in within the town , type of house to live in within the neighbourhood and especially the choice of his preferred characteristics and facilities.

The sudden dramatic escalation of house prices across different metropolitan areas of the world, such as in South Korea (Hannah, Kim, Mills, 1993; and Cho and Ma, 2006), Hong Kong (Cheung, Tsang and Mark, 1995; and Tse, 1998), Sydney (Abelson, 1997), Taiwan (Lin, 1993; and Chen and Patel, 1998), United Kingdom (Eve, 1992), and the

United State (Potepan, 1996)[1] has made house prices research more interesting than ever.

Even though relevant research has been made on the use of hedonic price model to explain house prices in bigger cities round the world, literatures and research on the use of important housing characteristics to analyse residential house prices in the Finnish housing market has been limited, even though the housing market in Finland has experienced a tremendous demand and activities in recent years (Oikarinen, 2006;)

It is important to examine the trend at which house prices varies in different commune of the four categories of Helsinki municipal region vis a vis important housing characterises.[2] These variations would be analysed by the use of hedonic model so as to understand the influence of the identified factors on house price in different region as well as to predict the response of home owners to these different housing characteristics in the future.

1.1 Aim

The aim of this thesis is to explain the influence of housing characteristics and neighbourhood on house price variations in different part of Helsinki housing market using Hedonic model.

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[1] Joseph T.L and Lee S., 2006; price discovery between Residential Land and Housing Markets

[2] The 79 important areas of Helsinki referred to as “commune” in this thesis is based on the different postal codes of the region. This is categorised into Helsinki 1, 2, 3, and 4 as specified in the publications of statistics Finland. The content of which will be highlighted later in this thesis.

1.2 Objective

I. To adopt a model that categorises Helsinki into four different region (Helsinki 1, 2, 3, 4), as done by Statistics Finland

II. To examine the different characteristics used as independent variable

III. To run a regression model with the use of dummies and important variables to arrive at the relationship useful in analysing the result of this thesis

IV. To use coefficient in analysing the residential market of Helsinki as a whole

V. Finally to draw conclusion based on the result of the used data Vis a Vis the economy situation of the case study area

1.3 Limitation

The thesis considers all house sales in the year 2001 for the residential apartments ("type 3"[3]) in Helsinki region. This year was selected because of the availability of data to carry out the aim of this study and especially it was a year that residential property market was getting stabilised after the burst in the year before. The housing characteristics that would be considered includes, house size in square meters, year of construction, date of transaction, house price, postal codes, number of rooms, season of purchase and whether first buyer or not[4]. Even though the study is limited with the

[3] Called Kerrostalo in finnish i.e. condominium apartment type of residential houses

[4] This will be defined later in this thesis

above structural, physical and location attribute, notwithstanding, the final result would be substantial enough to meet the study purposes.

1.4 Data Collection

The data used in this thesis is a source from statistics Finland unless otherwise stated, the content contained physical attribute (such as size, date of transaction, apartment type, no of rooms etc.) , location attribute (such as regional classification, post code etc.) as well as neighbourhood(municipality).

The data also contains all the housing prices in the whole of Helsinki region in a raw form, however filtering and sorting of the data is done according to its usefulness to this thesis in an unbiased way, multicollinearity is reduced by the use of variance inflation factor (VIF).

Furthermore, time series model is used in the model based on seasonal component in the transaction dates; also dummies are used to basically explain the influence of time trend on the house price.

The data is analysed by the use of SPSS 16.0 package.

1.5 Concept and Definition of Terms[5]

The definition of terms in this thesis is mostly linked to definition and usage in Finland; hence, most of the definitions are from the ones used by statistics Finland

- Residential Property: Property which is zoned for single family, homes, multi-family apartments, town houses, condominiums and or co-op
- Condominium: A form of property ownership in which each owner holds title to his/her individual unit, plus a fractional interest in the common areas of the multi-unit project. Each owner pays taxes on his/her property, and is free to sell or lease it. It could be an apartment but differs in the sense that, there could be a non residential condominium such as office space or hotel
- Apartment Type: It is a structure with individual dwelling unit but a common entrance or hallway. For the purpose of this thesis, it is sub-divided into

1. Detached homes
2. Town house
3. Blocks of flat (the focus of this thesis)

- Type of building: A classification for different types of dwellings, for example, blocks of flats, attached houses, detached houses. The dwelling price statistics utilise the categories blocks of flats and attached houses. The data on attached houses also include detached houses with shares in a housing corporation. The type used in this thesis is a block of flat tagged type “3”

[5] The definition of terms and concept were according to explanations of statistics Finland

- Dwelling: A dwelling refers to a room or a suite of rooms which is intended for year-round habitation; it's furnished with a kitchen, kitchenette or cooking area; and has a floor area of at least 7 square metres. Every dwelling must have its own entrance. A single-family house may be entered through an enclosed porch or veranda. If a dwelling is entered through the premises of another dwelling, it is not regarded as a separate dwelling but instead those two constitute one dwelling.
- First-time homebuyer: First-time dwelling transactions include those that are entitled to the exemption from asset transfer tax for first-time homebuyers[6]
- Floor area: The floor area refers to the living area of a dwelling. The floor area of a dwelling is also measured from the inner surfaces of its walls. The figure includes the floor areas of the utility room, walk-in cupboard, bathroom, lobby room, sauna, washroom and dressing room, as well as the floor areas of rooms used for working unless used by hired employees. The following are not counted in the dwelling's floor area: garage, cellar, sauna facilities in an unfurnished basement, unheated storage space, balcony and porch, veranda and attic space unless used as a living space. The floor area of a free time residence refers to its gross floor area.
- Government-subsidised dwelling: A government-subsidised dwelling in Finland is a dwelling produced with government ARAVA [7](act on state subsidized housing loan)

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[6] (www.vero.fi). Contains more details about Finnish tax system

[7] ARAVA loans can be granted for building, which refers to building one or several residential buildings, or for purchasing, which refers to the purchase of one or several apartments or other residential facilities from the existing building stock. The purchase of a lot can be included in the building and purchase of dwellings. The degree to which the purchase of a newly completed building or apartment shall be regarded as new building shall be laid down by decree **.**

loans, in which the rent is determined by the cost correlation principle. Most of government-subsidised dwellings are owned by municipalities.

- Hitas dwelling: Hitas is a regulation system in Finland, for the price and quality level of dwellings built on rented plots owned by the City of Helsinki. It refers to the dwellings subject to the regulation system in question.
- Index: An index is a ratio describing the relative change in a variable (e.g. price, volume or value) compared to a certain base period (e.g. one year). The index point figure for each point in time tells what percentage the given examined variable is of its respective value or volume at the base point in time. The mean of the index point figures for the base period is 100.
- Market price: The general actual selling price or the price where supply and demand meet
- Mean price: With the help of the mean price concept the information of the observation group can be condensed to one key figure by expressing the mean price level of the observation group. Depending on the statistics, the dwelling price statistics utilise either arithmetic or geometric mean prices.
- Nominal price index: Describes the change in prices relative to the base time period of the index (cf. real price index).
- Non-subsidised dwelling: Non-subsidised dwellings are dwellings produced in other ways than with government ARAVA loans
- Number of rooms: The number of rooms is the number of rooms in a dwelling. Kitchen is not counted as a room. Dwellings with at least three rooms belong to the category 3h+.
- Price per square metre for a dwelling: The dwelling price statistics utilise the unencumbered price per square metre, which means that the loan portion is included in the price. The price concept published is price per square metre (€/m2).

- Real price: The price calculated with the prices of a certain base year, from which the effects of changes in the price level have been removed. In most cases the real price refers to the nominal price deflated with the consumer price index.
- Real price index: Indicates the change in real prices compared with the index base time period (e.g. 2000, 1983 or 1970). The real price index is derived by dividing the point figure of the nominal price index with the point figure of the Consumer Price Index of the corresponding time period and base year.
- Type of financing: A classification describing the financing source of a dwelling or real estate, a government-subsidised dwelling is however, a dwelling produced with government ARAVA loans, in which the rent is determined by the cost correlation principle.

2 REVIEW OF LITERATURE

Review of related literature (Chang and Lee, 1999; Chau et al. 2001; Chin and Chau, 2003; Maand Li, 2003; Palmquist, 1984; Wen, 2004) showed that housing characteristics can be generally divided into three types: structure characteristics, neighbourhood characteristics, and location characteristics.

Most of the hedonic regression model includes characteristics of the community where the house is located, as well as the house's characteristics, neighbourhoods within cities; this is paramount because houses are located within a neighbourhood. Brown and Bulent, (2004) uses two of these characteristics and pointed out the effects of these characteristics (house and neighbourhood characteristics) on housing prices using a hierarchical linear model.

Clapp and Wang, (2006) uses the criteria of homogeneity , contiguity and parsimony to develop an empirical model suitable for placing boundaries for neighbourhood of single family properties within a political Jurisdiction. The result of which they displayed by classification and regression trees (CART) to group individual single-family properties into neighbourhoods based on similar location value: the value of a building lot at a given location.

Surprisingly, many empirical studies do not even include location as a characteristic of the house (Asko Miettilä, 2001), Miettilä notes that the only factor which distinguishes one location from another is the transport cost, in the case of bid rent curve for location with greater accessibility is determined by transport cost function.

Elias Oikarinen (2007) stresses the importance of neighbourhood even in the Finnish housing market. Oikarinen, demonstrates the housing price dynamics between centres and regions surrounding them, and concludes that there are number of reasons why it

may be assumed that housing price movements in an economic centre lead housing price change in surrounding areas. These reasons include structural differences and economic interdependence between regions as well as informational factor. This explanation may however not suitable for analysing regional housing price dynamics within a substantially larger and more heterogeneous countries than Finland, the United State for instance.

