UNIVERSITY OF GOTHENBURG
SCHOOL OF BUSINESS, ECONOMICS AND LAW

Preferences on the Rental Housing Market

What factors determine the attractiveness of an apartment in Gothenburg?

Victor Johansson

Graduate School
Master of Science in Economics
Master Degree Project No. 2012:51
Supervisor: Lennart Flood

Abstract

This thesis is an empirical examination of the demand side of the rental housing market in Gothenburg. The study is done in collaboration with Boplats Göteborg, the main housing agency in the city. Due to certain regulations on the rental housing market, the demand cannot be fully observed through the price mechanism. In this paper, the demand for an apartment (days since agency registration required for getting a first-hand contract) is decomposed into a price component and several apartment-specific characteristics in a linear model. Empirically, some extra focus is put on the districts of Majorna and Kungsladugård – two areas where a large share of the total housing consists of rental apartments, and where the demand for housing is exceptionally high. The results suggest that the geographic location to a very large extent determine the queuing time required. The monthly rents and (to some extent) the floors are also significant determinants. In addition, both Majorna and Kungsladugård seem to have extremely strong area effects, even when the lower rents in these areas are controlled for.

Acknowledgements

During the last two years I have studied at the MSc Economics program at the School of Business, Economics and Law in Gothenburg. These two years of challenges and analytical stimulation have made me think about economics in a new way, and I have developed a certain personal interest for some segments within the field. One such segment is the housing market.

I decided to write my Master's thesis on the housing market rather early. I spoke to Lennart Flood, one of my professors in econometrics, and he accepted to supervise me although the housing market was not his main area of research. For this I am very grateful. His knowledge in econometrics, his valuable inputs throughout the whole thesis process and his positive attitude towards this rather special thesis idea have all been crucial for me during the last months.

When I decided to examine the preferences on the rental housing market, I contacted Boplats Göteborg. I thought that they might be able to provide me with some material. The first person I spoke to at Boplats Göteborg was Shahbaz Khan, who immediately showed interest in my plans. He contacted Maria Meyer-Martins, CEO at Boplats Göteborg, and we booked an appointment. From day one, Maria Meyer-Martins spurred me in the thesis process. She has given me key information about legal aspects of the market, has come up with valuable ideas and has provided the data for the study. Without the help from Boplats Göteborg in general, and from Maria Meyer-Martins in particular, this study would not have been possible.

Other people have also contributed to the study and encouraged me in the process. Hans Lind at the Royal Institute of Technology in Stockholm, for instance, guided me with his advice in the early stages and provided appreciated background references.

Finally, I would also like to thank family and friends who have supported me in various ways throughout my time as a student.

Victor Johansson
Gothenburg, May 2012

Table of Contents

Abstract....1
Acknowledgements....2
1.1. Introduction....4
1.2 Purpose and Methodology....5
2.1. Price Setting on the Rental Housing Market....5
2.2. Distribution of Rental Housing Contracts in Gothenburg....7
2.3. Literature Overview....9
3. Theoretical Modeling and Hypotheses....12
4. Data and Summary Statistics....16
5. Empirical Results....18
6. Discussion and Conclusions....21
7. Suggestions for Further Research....23
References....24
Appendix 1....25
Appendix 2....28

1.1. Introduction

The prices on detached houses and tenant-owned apartments in Sweden have risen very sharply during the last two decades, especially in the metropolitan areas. According to the Swedish business site E24 Näringsliv, the general price level on tenant-owned apartments during the years 2000-2010 increased by 153 %. What factors have been driving these price increases is a question frequently discussed and heavily debated by economists, journalists and politicians. However, it is reasonable to claim that it, at least to some extent, reflects the problematic and challenging situation that people face if instead looking for apartments on the *rental* housing market. There is a high and increasing demand for housing in the metropolitan areas, but the supply of apartments is growing very slowly. This problem is the topic of Turner (2001), in which the causes of the disequilibrium are explained and potential market improvements are discussed.

The high prices undoubtedly make ownership housing inconvenient for low-income households and people that want to move rather frequently, since there are large transaction costs involved. Also, some people will simply tend to have preferences to rent apartments rather than to buy them. Obviously, the demand for rental housing will depend on how large these groups of people are. The market for rental housing, which these groups of people will turn to, works in a completely different way compared to the free markets on which houses and tenant-owned apartments are traded. Rather than on bidding auctions, prices of rental apartments are set in local negotiations between organizations representing the two parties (landlords and tenants). The characteristics and price-setting on this market will be described in more detail in section 2.

The focus of this paper is on the demand side of the rental housing market. What is the composition of the demand for rental housing? How do households value particular apartment characteristics? How do people value the different geographical areas of Gothenburg in terms of demand for housing? To what extent does the monthly rent determine the demand? These questions will be important in the future, as landlords (both private and public) will probably be forced to build new apartments due to the massive and growing demand surplus.

Two of the districts in which it is very difficult to get an apartment are Kungsladugård and Majorna. These two areas are located in the central-western part of Gothenburg, and many of the apartment buildings here are old and characteristic. Old apartment buildings in general tend to come with lower monthly rents. According to the rental housing agency Boplats Göteborg, people will on average have to wait approximately 8 years to get a first-hand contract in these districts. What is the reason behind the strong demand for these contracts?

Is it simply due to the lower rents or does the characteristic "feeling" of the area matter as well? These two area-specific effects will be tested formally.

To attack these questions without good data on household behavior would be a very problematic (if not impossible) task, since the demand for apartments in Gothenburg is sufficiently high for virtually any first-hand contract to be accepted by someone almost instantly. Again, the price cannot tell how attractive an apartment is, since it is not set on the market. Nevertheless, by studying the number of applications or the days in queue required to get a specific apartment, one can make inference about how people value different apartment characteristics.

Section 2 provides background information about the rental housing market and a literature overview, section 3 introduces the theoretical framework of the study, section 4 describes the data set, section 5 contains the estimation results and in section 6 the results are discussed and conclusions are presented.

1.2 Purpose and Methodology

The purpose of the study is to examine if and how apartment characteristics shape the demand for rental contracts. Many actors on the housing market may be interested in household preferences – landlords and tenants as well as politicians and people active in the housing sector. By mapping the effects of certain apartment characteristics, the preferences will be outlined. In addition, the purpose of the study is also to determine whether two of the most popular housing areas are considered attractive due to the lower rent level in these areas or due to something else.

Quantitative data and regression analysis will be used when examining the relationships. By using data on actual (revealed) consumer behavior provided by Boplats Göteborg, the obtained results are likely to be reliable and precise. Two straight-forward linear models in which queuing time is explained by apartment characteristics will be estimated by Ordinary Least Squares. More information on the data set and estimation techniques will be found in sections 4 and 5.

2.1. Price Setting on the Rental Housing Market

The three main types of housing tenure in Sweden are detached houses, tenant-owned apartments and rental apartments. Detached houses and tenant-owned apartments are

traded on a free market and prices are determined by current supply and demand relationships, so that preferences are reflected in the prices. The usual procedure is that the prices are determined on bidding auctions, where the highest bid wins the auction. The market for rental housing, on the other hand, works very differently. This market will be in focus almost exclusively throughout the paper.

According to Atterhög (2003), the price setting system on the Swedish rental housing market is neither a pure price regulation system nor a free market where prices adjust to their true equilibrium levels. The main idea is that prices are set according to the so-called utility value principle (in Swedish: bruksvärdesmetoden, bruksvärdesprincipen). The utility value principle was designed in order to let the features and the level of quality be reflected in the price, but at the same time work as a price regulation so that cities remain, or become, socially integrated. Despite this principle, the costs on the production side have tended to influence the price levels significantly, as shown by Björklund and Klingborg (2002). How the utility value principle works in practice will be described in more detail in the following sections.