Many researchers as well as thousand of econometric papers have used hedonic method to demonstrate relationship between variables (dependent and independent). In the real estate sector for instance, both the local and international scholars have written several research papers with the use of the hedonic model.

Can and Megbolugbe (1997), emphasise the importance of accurate and precise indices because housing price indices are a major input in the investigation of housing and mortgage market s for both researcher and business reasons. Mebolugbe et al. stated that this accuracy and precision of the indices will be affected by a number of factors, including the selection of characteristics, the functional form of hedonic function, the behavioural assumptions both on the parameter vectors and on the random error terms, and the econometric procedures used to estimate parameters. Building on earlier work of Can (1990, 1992), they offered a new strategy to incorporate functional interdependence into spatial hedonic model. In their conclusion they presented that it is possible to construct reasonable price indices on the basis of measurements on house age, living space, and land area, by taking into account location effect – both adjacency and neighbourhood effects not by having a meticulous detailed data sets, but by using the inherent power of GIS tools to analyse spatial dependence in large, readily available transactions data set.

In modelling hedonic price for Paris housing market, Raymond Maurer et al. (2004), estimates the regression model following the Box-Cox transformation[8]. They argue that it is necessary to specify the value determining characteristics of the observed real estate transactions. Hereby, apart from heterogeneous variable of sales price, only four other qualities represent metric variables: the surface, the number of garages, the number of bathrooms and the number of service rooms. All other characteristics indicate conditions and must therefore be dealt with as dummy variables.

Miettilä and Koponen (2001) used the basic hedonic model to depict consumer maximizing its utility from different characteristics of housing unit. In their model they treated apartment as a bundle of characteristics, i.e. each apartment "a" have level of "n" characteristics defined by vector $Z^a = (Z_1^a Z_2^a \ldots Z_n^a)$ in which the agents operating in the markets are willing to pay for these characteristics according to their preferences, these housing characteristics have been linked to the rental data using the Finnish dwelling data and real estate emblems, which is the best in quality.

Booth G. G, Martikainen T, and Yiuman T. (1996) found surprisingly that Tampere is the leading city as regards housing price dynamic lead in spite of the fact that Helsinki is by far the most important economic centre in the country. However, using longer time series Kuosmanen (2002), found evidence of the leading role in Helsinki, and this was corroborated by the findings of Oikarinen.

This thesis brings further evidence to the work of Miettilä and especially Oikarinen in the importance of housing characteristics as well as location attributes of housing. It however differs in the approach of dissecting the whole of Helsinki by municipalities and the set of dummies used.

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[8] The aim of the Box-Cox transformations is to ensure the usual assumptions for Linear Model hold. That is, $y \sim N(X\beta, \delta^2 In)$

3 HEDONIC MODEL REVIEW[9]

A.T Court, an analyst expert of the American automobile industry, established the hedonic price model in 1939 (Goodman, 1998). He adopted the term “hedonic”, as regard with an automobile price as a function of automobile’s different characteristics, and carried out hedonic price analysis of heterogeneous goods. His aim was to structure the price for the automobile industry.

Colwell and Dilmore (1999) put forward that Haas was the first user of hedonic model in 1922, when he used the concept of hedonic to set up simple hedonic price model for farmland, taking the distance to the city centre and the city size as two important characteristics variables.

Wallace (1926) and Waugh (1928) also used hedonic price method for studying farmland price and vegetables price.

Ridker (1967) was one of the earliest scholars to apply hedonic price theory to analyze the housing market. He used housing data to set up a hedonic price model, calculated the impact of improving environmental quality (such as the elimination of air pollution) on house prices. The theoretical foundation of this method was developed by Lancaster (1966) and Rosen (1974).

[9] Most statements used in this section are review of the book titled Property Investment; principles and practice of portfolio management. Martin Hoesli and Bryan D. Macgregor Chap 4, pg 62-65

3.1 Uses of Hedonic Model

The hedonic method is a widely used technique to control for the heterogeneous nature of properties when analysing house prices generally. It recognizes that properties are composite product: although attribute are not sold separately, regressing the sale price of property on their various characteristics yields the marginal contribution of each characteristics. The physical characteristics (of land and building) and location are very important in hedonic model and the must be considered as well.

Apart from using hedonic model to analyse housing market, it can go also be taken a step further to construct house price index. There are two basic ways of constructing an index using the hedonic method. The first approach according to S.C. Bourassa et al. is by performing a separate regression for each time period and the index is constructed by applying the estimated implicit prices to a standardized bundle of attributes. In the second approach however, one overall hedonic regression is performed and the time dummy variable are included. The estimated coefficient on the time variables yields the price index. The implicit price vary over time (the variation may be constrained by cross-equation restrictions) in the first method while in the second method the price do not vary unless additional flexibility is incorporated into the model (for example, by estimating implicit prices with a time trend or including a series of time dummies for each hedonic characteristics).

The main difference between the two cases is that the latter restricts the mean and variance of the error term to be identical across all the time period (unless, the model is corrected for heterodskedasticity), while the former allows the mean and variance of the error term to vary.

Hedonic method is also used in estimating property values on the basis of its characteristics, and also to construct price indices. When this method is used in valuation purposes, the characteristics of a property are valued using the regression coefficients (the price of the unit of characteristics) and the price of a property can be estimated by summing the price of the characteristics. Such model is being used in Switzerland to estimate the value of residential properties and the value of property portfolios of banks and institutions.

The analysis of price is obtained by using time dummy variable in hedonic regression

$$\ln\left(\frac{P}{m^2}\right)=\alpha+\beta_1X_1+\beta_2X_2+\ldots+\beta_mX_m+\sum_{t=1}^{T}\delta_tD_t+\varepsilon=\alpha+\sum_{k=1}^{m}\beta_kX_k+\sum_{t=1}^{T}\delta_tD_t+\varepsilon \qquad (2)$$

Where P/m^2, is the price per meter square, β is the coefficient, X is the independent variable, D_t is the dummies. α is the intercept.

Although it requires large amount of transaction data base (prices and attributes), it is the most reliable method used in constructing index.

As earlier stated, it will be within the scope of this thesis to equally mention that, hedonic method is also used in constructing index for different countries; this includes the Halifax building society which computes a quarterly index of UK house prices, in the US however, Thibodeau (1992), reports house price indices for 60 US metropolitan areas surveyed between 1974 and 1983 using hedonic method, many researchers have equally used hedonic method in several countries, Lin (1993), for example, uses it for Taiwan, Hoesli, Giaccotto and Favarger (1997), for Switzerland to construct price indices of residential building in Geneva.

4 CASE STUDY AREA

The thesis researches Helsinki area as the study case. The population of Helsinki as at 31 October 2007 was 568,146 (265414-men and 302732-women)[10]. It is the capital of Finland, a country with a population of about 5.2 million people and a member of European Union (EU) and European monetary union (EMU) since 1995 and 1999 respectively. The Helsinki area generates approximately one third of Finnish gross domestic product (GDP) with a GDP per capital roughly 1.5 times the national average, making Helsinki one of the wealthiest capital cities in Europe.

4.1 Finnish Economic Overview

Finland is an industrialized free-market economy based on intensive use of technology, capital investment, and abundant endowment of resources. The unemployment rate is still relatively high after a severe recession in the early 1990s but has been continually declining in recent years. The state traditionally plays important role in the growth of the economy and the federal charter of the banking sector is fully aligned with the governments' goals for economic growth. It is now considered as a success model for other countries in the EU both in economic management as well as stability of government.

[10] This according to the Finnish population register

Ownership rights in Finland are very strong and the level of corruption is considered one of the lowest in the world. This makes Finland a very safe place for real estate investors.

Furthermore, Finland is a member of the European Economic and Monetary Union (EMU) and it uses the euro as its currency along with the 16 other Euro zone countries. The steel, forest, and telecommunications industries are key sectors of Finland's economy. Its economy has traditionally been driven by export industries, but over the past two years, local private consumption has played a more prominent role in the increase of economic activity.

4.2 Property Market

The major participants in the Finnish Market are pension funds and insurance companies.

There are also several real estate investment companies active in the market. Due to the higher expected yields versus other developed European markets, foreign companies have entered the market with large capital investments. Initially their focus was on the office and retail markets in the Helsinki Metropolitan Area, but there is a trend that investments are growing in other types of real estate assets, as well as in other areas of the country.

4.3 Finnish exports

The Finnish export basket is diverse and balanced. Machinery, chemicals, metal products, timber, pulp, electronics and electrical products make up the bulk of the export base with a growing market in financial assets. Historically, the forestry industry has been the dominant force in Finnish industry.

In 1980, exports of forestry and paper products accounted for almost 50% of total Finnish exports. The other traditionally strong Finnish industrial sectors, i.e. metal and engineering industries, play an important role in export. Finland has a well-developed road and rail infrastructure and owning to its proximity to Russia, more than two-fifths of the European Union's road shipments to Russia travel through Finland.

Since 1990, the Finnish export structure has dramatically changed with the electronics industry taking the lead position. Its massive growth over the 1990s was primarily based on mobile phones with other IT products following further behind. Wood and paper, electronics and machinery and ship building form the largest share of the export base.

4.4 Basic Facts about Helsinki and Helsinki Region

Helsinki, the capital of Finland has a total area of 686 km² (264.8 mi²). This can further be divided into 186 km² (71.8 mi²) of usable land and 500 km² (193 mi²) of area which is covered by water. In addition it is located on the southern tip of Finland and is surrounded by water from the Baltic Sea on three sides. Hundreds of small islands lie immediately off the coastline, and are sometimes developed as restaurants and cottages by private owners and which are heavily utilized in the summertime by water

enthusiasts. The numerous Islands make most of the coastline unusable for commercial shipping except in areas where the lanes have been prepared by costly dredging.

Helsinki region, comprising the city of Helsinki and eleven neighbouring municipalities (Including Espoo and Vantaa which are the largest), has a combined population of about 1.2 million. It represents 23% of the population and 29% of the job market. Since most industries are represented in the Helsinki region, it has a wide economic base that gives it increased sustainability and protection from economic downturns. Helsinki region has a significantly high proportion of the workforce in the private service sector compared to the rest of the country. Since Helsinki also serves as an administrative centre, professional services and high-tech industries centre it, provides a labour market which draws on many of the neighbouring communities, however, the proportion of the work force in manufacturing industries is significantly lower than for the rest of Finland.

Helsinki is divided into 54 distinct neighbourhoods by the city council which is used for city planning and city government. Today, each neighbourhood is identified by both a two-digit number between 01 and 54 and an official name in both Finnish and Swedish. The neighbourhoods are also given postal codes which are the location tags that we have used in defining the areas under study.

4.5 Helsinki Economic Overview (Year 2001 To 2004)

The economy of Helsinki region is primarily service-based. The main economic base includes professional services, high-tech industries and public sector services. It has gradually moved away from heavy forms of industry, although the paper, textiles, and

shipbuilding industries are still present and operating in some form within the city limits.

The main employer in the country is NOKIA, who employs over 50,000 people worldwide and produces over 29% of Finland's GDP. Many of the industries providing service to NOKIA are located or headquartered in Helsinki. In addition, most large Finnish companies have their head offices and other administrative functions in the Helsinki area. The spill over effect is a slow migration of the population from suburbia Finland into the Helsinki business district. It is also the primary location of central government and federal offices. It should also be noted here that foreign investors and their satellite offices are usually located around the Helsinki business area. The GDP per capita is 1.5 times higher than the national average, making Helsinki one of wealthiest capitals in Europe.

All these factors expand the demand for housing and create positive price pressure on homes sold in the area.

4.6 Pre-period Economic Conditions

The Finnish economy has shown strong growth since the middle of 1990s. The Helsinki region experienced rapid growth in population and its share of economic activity. The growth was based mainly on the developments in the electronic sector.

At the start of the year 2001, the population of the Helsinki region increased by 13,500 and total output increased by about 3% for the same region. The economy was then impacted by the global downturn, and the GDP began to decrease as exports fell. As a result, the Finnish GDP ended the year with an overall increase of only 1%.

In Year 2002 however, the trend ending 2001 continued and slowed the growth in population and GDP. Economic uncertainty and the decreasing need for the new labour force led to lags in the housing market as well. The impact on the Helsinki region has proportionately heightened because of its significantly higher proportion of services compared to the remainder of the country (over 40% of the jobs).

Due to the global downturn during 2001 to 2003, the Finnish economy relied strongly on private consumption, which has been strengthened by reductions in both indirect and direct taxes. Inflation has remained at a very low level.

The start of a global economic recovery in 2004 led to increases in domestic consumer confidence levels which in turn led to stronger private consumption and moderate inflation growth rates supported also by wage raises. But economic growth in the Helsinki region was slightly slower compared with the remainder of the country. On the other hand, due to comparatively high yields in the property investment market, investment activities which began in 2002 continued to attract corporate investors. This is especially noteworthy in the office and retail market.

4.7 Post period Economic Conditions

Supported by the recovery of the global economy, the pace of growth continued in 2005. Exports to Russia and China remained strong and continued to increase. The investment activity in the Helsinki property market continued to grow at an unprecedented pace.

Generally, the economy of Helsinki grew by 3.2% in the year 2004 and as an industrialized country, there is a free market trade based on the intensive use of technology, capital investment, and abundant endowment of resources.

Finland is the only euro country in the Nordic countries and it has since be member of the European monetary union since 1999.

However, in the latter part of 1990, Finland had one of the best performing economies in the European Union and Europe, also between 1995 through 2000 Finland GDP growth rate varied between 3.6% and 6.3%

Although Finland is a small country, it has a very open economy and thus, very dependent on global economy development. The global economy downturn in 2001 accounted for the slower growth in the Finnish economy between 2000 through 2004. The economy also relied strongly on private consumption, which was supported by reduction in direct and in direct tax and moderate inflation.

Table 1 Key Figures-Finnish Economy

Year	1998	1999	2000	2001	2002	2003	2004	2005	2006
GDP(change in vol)	5.0	3.4	5.1	1.0	2.2	2.4	3.6	2.1	3.2
Inflation	1.4	1.2	3.4	2.6	1.6	0.9	0.4	1.3	1.8
Unemployment	11.4	10.2	9.8	9.1	9.1	9.0	8.8	8.4	8.0
Interest rate 3month	3.6	3.0	4.4	4.3	3.3	2.3	2.1	2.2	2.7
Interest rate 5 years	4.3	4.1	5.3	4.5	4.4	3.3	3.3	2.9	2.9

Source: Bank of Finland, Statistics Finland and Ministry of Finance

4.8 Housing loans, Interest rate, Tax system and Transaction cost

Over 90% of household loan in Finland are variable-rate loans, the effect of which put the majority of the borrowers into the risk of an increase in interest rates.

The prime rate however, is the most common used reference rate for the new housing loan agreement. In December 2007, 51% of all new business on housing loans was linked o the prime rate. It thus gained popularity, crowding out Eurobori rates, the most widely applied reference rate for housing loans in the last few years

The correlation between interest rate and house prices has been one of the key reasons for the volatility in the housing market. The average interest rate in Finland on new housing in December 2007 was 4.94%. The average interest rate rose slightly from the previous month, caused by the general increase in market interest rate as a result of financial market volatility but not withstanding this was a way below the historical peak of 13.7% in September 1992.

Non- residents in Finland are taxed on their income from Finnish-sourced income. Spouses are however taxed differently. Taxes also vary from Individual taxation such as income tax, income from capital to Property taxation and corporate taxations. Rental income is thus taxed in Finland at a flat rate of 28 % although income generating expenses are deductible. Capital gains taxes are considered as income from capital and are taxed at 28%. Inheritance tax is imposed at progressive rate of 10%, 13% and 16%

Table 2 Taxable income

Taxable Income	Rates
Up to €12,400	Nil
€12,400-€20,400	9% on band over €12,400
€20,400-€33,400	19.5% on band over €20,400
€33,400-€60,800	24% on band over €33,400
Over €60,800	32% on all income over €60,800

Source: Global Property Guide

It is important to point out that property right index, a subcomponent of economic freedom that measures the degree to which a country's laws protect private property rights, and the degree to which its government enforces the law, ranked Finland as one of the most desirable country on its index, which confirms the better protection properties generally enjoy in Finland. In 2000 however, the Finnish government removed the long clause on non-resident to obtain a permit to buy a secondary residential property in Finland, hence creating equality between foreigners and Finns in this regard, there are still restrictions for foreigners in acquiring property in the province of Aland (Ahvenanmaa), an archipelago

5 METHODOLOGY

Hedonic model is adopted in this thesis to analyse how house price varies with set of independent variables.

The traditional hedonic model is usually based on a multiple regression model, whereby the observed transaction prices of large number of properties are shown as dependent variable and the value determinant as independent variable. Since it is practically impossible to sell housing attributes separately the resulting regression coefficients yield the marginal contribution of each attribute to the sales price for the respective property, this accounted for differences in the way price index of real estate is constructed from other class of asset.

Hence, the regression model in this thesis will take a general form of hedonic price function, i.e.

$$P = f\,(S\beta, N\gamma, D\alpha) + \varepsilon, \qquad (3)$$

where, P is a vector of observed logarithm of house values or prices; S is a matrix of physical attributes containing variables such as the age, number of rooms and size of the apartment, N is the neighbourhood distinguished by municipality and postal code. D is the set of dummies that would be included in the matrix are age, location and seasons, these are represented by Age 1, 2, 4. Loc 1, 2, 4 and winter, summer, and autumn[11]

[11] Dates and definitions can be seen in the definition of terms

however, Age 3, Loc 3 and Spring season would be dropped in the model to avoid dummy variable trap (multicollinearity), while β, γ and α above are the parameter vectors corresponding to S, N and D respectively; ε is a vector of random error.

The methodology follows a sequential order from the above equation, through

$$P = \beta_0 + \sum_{k=1}^{N} \beta_k \; X_k + \sum_{d=1}^{N} \gamma_d \; D_d + \varepsilon \qquad (4)$$

$$\ln P = \beta_0 + \sum_{k=1}^{N} \beta_k \; X_k + \sum_{d=1}^{N} \gamma_d \; D_d + \varepsilon \qquad (5)$$

where

P= sales price of the property,

X_k= k_{th} characteristics of the property,

D_d = sets of dummies,

B and γ are coefficients of the characteristics and dummies

ε = property specific random residual value with zero mean and variance.

Detail of the equation 4 and 5 is expatiated in the data analysis (5.1)

5.1 Data Analysis

The data source used in this thesis is from statistics Finland, the content contained physical attribute (such as size, apartment type, no of rooms etc.), location attribute (such as regional classification, Helsinki 1,2,3 and 4.) as well as neighbourhood(municipality, separated by postal codes). It is a substantial data with the prices of all the housing sales in the whole of Finland, filtering and sorting of the data is done according to its relevance to this thesis in an unbiased way.

The outcome yields a complete housing transaction in the year 2001 for the whole of Helsinki. Multicollinearity is reduced by the use of variance inflation factor (VIF) and tolerance level is used to cross check this effect. The data however, serves the purpose of this thesis even though some attributes were not present due to the limitation of the data.

Table 3 below shows the descriptive statistics details of the variables, from the table, the number of observation used in running the regression was 10288; other descriptive headings are the range of the values, the minimum and maximum numbers of each variable as well as the mean and standard deviation of the statistics.