Since it is not possible for the landlords themselves to decide on the rent levels, price competition is probably not the main source of competition on the market. Instead, there is certainly some deal of competition in quality going on. Any level of housing quality is allowed from a legal point of view, given that some minimum requirements are fulfilled. But when it comes to metropolitan areas, such as that of Gothenburg, incentives for landlords to invest in a higher quality level than the minimum requirements rarely exist. The demand for housing is high enough for the apartments to be accepted even if they come with a relatively low standard. Furthermore, Atterhög (2003) argues that small-sized investments are hard to use as a reason for raising prices. Hence, a landlord might face quite strong incentives to take on a few large investments, but weak incentives to take on several small ones. For the landlords, especially for the small private owners, large investments might be hard to finance. Also, the utility value principle involves some rigidity, which implies that investments do not raise housing prices instantly, but start to yield payoffs after some time.

As for any other market, price regulation in terms of monthly rent has some real and intuitive effects on the economy. At least in the attractive metropolitan areas, the regulation will certainly drive the rents substantially below the market level. The supply of apartments is fixed in the short run. The very simple illustration in Figure 2-1 shows the effect of market rents *(R_m)* and rent regulation *(R_r)*.

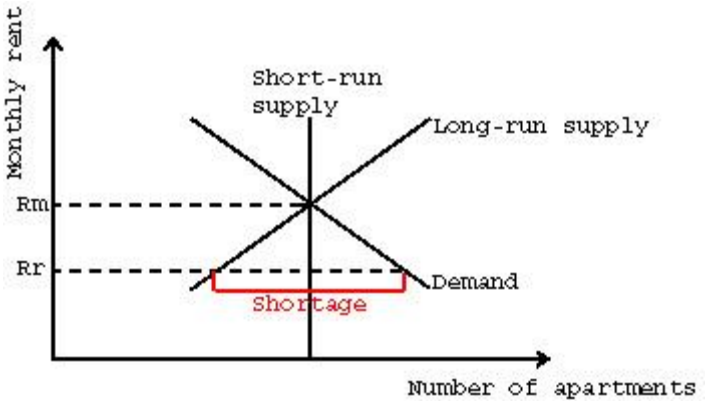

Figure 2-1. Short-run and long-run effects of rent control on the economy.
Source: O'Sullivan (2003). The illustration has been slightly simplified.

The idea is that in the short run, fixing the rent below the true equilibrium level basically works as a redistribution of wealth from landlords to tenants. In the long run, however, the supply will respond to the lower monthly rent and adjust downwards. When adjusted completely, there will be a shortage of apartments, represented by the red gap between long-run supply and demand (O'Sullivan, 2003, p. 490).

So, how are prices set in practice? How is the utility value principle implemented in situations of actual rent setting? One example of such implementation is the rent guidelines provided by SABO (2010), an organization representing the public housing companies, in their booklet *Sätt rätt hyra*. The guidelines include information about how different geographical locations, building types, kitchen standards, bathroom standards, balconies, ventilation systems, laundry rooms etc. could affect the rent setting. It also includes a number of more general definitions. For instance, a room has to be at least 10 m^2 to be defined as a proper room. Rooms between 6 m^2 and 10 m^2 are defined as half-rooms. The booklet gives a good view on how the utility value principle works in practice, but also shows that the system is rather complex. Again, the idea of rents being set in local negotiations is central on the Swedish rental housing market, and the utility value principle is the main framework in such negotiations.

2.2. Distribution of Rental Housing Contracts in Gothenburg

How first-hand contracts on rental apartments are distributed varies across the Swedish municipalities. In Gothenburg, the company named Boplats Göteborg has the main responsibility for this particular function. The company is basically a housing agency, owned by the municipality together with the public housing companies Bostads AB Poseidon, Göteborgs Stads Bostads AB, Familjebostäder i Göteborg AB and the landlord interest

organization Fastighetsägarna Göteborg Första Regionen. Boplats Göteborg does not hold any apartments, but work only as a distributor of rental contracts – i.e. as a link between landlords and tenants. The remainder of this section focuses on how the distribution of rental housing contracts in Gothenburg works.

People apply for first-hand contracts on available apartments via the agency webpage www.boplats.se or by visiting the local office. Each household enters certain information when registering, such as income level, number of persons in the household and current housing situation. The households also specify some desired characteristics of their potential future apartments, so that they can get accurate contract offers on the webpage.

To apply for apartments, the households simply have to sign in on the Boplats Göteborg webpage (presented in Appendix 1) and click on any available object. A household may apply for one or several apartments at the same time. There is no maximum number of simultaneous applications – basically, a household can be involved in an unlimited number of application processes at the same time. If a particular household is selected for a contract, an email with further information will be sent to the applicant. One of the selected households will then finally get to sign the contract and have first-hand access to the apartment. When a contract has signed, the registration time of the household is reset. Households may decide to reject an apartment that they have applied for. However, information about the household rejecting an apartment offer is stored in the system. Landlords may take this information into account when selecting applicants.

Broadly, the selection process works as follows. Public housing companies pick the applicant with the longest queue time, conditional on that the applicant fulfills the requirements that the company has set. It can for instance be yearly income requirements or a maximum number of persons in the household. Private landlords, on the other hand, decide whichever candidate they want – they are not forced to pick candidates by queue time. For the private landlords, Boplats Göteborg is simply a service for contract distribution. Private landlords use whichever channels they want when distributing their contract, and they are not in any way obliged to post available apartments on the Boplats Göteborg webpage. However, several large private housing companies, as well as smaller ones, use the Boplats Göteborg as a convenient alternative to announce available contracts.

A special kind of first-hand contracts are referred to as student apartments. Such contracts are given to students only (usually students at the University of Gothenburg or Chalmers University of Technology) and the apartments tend to be relatively small. When the studies are finished, the student will have to leave the apartment and the contract is again distributed to a student via Boplats Göteborg. Since 2007, one of the suppliers of student apartments,

Chalmers Studentbostäder, allows students to sign contracts without giving up their queuing time – a feature referred to at the Boplats webpage as “maintained queuing time".

2.3. Literature Overview

There are many ways to study the demand for rental housing. For instance, qualitative methods, such as interviews and case studies, have been used rather frequently. In *Homo Domesticus*, Vigerland (2007) sketches the strategies and preferences of housing consumers by focusing on two particular apartment buildings in Östermalm, Stockholm. Again, in the central areas of the larger cities in Sweden, there is certainly excess demand on the rental housing market. Hence, the shortage in Figure 2-1 presented above makes sense also in the Stockholm case. According to Vigerland (2007), the utility value principle does not capture the real preferences that people actually have. For this reason, people develop strategies in order to use the system to navigate successfully through their “housing career”. Indeed, it seems difficult to design an efficient and socially acceptable system for price-setting and distribution of rental apartments. Accommodation in general can be considered both a human right and a good traded on a market (Bengtsson, 1995), which certainly makes it even more problematic to design such a system.

Based on the methodology introduced by the French sociologist Pierre Bourdieu, Vigerland (2007) examines the strategies and the preferences of housing consumers. The results suggest that in the two apartment buildings studied, the housing strategies and preferences were roughly similar, despite differences in “social composition”. Moreover, when asked a hypothetical question about future price increases, people in general seemed willing to keep the same apartment even if the rent would increase sharply. This confirms the state of excess demand on the housing market in the studied area. It also suggests that there are key determinants other than the rent level that determine the popularity of a certain apartment. Most importantly, the geographical location seems to matter, according to the author. These results imply that price and district variables should definitely be included when studying the preferences through quantitative data methods. They also indicate that the price sensitivity in the most attractive areas may not be very strong. Other studies that examine housing preferences in a broad sense include Coolen and Hoekstra (2001). The approach is qualitative, but very different compared to Vigerland (2007). Here, the idea is that stated preferences for housing attributes can be explained by motivational, micro-level factors stemming from universal values such as power, hedonism and security.

Quantitative data has also been used when studying preferences on the rental housing market. For instance, in a Master's thesis by Zahir (2005) at the Royal Institute of Technology (Department of Infrastructure, Building and Real Estate Economics) in Stockholm, determinants of the queuing time for getting rental apartments are mapped. The regression analysis by Zahir (2005) builds upon the idea that the social status of an area, its distance from the city center and the monthly rents of the apartments explain the queue time needed. The model is examined for 1-room, 2-room and 3-room apartments separately. Rather than on apartment features, the focus of the analysis is on the geographical area and its characteristics. The results confirm the intuition – that increased monthly rent and increased distance to the center decreases the demand, and that high social status of an area implies high demand for housing. However, the study by Zahir (2005) has some considerable limitations. For instance, the datasets used do not contain any information about the size of the apartments (other than the number of rooms). Also, the results reflect the somewhat unique situation in Stockholm – by far the largest city in Sweden, with an extreme demand surplus for housing in the central districts and with a strict queue system (only queuing time matters for contract distribution). The results can hardly be generalized and assumed to be valid for Swedish cities in some broader sense. Nevertheless, the methodology is straight-forward and the explanatory variables included in the theoretical model all make sense. Therefore, a fairly similar methodology will be used in this thesis. In terms of apartment characteristics variables, though, the model used here will be richer. Also, this study will be supported by richer data sets than that of Zahir (2005).