Another important aspect of the data descriptive statistics is the skewness and the kurtosis observation. It is noted from the result of the descriptive statistics that most of the observations and especially size are outside of -1 and +1 margin, indicating the substantiality of the skewness of the distribution, overall positive skewness has a relative large values and tails off to the right while on the other hand a negative values means the opposite.

The kurtosis which gives information about the “peakedness” of the distribution when is reported also in the table, like the skewness, positive kurtosis indicates a relative peaked distribution while the negative indicates a relative flat distribution.

Table 3 Descriptive Statistics

	Variables						Skewness		Kurtosis	
	N	Range	Min	Max	Mean	Std. Dev	Statistic	Std. Error	Statistic	Std. Error
Age1	10288	1	0	1	,17	,371	1,804	,024	1,254	,048
Age2	10288	1	0	1	,30	,457	,893	,024	-1,203	,048
Age3	10288	1	0	1	,22	,415	1,346	,024	-,188	,048
Age4	10288	1	0	1	,32	,466	,782	,024	-1,388	,048
Dummy_autum	10288	1	0	1	,28	,447	1,000	,024	-,999	,048
Dummy_spring	10288	1	0	1	,27	,446	1,014	,024	-,973	,048
Dummy_summer	10288	1	0	1	,24	,425	1,243	,024	-,455	,048
Dummy_winter	10288	1	0	1	,21	,410	1,398	,024	-,045	,048
First_timebyer	10288	1	0	1	,29	,455	,913	,024	-1,168	,048
Loc_1	10288	1	0	1	,18	,384	1,664	,024	,770	,048
Loc_2	10288	1	0	1	,46	,498	,160	,024	-1,975	,048
Loc_3	10288	1	0	1	,16	,370	1,813	,024	1,289	,048
Loc_4	10288	1	0	1	,20	,397	1,535	,024	,357	,048
No_rms	10288	5	1	6	2,10	,994	,911	,024	,773	,048
size_sqm	10288	363,00	13,00	376,00	53,8061	25,22142	2,092	,024	11,274	,048
Trans_yr	10288	0	2001	2001	2001,00	,000	.	.	.	.

5.2 Helsinki description by region

Table 4 below shows the numbers of post codes in each location

Table 4 Helsinki by region

HELSINKI 1	
Helsinki keskusta	100
Punavori	120
Kaartinkaupunki	130
Kaivopuisto	140
Eira	150
Katajanokka	160
Kruununhaka	170
Ruoholahti	180

HELSINKI 2			
Lauttasaari	200	**Pohjois Haaga**	400
Vattuniemi	210	**Lassila**	440
Länsi pasila	240	**Sörnäainen**	500
Taka-Töölö	250	**Etu Vallila**	510
Keski-Töölö	260	**Itä Pasila**	520
Pohjois meilahti	270	**Kallio**	530
Ruskeasuo	280	**Vallila**	550
Meilahden sairaala-alue	290	**Kulosaari**	570
Pikku huopolahti	300	**Käpylä**	610
Kivihaka	310	**Länsi-pakila**	660
Etelä haaga	320	**Palohenä**	670
Munkkiniemi	330	**Itä-Pakila**	680
Kuusisaari-Lahtisaari	340	**Jollas**	850
Munkkivuori-iemenmäki	350	**Tammisalo**	830
Pitäjänmäen eollisuusalue	380	**Herttoniemi**	810

HELSINKI 3	HELSINKI 4

Pajamäki	360	**Suomenlinna**	190
Reimaria	370	**Hermannin Teollisuusalue**	580
Konala	390	**Tuomarinkylä-rpparinmäki**	690
Malminkartano	410	**Pihlajamäki**	710
Kannelmäki	420	**Tapanila**	730
Maunuuneva	430	**Siltamäki**	740
Toukola Vanhakaupunki	560	**Puistola**	750
Koskela	600	**Suurmetsä**	760
Metsälä-Etelä –Oulunkylä	620	**Jakomäki**	770
Maunula-Suursuo	630	**Roihuvuori**	820
Oulunkylä-Patola	640	**Santahamina**	860
Veräjämäki	650	**Roihupellon Teollisuusalue**	880
Malmi.	700	**Puotinharju**	900
Pukinmäki-Savela	720	**Puotia**	910
Tapaninvainio	780	**Myllypuro**	920
Viikki	790	**Itäkeskus-Marjaniemi**	930
Länsi-Herttoniemi	800	**Kontula**	940
Laajasalo	840	**Vartioharju**	950
Etelä-Laajasalo	870	**Pohjois-Vuosaari**	960
		Mellunkylä	970
		Etelä-Vuosaari	980
		Aurinkolahti	990

Postal codes also play important role in this thesis, it is used to categorise transactions according to its areas (location) and neighbourhoods. Helsinki municipality is represented by code “91” and sub-divided into post codes 00100 to 00990, the first two zeros are removed in this thesis for simplicity purposes, hence post codes “00120” is written as “120”.

There are 8 post codes in total in Helsinki “1”, 30 post codes in Helsinki “2”, 19 and 22 in Helsinki “3” and “4” respectively.

Also, tables 5, 6 and 7 below show the frequency of the set of variables transformed into dummies, the set of dummies are to give account of the different level effect of non-metric variables in predicting the dependent variables.

The parameters included as dummies are age, location and season.

This age dummy is constructed in such a way that if age of property is between “0” and “20”, the dummy is tagged age 1; if between “21 and “40” is tagged age 2; “41” and “60” is tagged age 3; while “61” and above is tagged age 4.

Similarly, if transaction occurrence is in Helsinki 1, it is tagged Loc1, Helsinki 2, 3 and 4 follows the same order. The same goes for seasons; if occurrence is in winter, it is tagged Dummy_winter, Dummy_spring if in spring, Dummy_summer if in summer and Dummy_Autumn if in autumn.

Table 5 Helsinki frequency

Location	Frequency	Percent	Cumulative Percent
1	1854	18,0	18,0
2	4733	46,0	64,0
3	1689	16,4	80,4
4	2012	19,6	100,0
Total	10288	100,0	

Table 6 Season Frequency

Season	Frequency	Percent	Cumulative Percent
Autum	2843	27,6	27,6
Spring	2819	27,4	55,0
Summer	2429	23,6	78,6
Winter	2197	21,4	100,0
Total	10288	100,0	

Table 7 Age Frequency

Age	Frequency	Percent	Cumulative Percent
1	1699	16,5	16,5
2	3047	29,6	46,1
3	2272	22,1	68,2
4	3270	31,8	100,0
Total	10288	100,0	

Thus, the model in this thesis is estimated from the regression:

$$\ln(P) = \beta_0 + \sum_{k=1}^{4} \beta_k \; X_k + \sum_{d=1}^{9} \gamma_d \, D_d + \varepsilon \ldots\ldots\ldots\ldots(7)$$

where

ln(P) = Log of sales price

β_k and γ_d = coefficient of the housing characteristics and sets of dummies (in independent variable)

K_{th} = sets of characteristics (No_rms, size_sqm, Hse_debt and first_timebyer)[12]

K_1 = Number of rooms (No_rms)

K_2 = Size in square meters (size_sqm)

K_3 = House debt; (Hse_debt)

K_4 = First time buyer; (first_timebyer)

D_1 =Location 1 (1 if in Helsinki 1, 0 otherwise);

D_2 = Location 2 (1 if in Helsinki 2, 0 otherwise);

D_3 = Location 4 (1 if in Helsinki 4, 0 otherwise);

D_4 = Autumn (1 if sales occur in autumn, 0 otherwise);

D_5 = Summer (1 if sales occur in summer, 0 otherwise);

D_6 = Winter (1 if sales occur in winter, 0 otherwise);

D_7 = Age 1 (1 if property age is between 0 and 20 years, 0 otherwise)

D_8 =Age 2 (1 if property age us between 21 and 40 years, 0 otherwise)

---

[12] The abbreviations used respectively means, number of rooms, size measured in square metres, house debt, age of the building, and first time buyer. Definition of these terms is spelt out in definition of terms.

D_9 =Age 4 (1 if property age is 61 and above, 0 otherwise)

Location 3, winter and age 3 were dropped in the model to avoid dummy variable trap. Once again, note that K_{th} is a set of continuous variable while D_{th} is a set of dummy. A Semi-log model is used in running of the regression because the fit is better when compared with log-linear model.

6 REGRESSION RESULT

The model estimation in this thesis is the ordinary least squares method. The analysis is based on standard multiple-regression obtained from SPSS 16.0 software and the analytical method used is “ENTER”.

The accuracy of this thesis as reported earlier would depend on the input data. Therefore a careful preliminary analysis was conducted to ensure compliance with assumptions of normality, linearity, multicollinearity and homoscedasticity.

The hedonic model is based on 13 independent variables out of which 9 variables are dummies.

This thesis also takes into consideration all postal codes in Helsinki and all housing transactions in the year 2001 of all type 3 apartments (blocks of flat) with rooms’ numbered between 1 and 6.

6.1 Model Summary

From the model summary above R square of the model is .728; meaning that 72.8% of the dependent variable (log of price) is explained by the set of characteristics listed as independent (predictor) variables, it can also be deduced from the same figure that the adjusted R square signifies that the model accounts for 72.7% of variance in the log of price.

It is also important to note from the ANOVAs figure below shows that the model has F value of 2110.448 with significant (sig. 000; that is p-value is less than .0005). This

shows that the fitness of the sample data to the model is statistically significant and the regression equation is effective.

The null hypothesis that multiple regressions in the population equals zero is also satisfied in the model.