Households face a choice between renting and owning. O'Sullivan (2003) compares these two possible decisions. In a competitive market, landlords make zero profits and households thus pay rents equal to the costs faced by their landlords. Although these assumptions are not completely in line with the Swedish system described earlier, this framework has some interesting and intuitive outcomes. The annual cost of a rental apartment can be described by the following equation,

$$C_r = V \cdot (i_r + d_r + m_r - g_r) \qquad \textit{(Annual cost of rental apartment)}$$

where V is the value of the dwelling, i is the interest rate paid by the property owner, d is the depreciation rate, m is the maintenance cost and g is the rate of capital gain.

Analogously, the annual cost of ownership housing is described by the following equation,

$$C_o = V \cdot (i_o + d_o + m_o - g_o) \qquad \textit{(Annual cost of ownership housing)}$$

Here, the terms represent costs for the housing occupant rather than for some landlord. Obviously, the household is indifferent between renting and owning its housing if $C_r = C_o$.

Important to note is that taxes are completely ignored in this framework. Although extremely simplified, the above conditions illustrate the basis for this particular household decision in a fairly clear way. O'Sullivan (2003) also argues that three other factors tend to make some households rent rather than buy their housing: low income households (that lack resources to finance the buying), mobility (easier to move between rental dwellings) and distaste for work on the home (maintenance and small repairs).

Some technical issues related to estimation of rental housing demand are outlined by Kim (1995). Although the market in South Korea is very different compared to those of many Western countries, the author discusses some important issues that possibly makes sense in other economies as well. More specifically, problems with implementation of theory and estimation of demand are raised and evaluated. The issues are 1) selectivity bias, 2) hedonic prices, 3) computation of permanent income and 4) functional forms. The fact that the main equation in Kim (1995) contains household characteristics, tastes etc. makes that model different to the one that will be used here. Rather than treating the households on the demand side as a homogenous mass, Kim (1995) builds on a model in which household features co-determine demand. Although methods to tackle the issues are presented, it is obvious that by only focusing on apartment characteristics and aggregating the households, estimation becomes much more straight-forward.

Firstly, a selectivity bias problem arises if information on rental data can be collected from tenants only. This will not be the case in this study, since the information is gathered from a database maintained by the main distributor of rental housing contracts in Gothenburg.

The second problem recognized is a problem related to estimation of hedonic prices. Such estimation is used when variables such as the quantity of housing services cannot be directly observed. The hedonic prices approach is described by Kim (1995, p. 60):

> *"The assumptions underlying the hedonic approach are that the rent or value of a housing unit comes directly from the quantity and types of characteristics it contains and that the market prices of these housing characteristics can be estimated by pooling information from many dwelling units via a multivariate regression analysis between rent and dwelling characteristics."*

Such multivariate regression is the approach that will be used in this study. Here, however, rent will be considered an explanatory variable, exogenously given, since it is not set on the market. For further information about price-setting on the Swedish rental housing market, see section 2.1. In addition, this study will use a data set that captures data on apartment size, number of rooms etc.

A problem regarding the permanent income hypothesis is the third issue. It is argued that permanent income, rather than measured income, is a key determinant of housing demand. For many reasons, it is problematic to estimate permanent (and transitory) income. Kim (1995) refers to Goodman and Kawai (1982) for an estimation technique that can be used to construct permanent and transitory income from measured income.

Lastly, the role of the functional form is discussed. Linear and log-linear equations are the most common modeling approach, but it is argued that a semi-log functional form would sometimes capture the relationships even better.

3. Theoretical Modeling and Hypotheses

The apartment-specific variables shown on the Boplats Göteborg webpage can be used to examine the demand side of the market, since these variables are considered by households when they decide whether to apply for an apartment or not. Basically, this is the only information available to the potential applicant before he or she gets to see the apartment. Therefore, a model built upon these variables should capture real relationships reasonably well. Again, compared to the model used by Zahir (2005), the model used here will focus more on apartment characteristics. This follows naturally from the fact that Boplats Göteborg provides certain information about apartment characteristics when people apply for apartments (see Appendix 1). These variables are assumed to be fundamental when households take decisions on which apartments to apply for.

Intuitively, there are two ways of comparing the value between different contracts. The number of applications on an apartment is assumed to reflect how the particular contract is valued by people – the higher the number of applications, the more valuable contract. The number of days since registration required to get a certain contract also captures information about the valuation of a contract – a high number of queuing days implies that the contract is valued relatively high. The latter alternative will be used here.

How the contract is valued, in turn, is here assumed to depend on the characteristics and the geographic location of the object, as well as on the price (in terms of monthly rent). A linear and straight-forward theoretical model is equation *(1)* below.

$$QT = \alpha + \beta_0 RENT + \beta_X AREA\ DUMMIES + \beta_Y FLOOR\ DUMMIES + \beta_Z\ SIZE + \cdots + \varepsilon \qquad (1)$$

LHS	RHS, complete list	Description
QT	α	Intercept.
(Queuing time, days since registration at Boplats Göteborg)	β_0 *RENT*	Monthly rent in SEK.
	β_1 *AREA_CENTR*	Location dummy for central Gothenburg.
	β_2 *AREA_OTHER*	Location dummy for other municipalities close to Gothenburg.

	β_3 *AREA_MOLND*	Location dummy for Mölndal.
	β_4 *AREA_NORTH*	Location dummy for northern Gothenburg.
	β_5 *AREA_PARTI*	Location dummy for Partille.
	β_6 *AREA_EAST*	Location dummy for eastern Gothenburg.
	β_7 *AREA_WEST*	Location dummy for western Gothenburg.*
	β_8 *AREA_MAJOR*	Location dummy for Majorna.
	β_9 *AREA_KUNGS*	Location dummy for Kungsladugard.
	β_{10} *FLOOR_B0*	Floor dummy for floors below 0.
	β_{11} *FLOOR_1*	Floor dummy for floor 1.
	β_{12} *FLOOR_2*	Floor dummy for floor 2.
	β_{13} *FLOOR_3*	Floor dummy for floor 3.
	β_{14} *FLOOR_4*	Floor dummy for floor 4.
	β_{15} *FLOOR_A4*	Floor dummy for floors above floor 4.
	β_{16} *SIZE*	Apartment size in square meters.
	β_{17} *ROOMS*	Number of rooms.
	β_{18} *STUDENT*	Student apartment dummy.
	ε	Disturbance term.

Table 3-1. Equation (1) specified for Gothenburg. AREA_HISIN (Location dummy for Hisingen) and FLOOR_0 (Floor dummy for floor 0) constitute the reference area and reference floor, and are therefore not included in the RHS variables list.
** Majorna and Kungsladugård are not included in AREA_WEST.*

Apart from the main areas of Gothenburg, two particular districts will be examined in more detail – Kungsladugård and Majorna. These districts are characterized by a special type of architecture (normally "Landshövdingehus") and the buildings here usually date from the turn of the 19th century. The apartments in these buildings generally come with a lower standard than that of newly produced apartments, but the buildings give the districts a rather unique touch. Furthermore, the price setting practice and the utility value principle described earlier do not allow for high rents on such apartments, due to the relatively low quality standard. However, the demand is not necessarily affected negatively by the somewhat lower quality, since the characteristic feeling of the area and the buildings may outweigh the lack of top-notch standards, and since the monthly rents are lower. This is an empirical matter and will therefore be discussed after having estimated the model. The problem itself is hypothesized below.