Model Summaryb

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,853[a]	,728	,727	,256291146240758

a. Predictors: (Constant), Age4, First_timebyer, Dummy_autum, Hse_debt, Loc_2, size_sqm, Dummy_winter, Age1, Dummy_summer, Loc_4, Age2, Loc_1, No_rms

b. Dependent Variable: LOGP

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
	Regression	1802,126	13	138,625	2110,448	,000[a]
	Residual	674,849	10274	,066		
	Total	2476,975	10287			

a. Predictors: (Constant), Age4, First_timebyer, Dummy_autum, Hse_debt, Loc_2, size_sqm, Dummy_winter, Age1, Dummy_summer, Loc_4, Age2, Loc_1, No_rms

b. Dependent Variable: LOGP

6.2 Regression Analysis

Generally, the regression results from table 8 below shows positive beta coefficients for all the housing characteristics as well as the sets of dummies except for Dummy_winter with a negative sign when compared with Dummy_spring.

It is also pertinent to note that the collinearity statistics through Tolerance and Variance Inflation factor (VIF). The tolerance values measure the correlation among the independent valuables and it varies between 0 and 1. The closer to zero the tolerance value is for a variable, the stronger the relationship between this and the other independent variables. VIF is the reciprocal of tolerance and alternative measure of collinearity in which a larger value indicate a strong relationship among the independent variables. The collinearity statistics shows that neither of the obtained values under tolerance is less than 0.1 nor the VIF greater than 10. This gives the assurance that multicollinearity is not a factor to be worried about in this thesis.

Since the focus of this thesis is to analyse the Helsinki housing market using hedonic model, it is important to report the outcome of the regression according to the attributes used in the model.

The table 8 below is an extract from the regression model result.

Table 8 Extract From Regression Result

Model	Unstandardized coef β	Std.Error	Beta	t	sig
No_rms	,048	,005	,097	10,370	,000
size_sqm	,013	,000	,678	73,213	,000
Hse_debt	6,257E-6	,000	,135	23,899	,000
First_timebyer	,013	,006	,012	2,343	,019

6.3 Coefficient Explanation

Number of Rooms

It can be deduced from the result that for one additional room in the Helsinki housing type 3 (blocks of flat), log of price increases by 4.8% holding other variables constant, this is reported with an error of ±0.5% standard error. Even though the number of rooms is significant in the model, as is explained by the t test, which is 10.37 as shown in the figure above

Size in square meters

Also, it can be reported that a unit increase in apartment size in square meter increases the log of price by 1.3%, holding other variables constant. And with T test of 73.2, the size of apartment in the Helsinki housing in the year 2001 shows strong impact among the four main independent variables listed in the regression model above. This result is

in agreement with what is obtained from the market, in fact house price is generally summarized or written even in square meters, hence we have price per square meters.

The Helsinki house price thus shows that much importance is attached to the size even more than number of rooms.

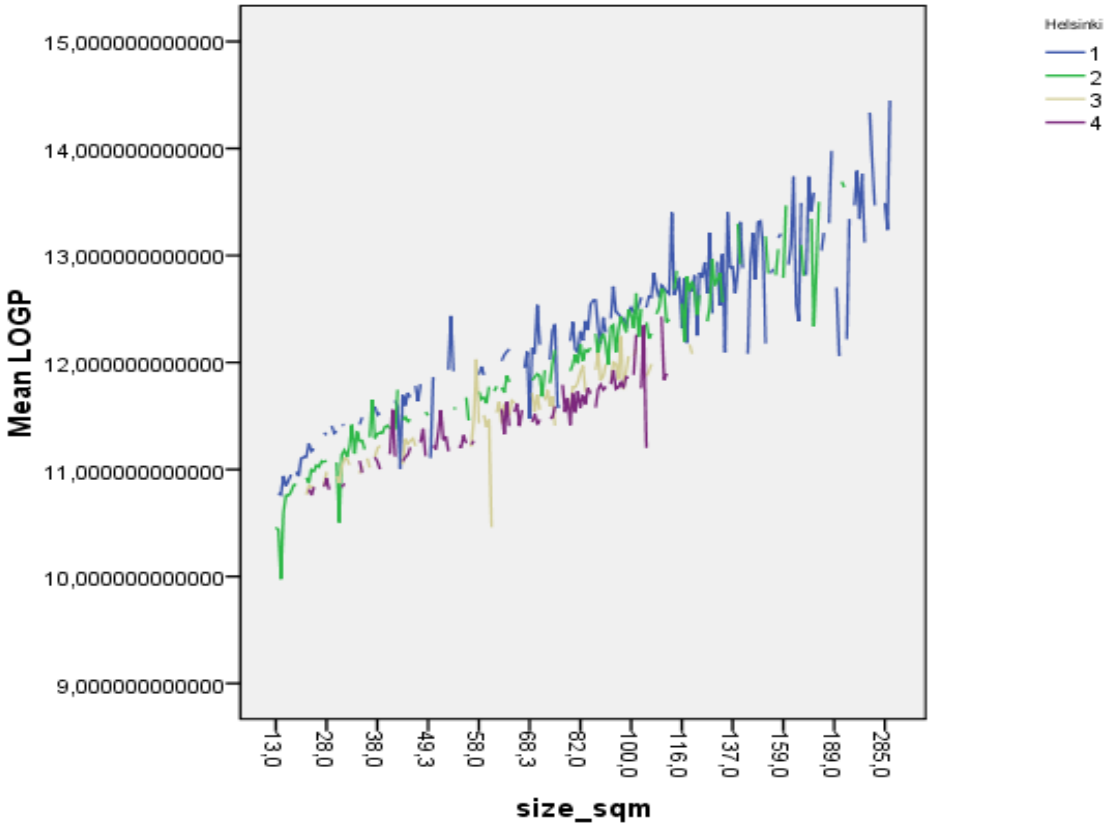
This is further illustrated in the figure 1 below (mean log of price and size in square meters). The figure demonstrated the effect of size and mean log of price, although there are little fluctuations in the graph result, this is so because of location peculiarity of location which would be discussed latter.

It is also observed in Helsinki 1 that the highest numbers of room exist there with a corresponding highest mean log of price. This is also explained graphically in appendix 1

House debt

Coefficient of House debt is relatively very small and has little or no impact on the log of price; however, the impact of house debt on the model and especially among the other independent variable is significantly high and too important to be ignored. In reality, increase or decrease in house debt does not bring about a corresponding increase or decrease in the house price but rather the difference in the house debt and house price is figured out in the sales. This is also included in house price', even though the fluctuation in interest rate may be a concern

Figure 1 Mean LogP vs Size



First Time buyer

First time buyers in Finland enjoys favourable tax benefit. This generally encourages first time buyer to make their first purchase ever. From the model, each additional first buyer increases the log of price by 1.3% with a margin error of ±0.6%. Although this variable is significant at p value of .019, the impact among other attribute is very weak and low significance as well.

Table 9 Coefficients output

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95% Confidence Interval for B		Correlations			Collinearity Statistics	
	B	Std. Error	Beta			Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
1 (Constant)	10,515	,011		947,532	,000	10,493	10,537					
No_rms	**,048**	,005	,097	**10,370**	**,000**	,039	,057	,607	,102	,053	**,303**	**3,299**
size_sqm	**,013**	,000	,678	**73,213**	**,000**	,013	,014	,761	,586	,377	**,309**	**3,232**
Hse_debt	**6,257E-6**	,000	,135	**23,899**	**,000**	,000	,000	,177	,229	,123	**,830**	**1,205**
First_timebyer	**,013**	,006	,012	**2,343**	**,019**	,002	,024	-,091	,023	,012	**,978**	**1,023**
Loc_1	,442	,010	,347	43,507	,000	,422	,462	,342	,394	,224	,418	2,392
Loc_2	,210	,008	,214	26,828	,000	,195	,226	-,034	,256	,138	,418	2,394
Loc_4	-,128	,009	-,103	-14,672	,000	-,145	-,111	-,169	-,143	-,076	,536	1,865
Dummy_autum	,016	,007	,014	2,316	,021	,002	,029	,019	,023	,012	,686	1,458
Dummy_summer	3,145E-5	,007	,000	,004	,996	-,014	,014	-,004	,000	,000	,701	1,426
Dummy_winter	-,007	,007	-,006	-,978	,328	-,021	,007	-,010	-,010	-,005	,714	1,401
Age1	,005	,009	,004	,523	,601	-,013	,023	,060	,005	,003	,558	1,792
Age2	,004	,008	,003	,464	,643	-,011	,018	-,139	,005	,002	,529	1,890
Age4	,012	,008	,011	1,482	,138	-,004	,027	,153	,015	,008	,471	2,121

a. Dependent Variable: LOGP

Another important uniqueness of this thesis lies in the dummy variables. Location, Season, and ages of building, these are the important dummies examined in this thesis.