All floors and areas cannot be included in the regression model, since this would create a problem of perfect multicollinearity. Instead, some floor and some area must be excluded from the model to constitute references when interpreting the effects of other floors and areas. Floor zero is chosen as reference floor, since it seems natural to compare effects of different floors to the entrance floor. For the area variables, there is no obvious and straight-forward choice. The area Hisingen will be selected as reference here, due to a large base of observations within this area and due to its "heterogeneity". There are both very attractive neighborhoods and less demanded areas located on Hisingen, so the *AREA_HISIN* variable constitutes a good reference for other area effects. Again, the results as such are not affected by the choice of references.

Intuitive expectations on some parameters in equation *(1)* follow.

- Clearly, the coefficient of *RENT* should be negative, i.e. $\beta_0 < 0$. Everything else held constant, an increase in monthly rent of a certain apartment will lower the demand for that particular contract.
- Intuitively, the *AREA* coefficients may differ dramatically. Most cities obviously tend to have attractive and less attractive neighborhoods. These coefficients will capture pure district effects since prices are controlled for in the model. As assumed in Zahir (2005) as well as in most other theory on urban housing, it is often considered attractive to live in the central parts of the city. Thus, *AREA_CENTR* should have a positive coefficient, i.e. $\beta_1 > 0$.
- *SIZE* and *ROOMS* should have positive impacts on the queuing time, i.e. it should be that $\beta_{16} > 0$ and $\beta_{17} > 0$. Everything else held constant, a larger apartment should be valued higher than a smaller one.
- Due to the legal limitations of student apartments, *STUDENT* should have a negative impact on the queuing time, i.e. $\beta_{18} < 0$. These contracts should not be considered as valuable as ordinary first-hand contracts. Another argument supporting this assumption is that students tend to be younger than the population in general, and younger people probably tend to have shorter queuing time for natural reasons.

How the coefficients of *AREA_MAJOR* and *AREA_KUNGS* differ from *AREA_WEST* (which they should have belonged to if they were not extracted as separate variables) is harder to predict. It is already known that these areas are extremely popular. If this is merely due to the price effect, β_8 and β_9 should be close to β_7. On the other hand, if these areas are considered attractive in themselves, β_8 and β_9 should be significantly larger than β_7. Formally, the following null hypothesis is tested,

$H_0: \beta 7 = \beta 8 = \beta 9$
(the high popularity of Majorna and Kungsladugård depend exclusively on the lower rent level and other factors controlled for in the models)

against the alternative hypothesis,

$H_1: \beta 8 > \beta 7$ *and* $\beta 9 > \beta 7$
(Majorna and Kungsladugård have significant and positive area-specific effects)

As mentioned in section 2.2., private landlords may choose not to distribute their contracts to the applicants with the longest registration time. Therefore, the queuing days required to get such contracts may not reflect the relative value of the contract very well. In the most extreme case, a really attractive contract would for some reason be given to a household which has been registered for only a few days.

The most direct way to get around this problem is simply to focus exclusively on apartments provided by the public housing companies. This limits the framework in the sense that potential differences in public and private housing will be lost, and that fewer observations will be used in the empirical section below. However, there are reasons to believe that these limitations are not that bad. Firstly, there are hardly any large differences between public housing and private housing from the tenant point of view – at least not when the decision is taken whether to apply for an apartment or not. Secondly, a large number of public housing contracts are distributed in Gothenburg each year, so the number of observations will turn out not to be a problem. Thus, the model will be estimated both with and without apartments provided by private landlords. Due to the different rules regarding the behavior of private and public landlords, the model should have a better fit when only public landlords are considered.

The methodology of Zahir (2005) builds upon the idea is that 1-room, 2-room and 3-room apartments are considered different enough for the model to be applied separately for each category. For this to be a straight-forward and intuitive approach, apartments with a different number of rooms should ideally be considered separate sub-markets. But clearly, as an example, there are many 2-room apartments that are larger than some other 3-room apartments. Furthermore, it is reasonable to think that many households look for apartments within two or more different groups (for instance 3-room and 4-room apartments). Hence, the number of rooms will be included as an ordinary explanatory variable here.

Whether or not to allow for non-linear relationships in the models is not a crystal clear matter. To argue for non-linearity by theoretical reasoning is rather difficult, since there is no obvious and intuitive reason as for why such nonlinearities would exist. Instead, one can consider this to be an empirical issue and include such terms if they are significant determinants of the queuing time.

Lastly, interaction effects between two or more variables might exist. In order to preserve the interpretation straight-forwardness of the original model, such interaction effects will be introduced and discussed in a separate model. Equation *(2)* below constitutes a theoretical model similar to equation *(1)*, but with interaction effects,

$$QT = \alpha + \beta_0 RENT + \beta_X AREA\ DUMMIES + \beta_Y FLOOR\ DUMMIES + \beta_Z\ SIZE + \cdots + \beta_I\ INTERACTIONS + \varepsilon \qquad (2)$$

where *INTERACTIONS* contain the different interaction variables (simply one variable multiplied by another one). It can for instance be an interaction between *RENT* and *SIZE*. If such effects matter for households is an empirical matter and will be examined in the results section. Additionally, it will be interesting to look for interaction effects between *RENT* and

AREA_MAJOR as well as between *RENT* and *AREA_KUNGS*. The main argument is the generally lower rent level in old apartment buildings, described in earlier sections.

4. Data and Summary Statistics

The models in the previous section build upon the fact that the right-hand side apartment variables are considered by the households when they apply for apartments through the Boplats Göteborg web interface (see Appendix 1). Information on each apartment is stored in a database maintained by Boplats Göteborg. The empirical data on apartment characteristics, geographical location and queuing days that will be used when estimating the models is taken from this database. The data set is not publicly available for confidentiality and privacy reasons.

Data reliability will not be a problem at all. The data on apartment characteristics are reported by the landlords and will certainly be verified by the households that get to see the apartment. The data on queuing days is generated from actual and revealed consumer behavior, in terms of how many days of queuing households are willing to give up in order to get a certain contract. The full data set contains data on apartments distributed between 1 April, 2011 and 30 March, 2012. Table 4-1 below summarizes the data.

Boplats Göteborg has distributed rental housing contracts through the same system since September 2004. Since 2007, public landlords distribute contracts strictly according to queuing time (as long as the minimal requirements are fulfilled). The sample between April, 2011 and March, 2012 should probably be representative for the whole period, since it contains thousands of observations and since there have not been any radical changes in the conditions on the rental market during the last decade. Nevertheless, depending on what sample period is chosen, there would probably be some minor changes in the parameters.

	Full sample				**Public landlords**				**Private landlords**			
N	*6759*				*3901*				*2858*			
	Mean	St.dev.	Min	Max	Mean	St.dev.	Min	Max	Mean	St.dev.	Min	Max
QT (days)	*832*	*584*	*0*	*2752*	*1010*	*598*	*0*	*2752*	*588*	*467*	*0*	*2723*
RENT (SEK)	*5276*	*2030*	*1527*	*17821*	*5056*	*1937*	*1527*	*17821*	*5540*	*2106*	*1919*	*17000*
SIZE (m^2)	*57*	*22*	*10*	*198*	*58*	*19*	*10*	*147*	*56*	*26*	*10*	*198*
ROOMS	*2.16*	*0.96*	*1*	*8*	*2.20*	*0.85*	*1*	*6*	*2.11*	*1.07*	*1*	*8*
STUDENT*	*0.13*				*0.05*				*0.23*			
AREA_CENTR*	*0.20*				*0.09*				*0.33*			
AREA_OTHER*	*0.02*				*<0.01*				*0.03*			
AREA_MOLND*	*0.06*				*0.07*				*0.05*			
AREA_NORTH*	*0.21*				*0.27*				*0.13*			
AREA_PARTI*	*<0.01*				*N/A*				*0.01*			
AREA_EAST*	*0.07*				*0.03*				*0.11*			
AREA_WEST*	*0.12*				*0.14*				*0.09*			
AREA_MAJOR*	*0.02*				*0.03*				*<0.01*			
AREA_KUNGS*	*0.02*				*0.02*				*<0.01*			
AREA_HISIN*	*0.29*				*0.34*				*0.23*			
FLOOR_Bo*	*<0.01*				*<0.01*				*<0.01*			
FLOOR_0*	*0.09*				*0.09*				*0.08*			

FLOOR_1*	*0.22*	*0.23*	*0.21*
FLOOR_2*	*0.23*	*0.25*	*0.21*
FLOOR_3*	*0.20*	*0.22*	*0.18*
FLOOR_4*	*0.08*	*0.07*	*0.09*
FLOOR_A4*	*0.17*	*0.13*	*0.21*

Table 4-1. Summary statistics.