Location

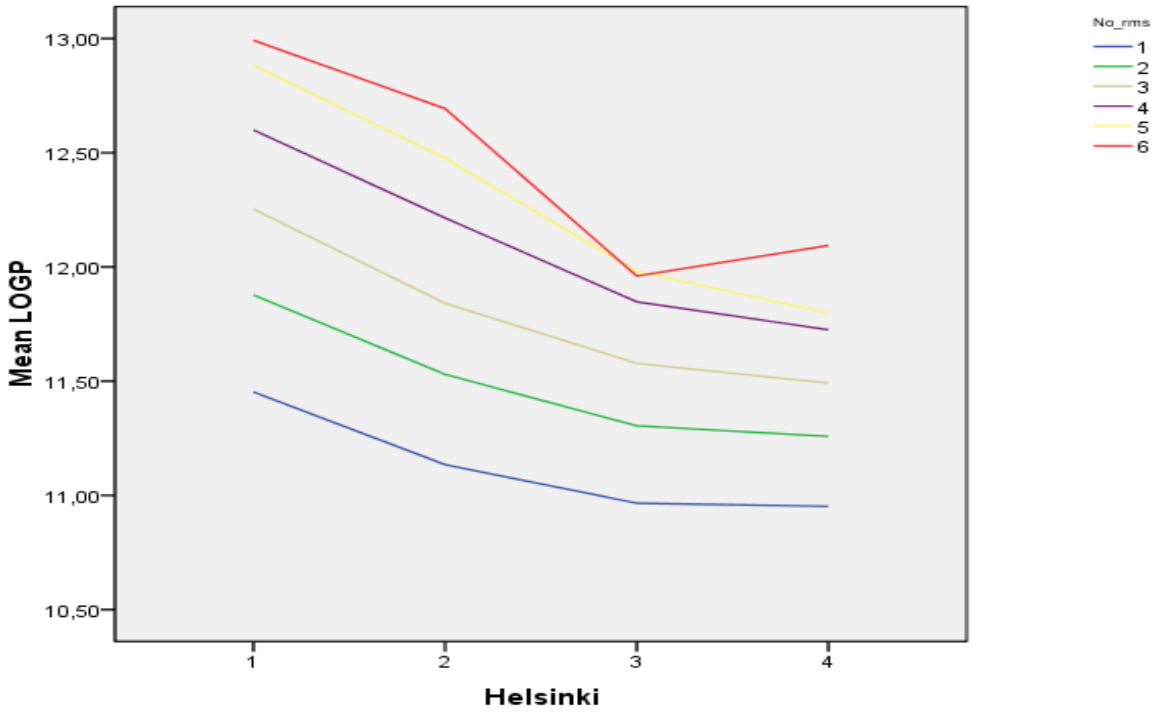
Location 1, 2 and 4 are the set of location dummies considered in this thesis while location 3 is left out to avoid dummy trap. Locations are separated by post codes[13] and its preference is according to the income of the average household, nearness to the central business district (CBD), age of occupants as well as building, among other factors.

The outcome of the regression table shows that location 1 and location 2 are 44.2% and 21% more expensive than location 3

This is expressly demonstrated in the figure 2 above, where it can be seen that the higher the number of rooms the more the upward slope of the graph. This means increase in number of rooms leads to increase in corresponding mean log of price in all the location except for house with 6 rooms between location 3 and 4.

[13] This can be seen in chapter 4

Figure 2 Mean Log P vs Helsinki (location)



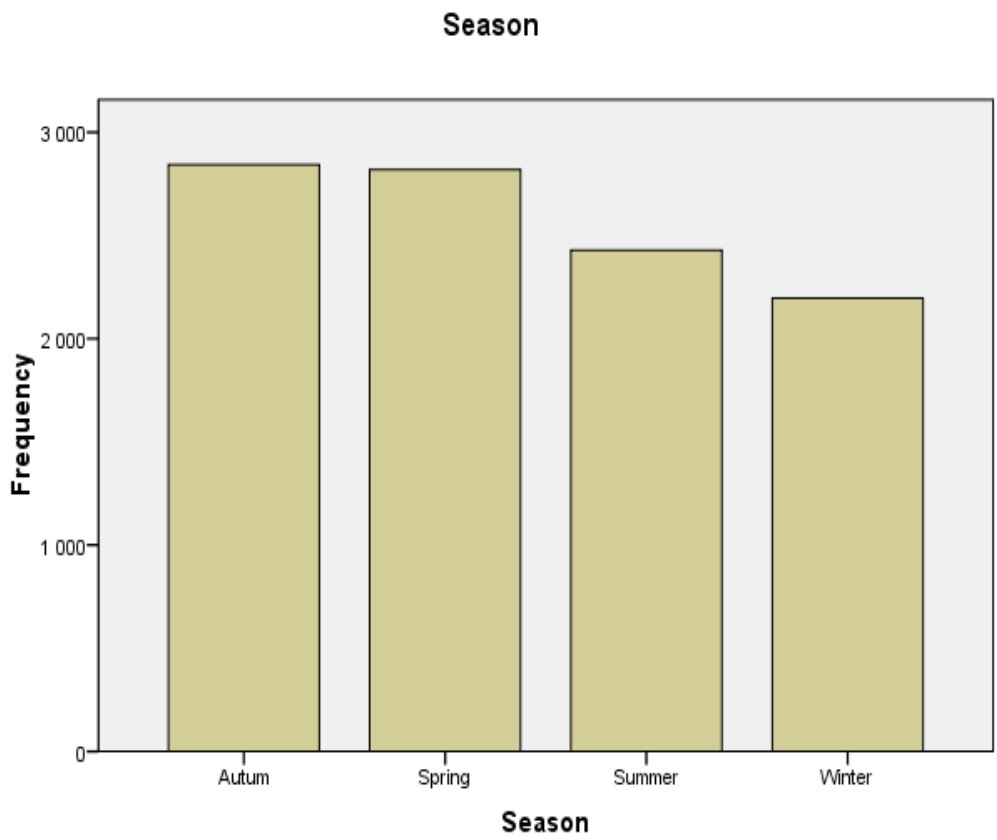
It is also important to note that location 4 is 12.8% less expensive when compared with location 3.

We can thus conclude for instance that, holding other variables constant, a unit square meter added increases the log of price by 1.3% and if it is in location 1, it will be 44.2% more expensive than location 3.

Season

Season as a set of dummy in this thesis shows that transactions done in autumn are the only significant attribute when compared with dummy_spring. There is a weak relationship in dummy_winter and dummy_spring, the analysis revealed that transactions in winter are 0.7% less expensive in year 2001 when compared with spring. This could be as a result of the higher number of transactions in spring than in winter as shown in figure 3 below.

Figure 3 Season Frequency



However, analysis of housing transactions reveals that house price in autumn is 1.6% more expensive than house price in spring. Also the year 2001 is the turning point year from the general fall in the house price that occurred between 1999-2001, autumn is thus about the time that the housing market began to pick up.

Age

Table 9 shows that there is no direct relationship between age and price of apartments, new apartments were expected to have higher prices than the old apartment, infact, the analysis revealed that holding other things constant, the apartment within age 4 are

1.2% more expensive than age 3 with ±0.8% error margin[14]. Although figure 5 below shows that Helsinki 1 has the least number of transaction and the highest number of old apartments, but also, figure 4 below shows that Helsinki 1 has the highest numbers in mean log of price. This result indicates that apart from other factor such as nearness to the CBD and other neighbourhood attribute, it can also be reported that historical value and competitiveness is also a contributing factor to the choice of this neighbourhood.

Although, it is beyond the scope of this thesis, it was noticed that households in Helsinki 1 have similar jobs, such as health care services, clerical jobs, ministry workers etc. The population of immigrant and student as well as low income household earners are minimal in this location, even though it has a great link to higher institutions in Helsinki.

It can be deduced that special attributes earlier mentioned in this location accounts for the set of households living in this location. This is shown graphically in figure 6 below

Competitiveness in terms of limited supply against rising demand, resulting into higher price suggests that, certain group of people can afford purchases in Helsinki1.

Figure 6 show that households with income over 56,000 euros per annum reside more in Helsinki 1 than any other location, even though more than 50% of the houses there are over 65 years.