** Dummy variable.*

Worth noticing is that public landlords did not distribute any contract in the Partille municipality during the sample period, through the Boplats Göteborg webpage. Furthermore, Hisingen, North, Center and West are the largest area groups in terms of distributed contracts.

The mean queuing time for the full sample is 831 days, with a standard deviation of 584 days. On average, households wait for 2 years and 3 months to get an apartment. The queuing time tend to be longer for apartments provided by public landlords and shorter for those provided by private landlords. The following histograms illustrate how *QT* is distributed, with percent frequency on the vertical axis.

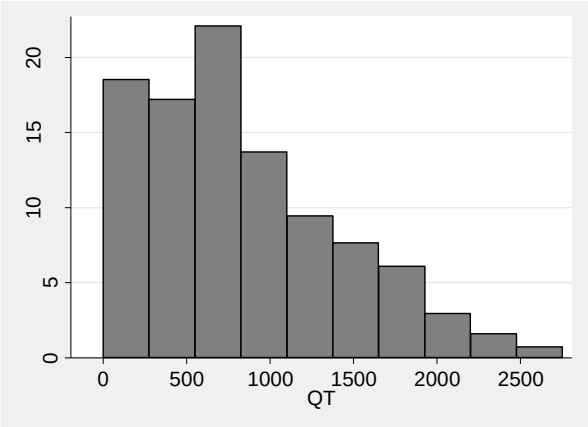

Figure 4-1. Queuing days and percent frequency. Full sample.

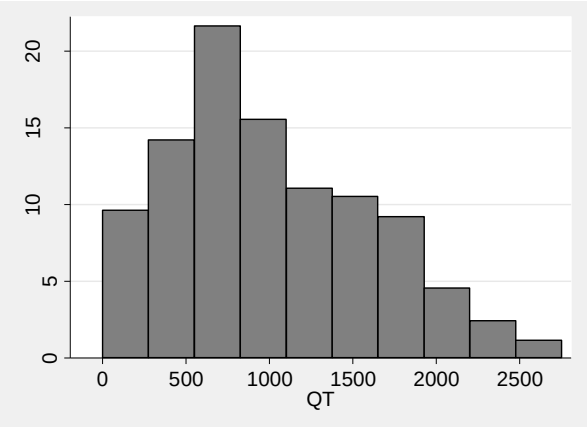

Figure 4-2. Queuing days and percent frequency. Public landlords only.

The two histograms look rather different. The reason for this is that while public landlords, as described earlier, distribute contracts (more or less) strictly by queuing time, private landlords are not forced to follow any particular pattern or rationale. In particular, a comparison between the two histograms reveals that many contracts on apartments provided by private landlords have been signed by households with very short queuing time.

Table 4-2 below elaborates on the summary statistics in the *Full sample* column of the previous table. The numbers are now grouped by *QT* centiles. The first column in table 4-2 shows summary statistics for the group of apartments with the shortest queuing time, the second column is for apartments with medium queuing time and the third column is for apartments with long queuing time.

	Short QT (lowest 10 %)				Medium QT (mid 10 %)				Long QT (highest 10 %)			
N	678				678				676			
	Mean	St.dev.	Min	Max	Mean	St.dev.	Min	Max	Mean	St.dev.	Min	Max
QT (days)	58	33	0	122	717	36	655	783	2015	255	1712	2752
RENT (SEK)	5687	2108	1760	15674	4810	1842	1665	12728	5535	2071	1527	17821
SIZE (m^2)	63	22	10	156	51	22	18	123	62	23	10	198
ROOMS	2.32	0.97	1	5	1.91	0.95	1	8	2.35	1.00	1	7
STUDENT*	0.08				0.23				0.05			
AREA_CENTR*	0.11				0.24				0.20			
AREA_OTHER*	0.06				<0.01				0.02			
AREA_MOLND*	0.13				0.04				0.03			
AREA_NORTH*	0.24				0.25				0.21			
AREA_PARTI*	0.01				<0.01				<0.01			
AREA_EAST*	0.09				0.03				0.09			
AREA_WEST*	0.12				0.09				0.10			
AREA_MAJOR*	0.01				<0.01				0.06			
AREA_KUNGS*	<0.01				<0.01				0.05			
AREA_HISIN*	0.24				0.34				0.22			
FLOOR_Bo*	<0.01				0.02				<0.01			
FLOOR_0*	0.08				0.10				0.09			
FLOOR_1*	0.22				0.20				0.24			
FLOOR_2*	0.27				0.21				0.24			
FLOOR_3*	0.19				0.21				0.21			
FLOOR_4*	0.07				0.08				0.07			
FLOOR_A4*	0.16				0.18				0.15			

Table 4-2. Summary statistics grouped by queuing days. Both public and private landlords are considered.

** Dummy variable.*

The table above gives some hints about the results. In the *Short QT* column, the share of apartments located in the central parts of the city is small. There are almost no apartments located in Majorna or Kungsladugård in the *Short QT* and *Medium QT* columns. It becomes more problematic when trying to identify any clear patterns in *RENT*, *ROOMS, SIZE* and *FLOOR* by using summary statistics, though.

In the *Short QT* column, one can see that there are observations for which the queuing time is zero days. It is not obvious how the fact that some contracts are signed after zero queuing days should be interpreted. To be able to obtain unbiased and reliable estimates, these zero-*QT* observations must not be abnormal in any sense and should not be too many. A further inspection shows that for 23 of the observations (out of 6550), $QT = 0$. Although 23 is not a very large number, the empirical section will briefly discuss how the results are affected.

5. Empirical Results

Following the procedures and standards of empirical studies within the same area, the most convenient and straight-forward estimation method is Ordinary Least Squares. OLS estimates of the parameters in equations *(1)* and *(2)* are shown in table 5-1 below.

	Full sample		Public landlords only	
	(1)	*(2)*	*(1)*	*(2)*
RENT	*-0.06* ***	*-0.03* **	*-0.06* ***	*0.03* **
	(0.006)	*(0.012)*	*(0.008)*	*(0.015)*
AREA_CENTR	*498.06* ***	*497.95* ***	*752.37* ***	*789.39* ***
	(23.016)	*(23.025)*	*(31.238)*	*(30.959)*
AREA_OTHER	*-343.14* ***	*-342.27* ***	*-599.21* **	*-663.99* **

	(62.701)	*(62.397)*	*(273.827)*	*(269.741)*
AREA_MOLND	*-121.13* ***	*-124.50* ***	*-99.35* ***	*-113.60* ***
	(28.465)	*(28.383)*	*(31.288)*	*(30.969)*
AREA_NORTH	*-131.01* ***	*-130.04* ***	*-124.35* ***	*-127.55* ***
	(19.770)	*(19.702)*	*(21.068)*	*(20.834)*
AREA_PARTI	*-218.93* **	*-232.56* ***	*N/A*	*N/A*
	(89.699)	*(89.352)*	*(N/A)*	*(N/A)*
AREA_EAST	*274.00* ***	*272.11* ***	*862.78* ***	*855.80* ***
	(28.679)	*(28.545)*	*(44.243)*	*(43.574)*
AREA_WEST	*215.84* ***	*214.86* ***	*376.26* ***	*362.46* ***
	(22.883)	*(22.798)*	*(25.709)*	*(25.387)*
AREA_MAJOR	*902.24* ***	*712.54* ***	*958.90* ***	*-80.57*
	(44.756)	*(171.566)*	*(44.503)*	*(195.266)*
AREA_KUNGS	*925.09* ***	*1550.29* ***	*964.78* ***	*791.27* ***
	(51.893)	*(136.377)*	*(51.027)*	*(208.662)*
FLOOR_Bo	*-103.34*	*-94.94*	*-116.06*	*-131.77*
	(72.487)	*(72.137)*	*(86.606)*	*(85.336)*
FLOOR_1	*26.94*	*24.35*	*22.39*	*32.88*
	(26.782)	*(26.719)*	*(31.099)*	*(30.740)*
FLOOR_2	*39.15*	*35.13*	*47.58*	*57.64* *
	(26.516)	*(26.487)*	*(30.587)*	*(30.272)*
FLOOR_3	*61.62* **	*57.53* **	*79.09* **	*91.30* ***
	(26.938)	*(26.923)*	*(30.973)*	*(30.672)*
FLOOR_4	*48.25*	*50.22*	*58.14*	*84.49* **
	(32.659)	*(32.614)*	*(39.992)*	*(39.523)*
FLOOR_A4	*33.87*	*25.50*	*35.48*	*50.33*
	(27.999)	*(27.970)*	*(34.147)*	*(33.813)*
SIZE	*-1.50*	*1.91*	*-2.46* **	*13.92* ***
	(0.916)	*(1.883)*	*(1.140)*	*(2.245)*
ROOMS	*94.45* ***	*48.881*	*118.91* ***	*-232.59* ***
	(15.761)	*(46.744)*	*(19.931)*	*(57.324)*
STUDENT	*-458.42* ***	*-713.36* ***	*-465.39* ***	*-314.55* **
	(25.862)	*(74.089)*	*(37.610)*	*(128.659)*
AREA_MAJOR x RENT	-	*0.03*	-	*0.20* ***
		(0.031)		*(0.037)*
AREA_KUNGS x RENT	-	*-0.12* ***	-	*0.03*
		(0.024)		*(0.045)*
SIZE x RENT	-	*-0.0007* **	-	*-0.0034* ***
		(0.00027)		*(0.00038)*
ROOMS x RENT	-	*0.008*	-	*0.064* ***
		(0.007)		*(0.010)*
STUDENT x RENT	-	*0.07* ***	-	*-0.04*
		(0.017)		*(0.032)*
_CONSTANT	*915.46* ***	*790.86* ***	*995.73* ***	*674.14* ***
	(31.751)	*(54.260)*	*(36.409)*	*(62.185)*
R-squared	*0.2006*	*0.2092*	*0.3783*	*0.3981*
Observations (N)	*6549*	*6549*	*3799*	*3799*

*Absolute value of standard error in brackets. *** = coefficient significant at 1 % confidence level; ** = coefficient significant at 5 % confidence level; * = coefficient significant at 10 % confidence level.*

Table 5-1. OLS estimates of the two models.

The first column shows the estimates for the basic model of equation *(1)* on the full data set. The monthly rent is a significant and negative determinant of the queuing time. The result can be interpreted as that a 100 SEK increase in monthly rent of an apartment results in 6 days shorter queuing time to get a contract on that apartment, *ceteris paribus*. This is in line with the theoretical expectations on the sign of the parameter, described in section 3.

Between the different geographical areas, the differences are dramatic. Overall, the statistical significance is very strong among these parameters. The numbers should be interpreted as "extra queuing days required for getting an apartment in this area, rather than a similar apartment on Hisingen". A positive coefficient implies that getting an apartment in this particular area requires more queuing days than a similar apartment on Hisingen, while a negative coefficient implies that fewer queuing days are required. For instance, an apartment contract in western Gothenburg on average requires 216 more days than an apartment on

Hisingen. To get an idea of absolute queuing times, the mean *QT* on all apartments on Hisingen in the full sample is 745 days. The corresponding number is 859 days if only public landlords are considered.

The coefficients for Majorna and Kungsladugård turn out to be huge. Although it was known beforehand that these areas are popular, it was not obvious if the popularity was due to the lower rents or simply due to area characteristics. Yet, by comparing the coefficients, one can see that these areas have really strong impact on the dependent variable despite the fact that monthly rent is controlled for in the regression. In the first column, *AREA_MAJOR* and *AREA_KUNGS* both have coefficients of above 900, while the coefficient for the rest of the western region is just above 200. A *t*-test of the estimates rejects the null hypothesis and concludes that both of the areas have significant area-specific effects. The immediate interpretation is that these two areas for some reason have a strong attraction on the rental housing market. This will be further discussed in the next section.

Overall, the relationship between which floor an apartment is located on and the number of queuing days required to get the apartment is very weak. The positive third floor coefficient turns out to be the only significant parameter here. Again, there is a large demand surplus on the rental housing market. When people decide whether to accept an apartment offer or not, they do not seem to take this information into consideration – at least it does not seem to be the most important determinant. Perhaps, if the market situation would have been different, people would not be that desperate when looking for apartments and therefore choose apartments located on their "desired" floor. The interpretation of a *FLOOR* coefficient in the regression is "extra queuing days required for getting an apartment on this floor, rather than a similar apartment on floor 0 (entrance floor)". A positive coefficient implies that an apartment on the specific floor requires more queuing days than a similar apartment located on floor 0 (and vice versa for a negative coefficient). However, these interpretations are only valid for the third floor in the regression table above, due to the low precision of the other *FLOOR* estimates.

The *SIZE* and *ROOMS* parameters are both significant when estimating the equations on the sub-sample with public landlords only. In the first column, however, only the *ROOMS* parameter is significant and positive – an extra room on average requires 94 more days in the queue, if the rest of the equation is held constant. The outcome that *SIZE* turns out to be insignificant is actually not that problematic. The two variables somewhat capture the same information. Clearly, there is much correlation between how many rooms an apartment has, and how large it is measured in square meters. A correlation matrix can be found in Appendix 2.

The *STUDENT* apartment dummy has a negative and significant parameter in all columns, although its magnitude varies. Again, the negative sign was expected, since student apartments come with some considerable limitations – they are offered to students only, and students must leave them when they quit studying.

When equation *(1)* is estimated on contracts provided by public landlords only, some results change rather dramatically. Firstly, R^2 increases from roughly 20 % to almost 38 %. The model captures the relationship with public landlords better. The reason for this has already been discussed – public landlords distribute contracts (more or less strictly) according to queuing time, while private landlords are not forced to do so. When private landlords choose to ignore queuing time and distribute contracts according to other criteria, the relationships of equations *(1)* and *(2)* break down. The changes in *AREA* and *FLOOR* coefficients probably result from differences in the housing stock between private and public landlords.

To be confident about the unbiasedness of the estimates, Appendix 2 contains a lower-limit Tobit estimation. The marginal effects suggested by such estimation correspond to the coefficients above rather well, indicating that the observations for which $QT = 0$ do not bias the results.

6. Discussion and Conclusions

This paper has examined the determinants of the rental housing demand in Gothenburg. Households have been treated as a homogenous mass and the demand has been decomposed into apartment characteristics such as the rent level, the number of rooms and the geographical area. Prices on rental housing, i.e. rents, are not set freely on the market. Therefore, one cannot simply use price information to examine which apartment features are attractive and which are not. This study has provided rather unique information on preferences, information that can be taken into consideration when planning for an expansion of the current rental housing stock.

The relationships have been modeled in two equations, in which an apartment's characteristics have been assumed to explain the queuing time required to get the apartment. Data from the largest distributor of first-hand apartment contracts in Gothenburg has been used to estimate the parameters of the models.

The results show that the monthly rent, the geographical location and the size (measured as either square meters or the number of rooms) are significant determinants when it comes to how much queuing time people are willing to give up when they are offered a first-hand

contract on a specific apartment. Most popular locations are the city center, the western parts (including Majorna and Kungsladugård) and the eastern parts. In these districts, a queuing time of several years is generally required in order to get a contract.

The result that a 100 SEK increase in the monthly rent on average only shortens the queuing time by 6 days basically suggests that the geographical location of an apartment is currently more important to the households than the price. There are at least two interesting explanations behind this result. Firstly, as discussed in section 2.1, rents in attractive areas are fixed below the market level. Obviously, many households could certainly afford an apartment even if the rent would increase rather sharply. It is reasonable to claim that if the rents would rise, so would the price sensitivity of the households. Secondly, housing subsidies potentially play a role. If households get some fraction of the rent paid by the local government each month, the rent sensitivity of the household obviously falls.