[14] See chapter 4 for age 1,2 and 4 analysis

Figure 4 Mean Log P vs Age

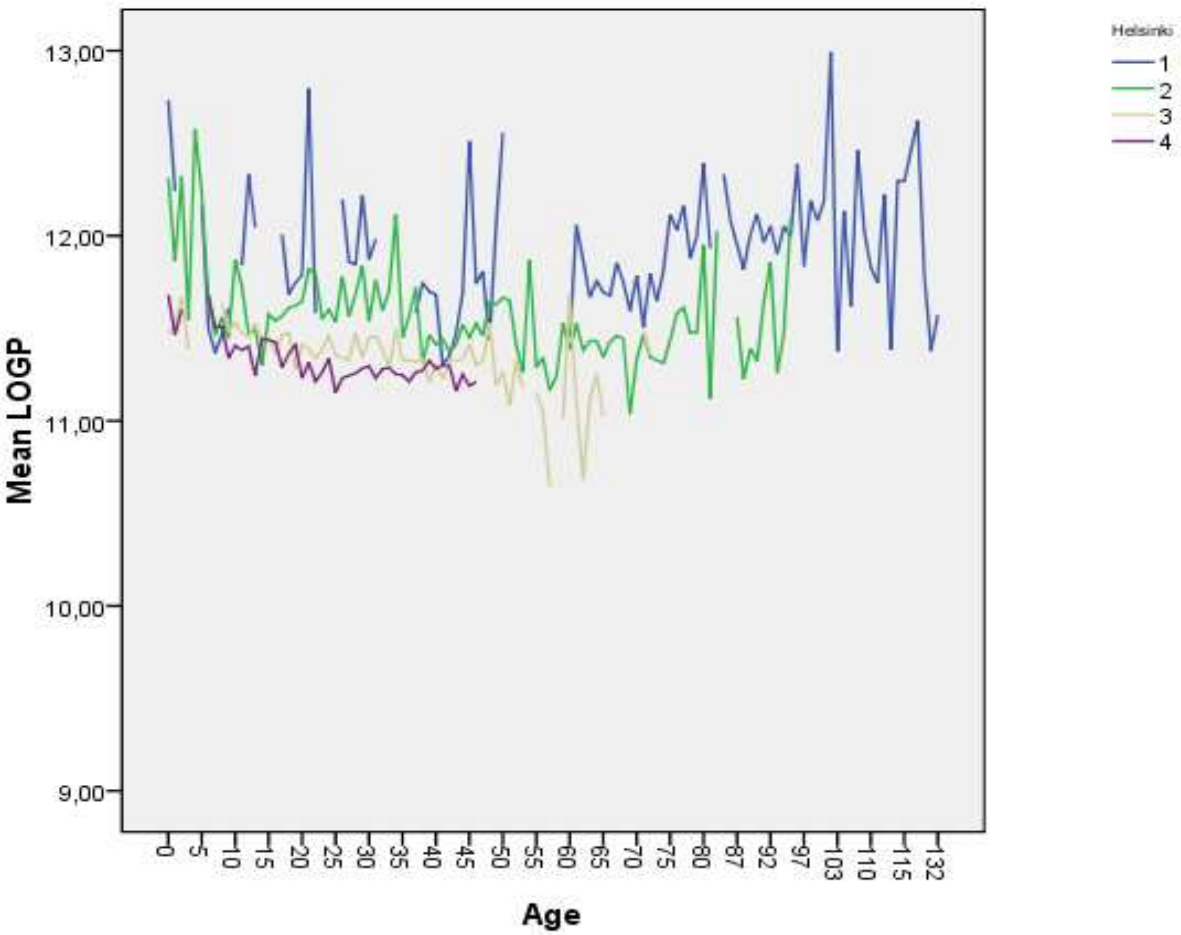
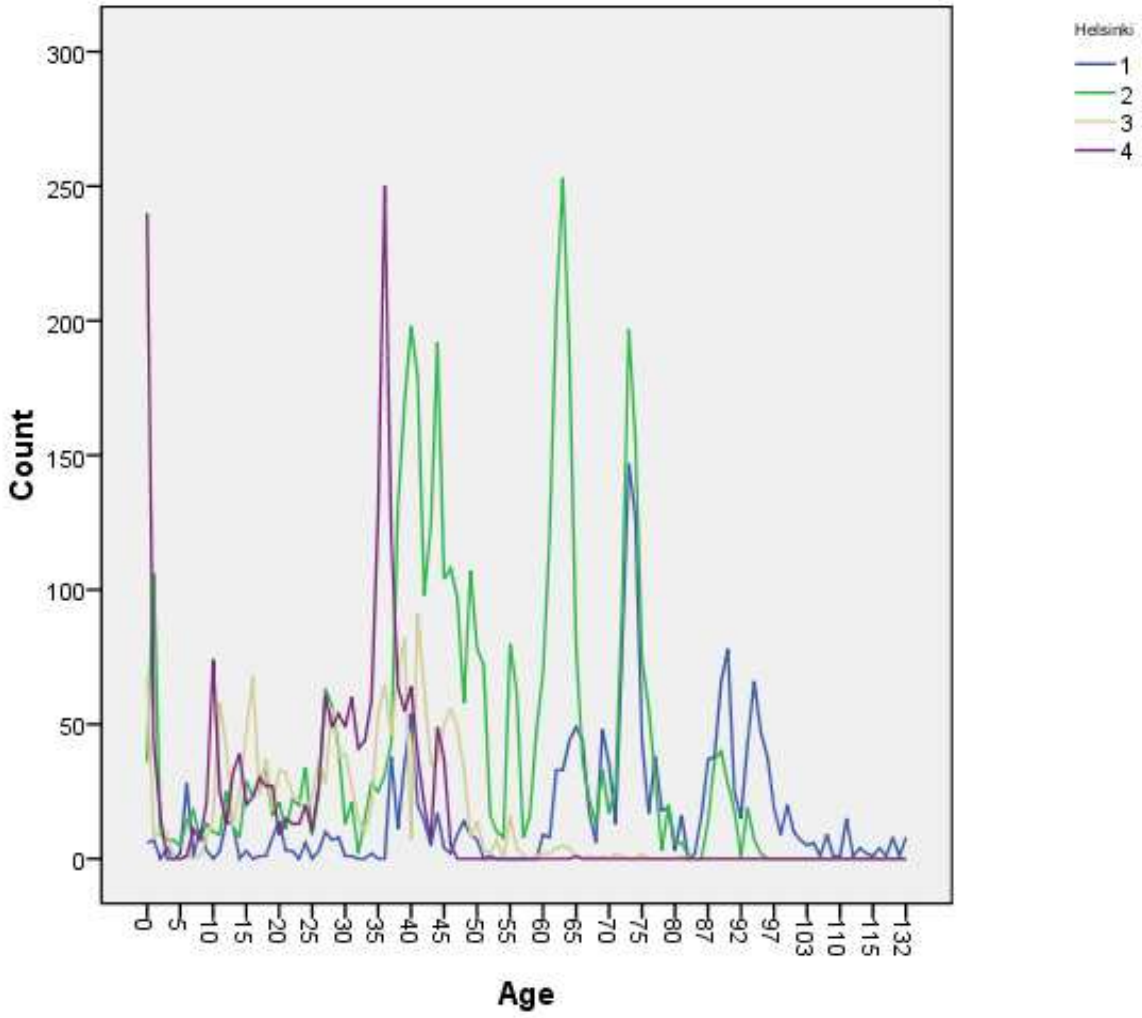


Figure 5 Graph of Age frequency



6.4 Household Income Effect

Household income plays a major role in household decision making. Figure 6 below displays the income category of household separated by location. It is important to report that all the locations consist of other type of housing but it is beyond the limit of this thesis and would not be mentioned. However, the demographic income plays important role in choice of location as well as social status attach to housing historical values. The income category in figure 6 is as follows:

Household with income under 13,000 is categorized as Lowest,

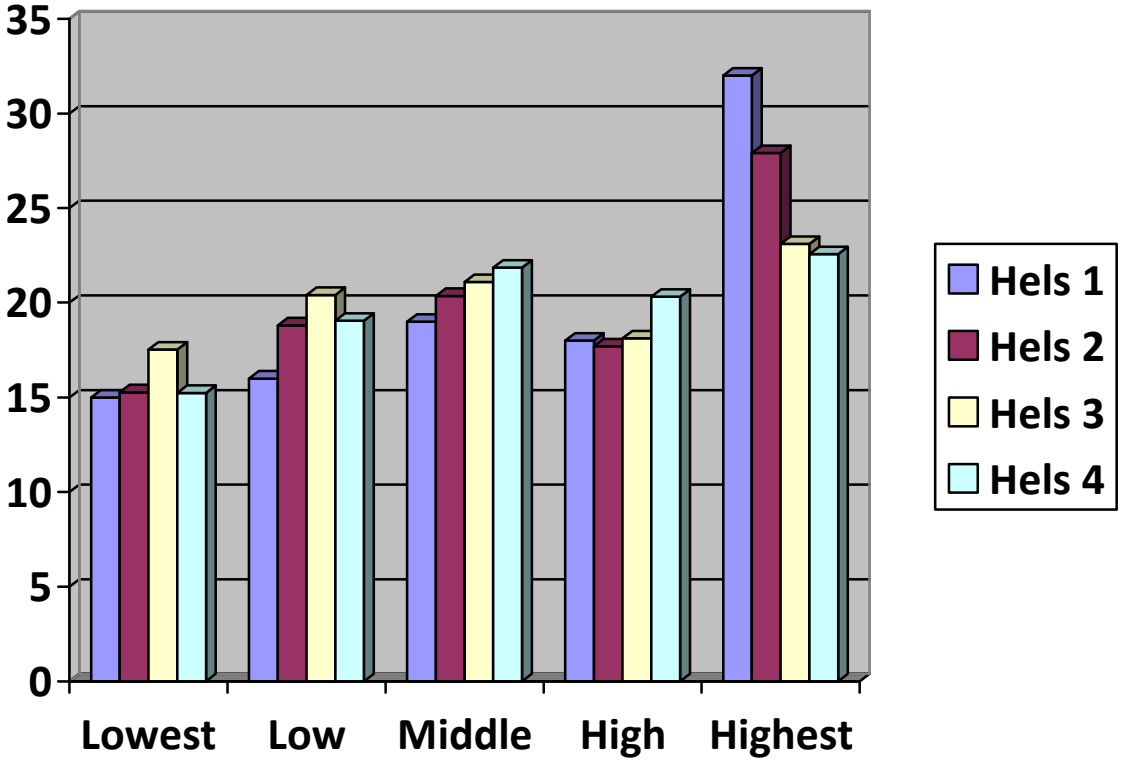
Households earning between 13,000 and 23,999 as Low,

Households earning between 24,000 and 36,999 as Middle

Households earning between 37,000 and 55,999 as High, while,

Households earning 56,000 and above as highest

Figure 6 Household income and location



7 CONCLUSION

The complexity of real estate characteristics such as heterogeneity, illiquidity, lack of efficient information and indivisibility, have made the real estate market analysis more interesting to researchers, investors as well as policy makers.

Hedonic price analysis requires a large quantity of data to depict the important latent factors of the housing attribute. Depending on the accuracy of the attributes included in hedonic model, the resultant effect is basically determined by the assumptions surrounding the input data.

This thesis displayed house price analysis of Helsinki area based on 9 specific attributes including set of dummies in arriving at its unique conclusion

It shows the importance of apartment, room numbers and sizes in all the considered location considered, even though house debts also have special and unique impact on price.

It was discovered that the preference and desires of home owners from one location to another differs according to household status. Location in this thesis was seen more of a social status, as households of the same status cluster more together even than the newness of properties in terms of age. It is considered in this thesis to group households according to their incomes and location with a resultant effect to proof the realized outcome.

Age of building was also another important factor in this thesis, it was realized that age of building did not realise a corresponding price increase but rather older building attracted higher prices. It was also discovered that older building have more rooms than the new as well as sizes, which could be a strong reasons why it is preferred by older citizens.

The importance of the Finnish season is conspicuous in the result realized in this thesis, it was noticed that more transactions occurred in autumn than any other season, spring, summer and winter respectively. However, the thesis discovered that transactions in winter are 0.7% cheaper compared to spring and 1.6% more expensive in autumn than spring. This is in accordance with the importance of Finnish weather in housing market and cycle, as supplies usually come into the market in summer, inspection is also carried out about this period and conclusion is usually reached in autumn. Due to the law of demand and supply, prices are higher in this period than any other period.

Finally, this thesis has demonstrated the uniqueness of hedonic model in explaining house price by its attribute. Even though the aim of this thesis is met, further research can still be explored to ascertain other factors that can be responsible for variation in house price that may not have been explained by the thesis due to constraint in data availability.