It was known beforehand that Majorna and Kungsladugård are two extremely popular districts. The outcome of this study has indeed confirmed, if not strengthened, this view. In addition, it has been shown that the lower rents (resulting from the utility value principle and the rather old housing estate in the areas) cannot fully explain the popularity. The areas have something else that is considered super attractive by applicants. The characteristic feeling of the area, the architecture and the location (close to the city center, but also close to more calm areas such as parks and jogging tracks) almost certainly play key roles. Thus, although more or less all contracts are accepted by someone almost immediately due to demand surplus, apartments in areas such as Majorna and Kungsladugård are what the people demand the most. This result could also be linked to Coolen and Hoekstra (2001) and examined from a values and goals point of view. Which values are associated with the households in Majorna and Kungsladugård?

The regression results do not establish any clear relationships between what floor an apartment is located on and how attractive it is considered by applicants. The only exception is that an apartment on the third floor is considered more attractive than one on the entrance floor – a result significant in both model specifications and sub-samples. Since many buildings contain three floors only, getting a contract on the third floor often times imply that the apartment is located on the top floor. If this is something that people like, it might very well explain the significant third floor parameter. Furthermore, the fact that there is a large demand surplus for rental housing in Gothenburg perhaps makes households prioritize other apartment features and accept apartments independent of what floors they are located on – leading to an overall lack of statistical significance here. Apparently, it can also be that households simply do not tend to have any specific preferences regarding this particular feature.

7. Suggestions for Further Research

The Swedish rental housing market in general and the preferences in particular is an interesting area to study for many reasons. The price-setting system is heavily debated and will most likely be subject to changes, at least within a decade or so. Mapping the preferences on this market will facilitate the design of a new system. For landlords and other players on the market, insights about tenant preferences may very well generate substantial profit possibilities. From the policy-maker point of view, rental housing preferences is key information when trying to maximize the utility in the society as a whole.

An interesting approach would be to compare these preferences with the market for tenant-owned apartments. This would be a rather straight-forward task, since the prices on such apartments reflect current supply and demand relationships. Naturally, people are ready to pay for features that they find attractive and valuable. Once the preferences are mapped, a number of interesting questions arise. Do the preferences on the two markets differ? If so, why and how do they differ?

Additionally, this study could very well be expanded to include household characteristics. In practice, such expansion would raise some of the issues and concerns identified by Kim (1995) discussed in section 2.3. Allowing for household heterogeneity would complicate the estimation process, but also broaden the analysis and the importance of the results considerably. Such results could for instance be used by policy-makers when trying to target a certain group of people with social and economic improvements.

Another interesting angle would be to examine the consistency of preferences over time. This could be done within the framework used in this study or in a richer model including household characteristics.

Finally, research on the distribution of available contracts could be essential in solving the problems people face on the rental housing market today. Both efficiency and equity concerns could be examined in such study. The current situation of excess demand forces people to wait for several years in order to get a rental contract. This problem certainly makes a fraction of the households consider buying apartments, although they actually prefer to rent. Extra pressure is then put on the market for tenant-owned apartments and households are more or less forced to borrow large amounts of money. To develop the distribution process could, to some extent, improve the situation for the households. As an example, a new proposal from Boplats Göteborg suggests that they should start charging a queuing fee. Households that really need an apartment would probably pay this fee, while households that are in the queue “just in case” would perhaps decide to leave.

References

Atterhög, M. (2003). *Effekter av förändringar i konkurrenssituation på bostadshyresmarknanden.* KTHs Bostadsprojekt rapport nr 16. Stockholm.

Bengtsson, B. (1995). *Bostaden – välfärdsstatens marknadsvara*. Uppsala Universitet, Almqvist & Wiksell. Stockholm.

Björklund, K. and Klingborg, K. (2002). *Kvalitet och pris – en ohelig allians på bostadshyresmarknaden*. Bygg- och fastighetsekonomi, KTH. Stockholm.

Coolen, H. and Hoekstra, J. (2001). Values as Determinants of Preferences for Housing Attributes. *Journal of Housing and the Built Environment*, 16, pp. 285-306.

Goodman, A. and Kawai, M. (1982). Permanent Income, Hedonic Prices and Demand for Housing: New Evidence. *Journal of Urban Economics*, 12, pp. 214-237.

Kim, S. J. (1995). Demand for Rental Housing in Korea with Some Estimation Issues. *Journal of Urban Planning and Development*. 121 (2), pp. 57-73.

O'Sullivan, A. (2003). *Urban Economics*. 5th ed. New York: McGraw-Hill/Irwin, pp. 433-500.

SABO (2010). *Sätt rätt hyra*. Trycksaksnummer: 13600/2010-05. Illustrationer: Annicka Istemo. Grafisk produktion: SABO Kommunikation. Tryck: 08 Tryck, Bromma.*

Turner, B. (2001). Varför byggs det så lite där efterfrågan är som störst? *Ekonomisk Debatt*, 29 (2), pp. 117-127.

Vigerland, L. (2007). *Homo Domesticus: En marknadsanalys av bostadskonsumenters strategier och preferenser*. Företagsekonomiska institutionen, University of Stockholm.

Zahir, M. N. H. (2005). *Determinants of the queuing time for getting rental apartments in Stockholm*. Master of Science Thesis number 299. Royal Institute of Technology, Department of Infrastructure. Building and Real Estate Economics. Stockholm.

** http://www.hyresgastforeningen.se/Om_Oss/ladda_hem/rapporter/Documents/hyreshandbok_100511.pdf (Accessed: 2012-05-11)*

Appendix 1

This appendix will very briefly describe the Boplats Göteborg web interface, through which households apply for apartments. The theoretical model builds upon the fact that this is what is considered by the households when they take the decisions. Also, the data that is used in the empirical section was partly generated through this interface.

Figure A1-1. The welcome screen.

The above screen shows up after user log in. Although English has been chosen as preferred language, Figure A1-1 shows that some text on the welcome page is not translated from Swedish. However, there is some key information about the specific household shown on the screen, and this is presented English:

- The user registered on the 30th of October, 2009
- There are totally 92 apartments available (not user-specific)
- There are 3 apartments available that matches the profile of the user
- The user has active applications on 14 apartments

According to Boplats Göteborg, it is more or less impossible to get a contract on an apartment that does not match the user profile. Users are encouraged to only apply for contracts that match their profile, and they should ideally spend some time on configuring the profile correctly.

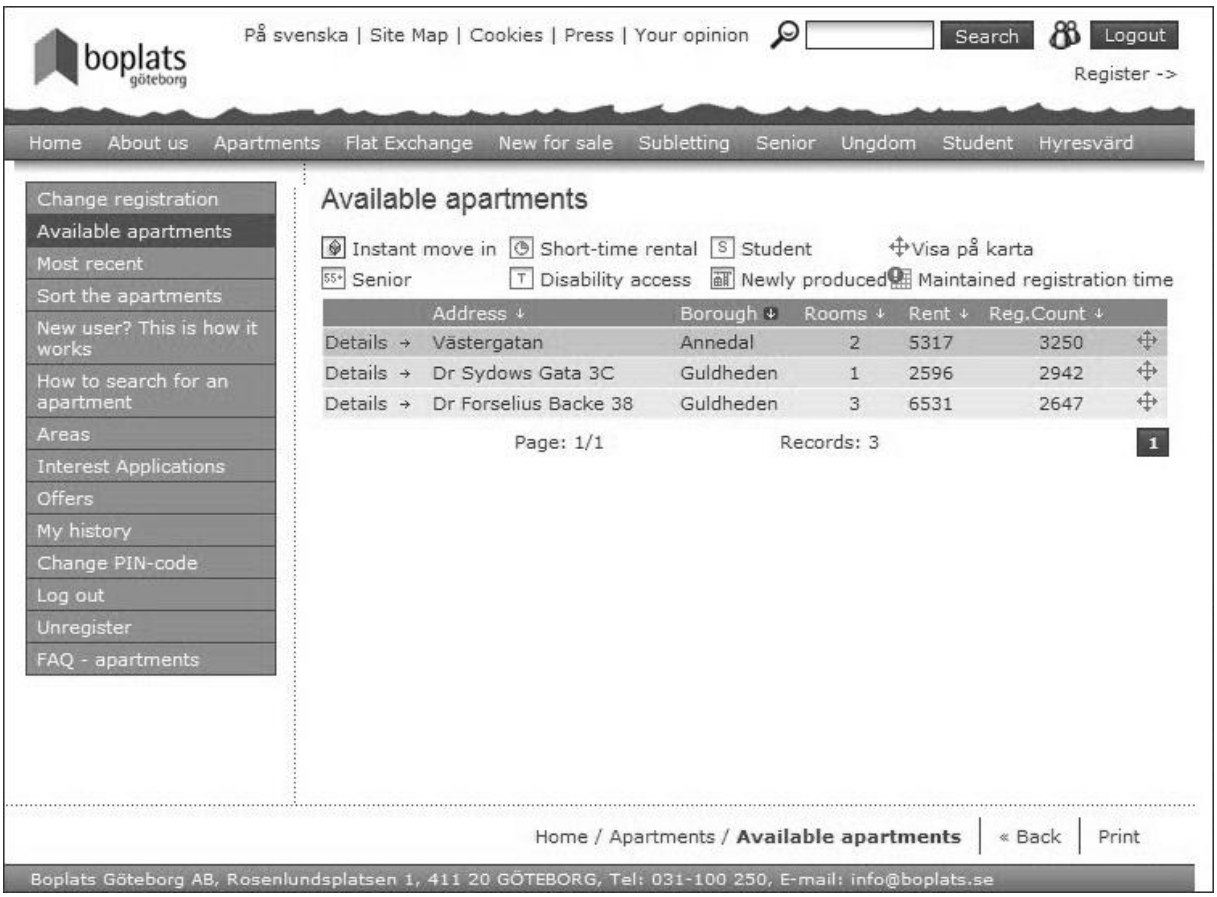

Figure A1-2. Available apartments that match the current user profile.

The three apartments that match the user profile are shown in Figure A1-2. The first row is shaded, which indicates that this apartment has already been applied for by the user. Some key information about each apartment is also shown. There is a link on each row, called "Details", which will provide further information about any of the apartments. The next screen, in Figure A1-3, is the "Details" page.

Figure A1-3. Apartment details and "Apply" button.

This is the apartment-specific page, on which the user may apply for a specific apartment. Here, some of the variables used in the study are presented to the applicant. The logotype in the top-right corner suggests that this particular apartment is owned by "Bostads AB Poseidon", one of the larger public landlords in the city.

Appendix 2

This appendix contains additional information about the data used in the study. Firstly, the city geography is outlined. Secondly, the potential problem of the observations with $QT = 0$ are examined. Lastly, a correlation matrix is presented.

The main areas used when creating the *AREA* dummy variables are illustrated in the map below.

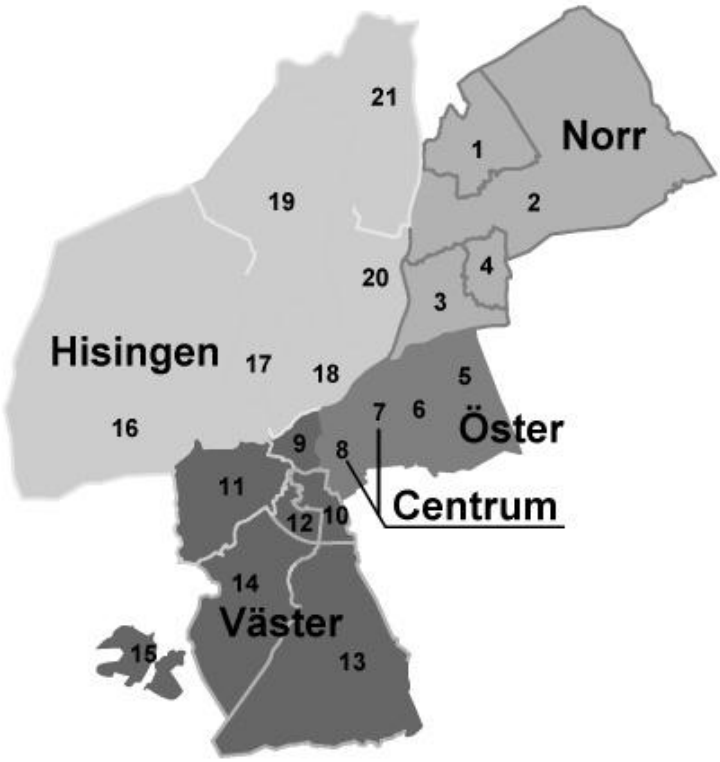

Figure A2-1. The main areas of Gothenburg.

The areas translate into the following variable names:

- Centrum : *AREA_CENTR*
- Norr: *AREA_NORTH*
- Öster: *AREA_EAST*
- Väster: *AREA_WEST*
- Hisingen: *AREA_HISIN*

In addition, the study included three *AREA* dummies capturing relevant municipalities other than Gothenburg. These were Mölndal (*AREA_MOLND*) located south of the city, Partille (*AREA_PARTI*) located north-east of the city, and other municipalities close to Gothenburg (AREA_OTHER).

Obviously, the lower limit of the *QT* variable is zero. It does not make sense to assume negative queuing times. How the group of $QT = 0$ observations affects the results can be examined by a lower-limit Tobit estimation. The marginal effects for equation *(1)* when the full sample is considered are presented in the table below, together with the corresponding estimates from table 5-1.

	(1) OLS	***(1) Tobit (MFX)***
RENT	*-0.06* ***	*-0.06* ***
	(0.006)	*(0.006)*
AREA_CENTR	*498.06* ***	*497.84* ***
	(23.016)	*(23.052)*
AREA_OTHER	*-343.14* ***	*-346.31* ***
	(62.701)	*(62.875)*
AREA_MOLND	*-121.13* ***	*-121.28* ***
	(28.465)	*(28.511)*
AREA_NORTH	*-131.01* ***	*-131.13* ***
	(19.770)	*(19.802)*
AREA_PARTI	*-218.93* **	*-218.36* **
	(89.699)	*(89.824)*
AREA_EAST	*274.00* ***	*273.42* ***
	(28.679)	*(28.727)*
AREA_WEST	*215.84* ***	*216.03* ***
	(22.883)	*(22.918)*
AREA_MAJOR	*902.24* ***	*900.75* ***
	(44.756)	*(44.835)*
AREA_KUNGS	*925.09* ***	*925.50* ***
	(51.893)	*(51.966)*
FLOOR_B0	*-103.34*	*-102.42*
	(72.487)	*(72.590)*
FLOOR_1	*26.94*	*27.30*
	(26.782)	*(26.825)*
FLOOR_2	*39.15*	*38.56*
	(26.516)	*(26.562)*
FLOOR_3	*61.62* **	*62.11* **
	(26.938)	*(26.981)*
FLOOR_4	*47.25*	*47.91*
	(32.659)	*(32.716)*
FLOOR_A4	*33.87*	*34.13*
	(27.999)	*(28.047)*
SIZE	*-1.50*	*-1.53* *
	(0.916)	*(0.917)*
ROOMS	*94.45* ***	*94.87* ***
	(15.761)	*(15.790)*
STUDENT	*-458.42* ***	*-460.20* ***
	(25.862)	*(25.916)*
_CONSTANT	*-0.06* ***	-
	(0.006)	

Table A2-1. OLS estimates and marginal effects from a Tobit estimation of equation (1).

The differences between the marginal effects from the Tobit regression and the OLS estimates are negligible. The conclusion is that the OLS estimates are not severely affected by the lower-limit group of observations at $QT = 0$. Thus, correct inference can be made from table 5-1.

Finally, a correlation matrix for some of the variables is provided below.

	QT	RENT	SIZE	ROOMS
QT	*1.0000*	-	-	-
RENT	*-0.0139*	*1.0000*	-	-
SIZE	*-0.0246*	*0.7793*	*1.0000*	-
ROOMS	*-0.0032*	*0.6686*	*0.8897*	*1.0000*

Table A2-2. Correlation matrix.

Size and rooms are highly correlated (0.89) which explains why the *SIZE* parameter is insignificant in the table 5-1 regression – *SIZE* and *ROOMS* somewhat contain the same information.