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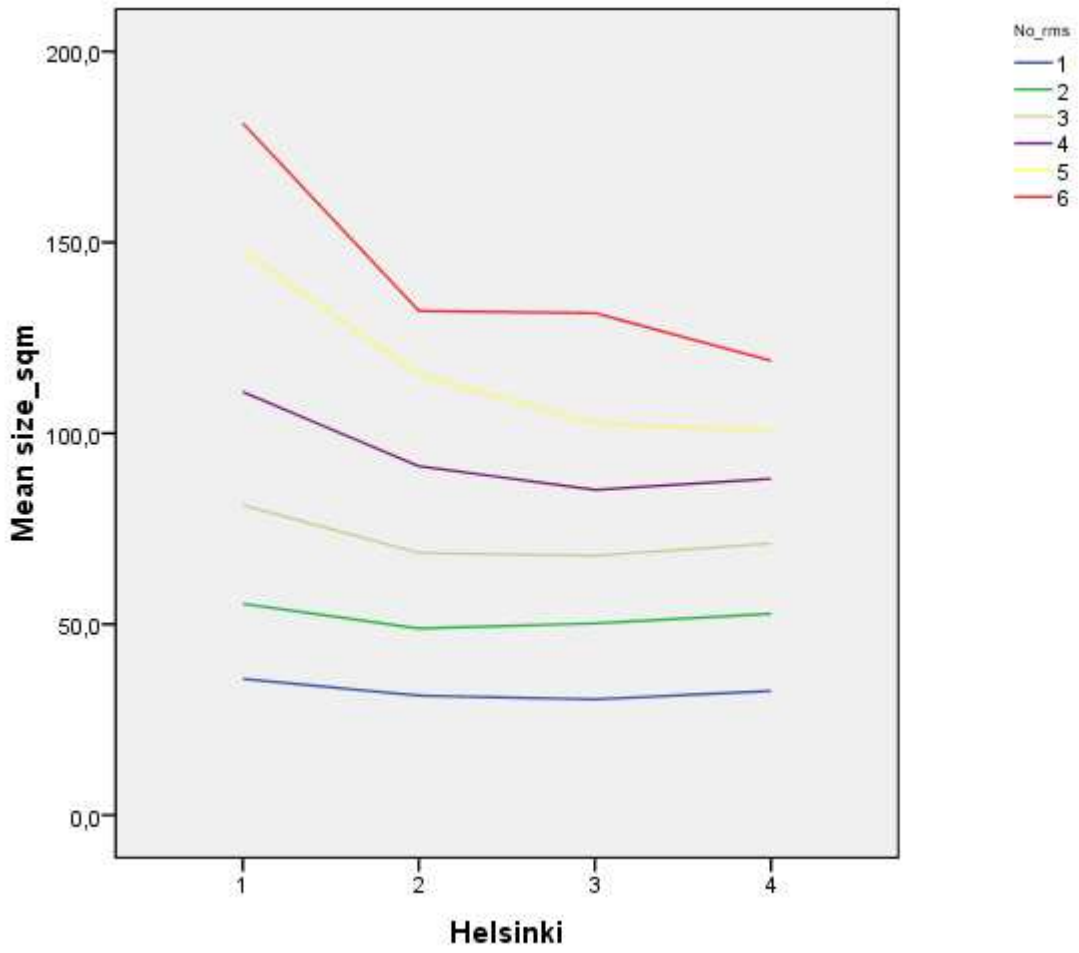
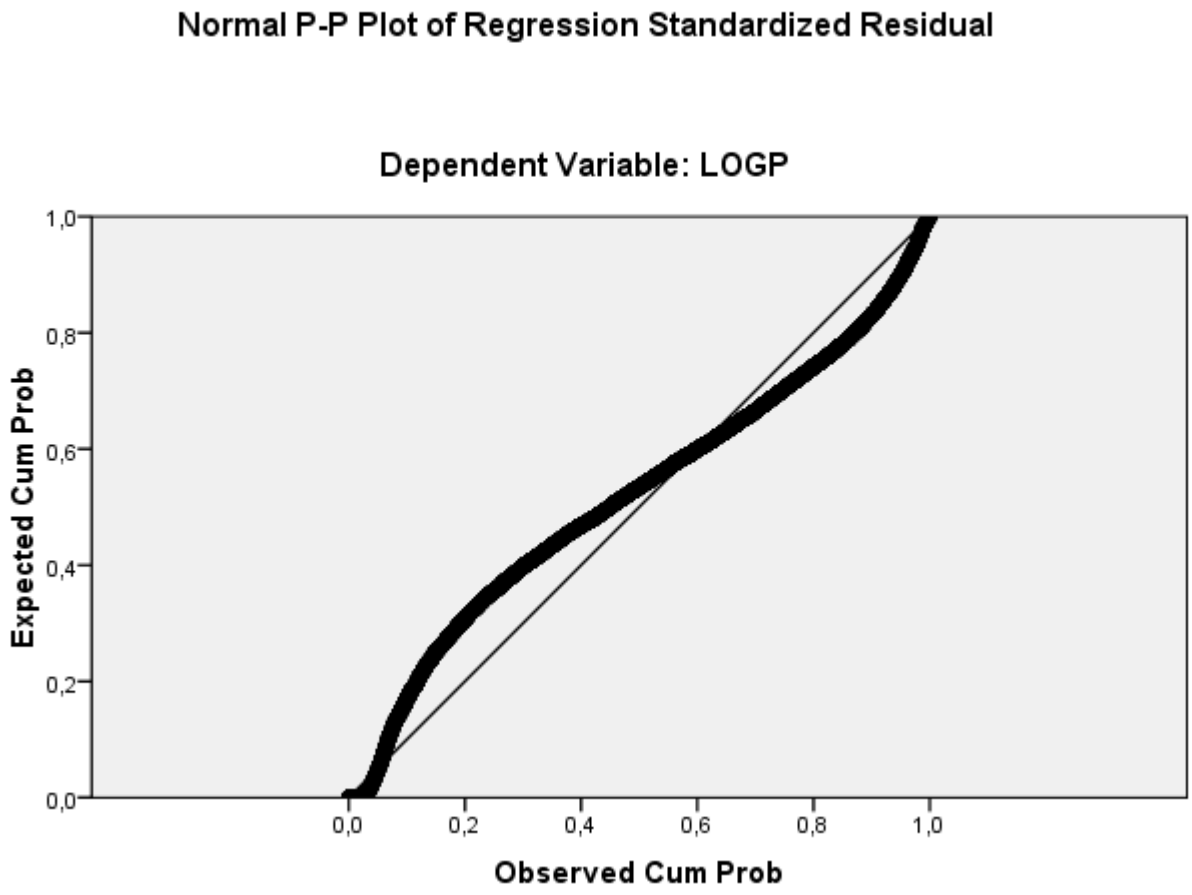
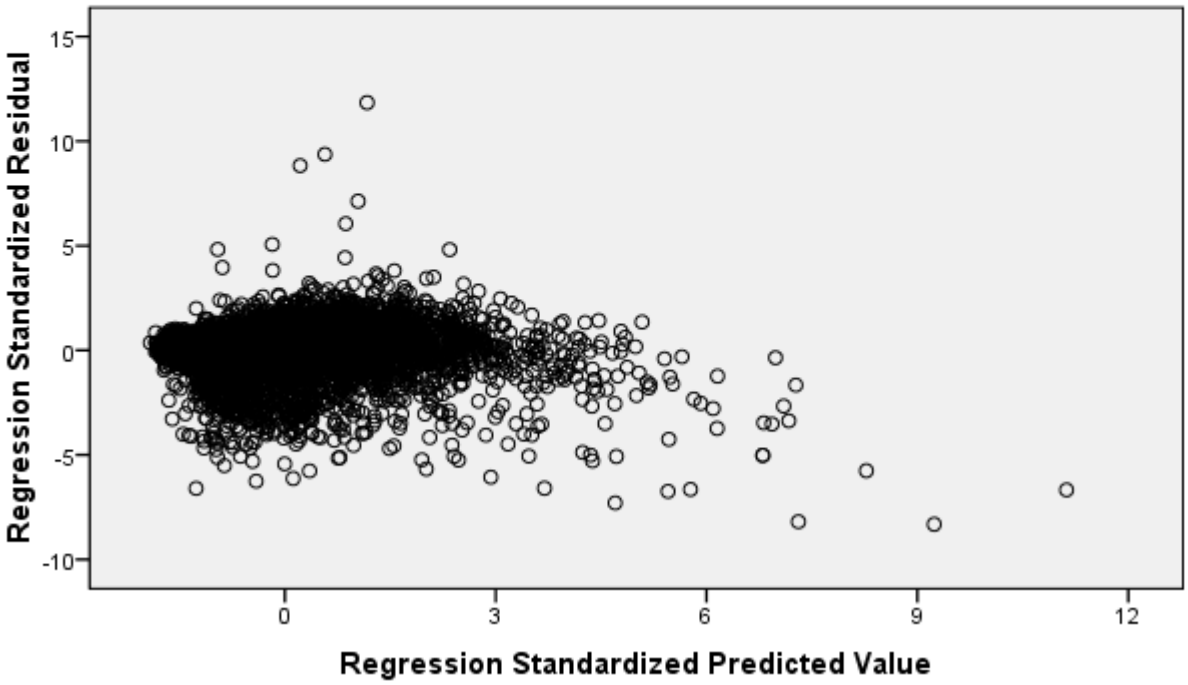
APPENDIX

Mean of size against Location separated by room numbers




Normal P-P Plot of Regression Standardized Residual
Dependent Variable: LOGP
Expected Cum Prob
Observed Cum Prob
0,0
0,2
0,4
0,6
0,8
1,0

Scatterplot

Dependent Variable: LOGP