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Market Rents in Stockholm

An Estimation of Market Rents using Queuing time

Johanna Strömsten♣ Louise Nabseth♦

ABSTRACT
The aim of this thesis is to use queuing time as an indication of demand to estimate market rents in Stockholm. This is done by presenting rent dynamics in the Stockholm area, conducting an OLS (Ordinary Least Square) regression and creating a proxy for market rents for each specific apartment in a comprehensive data set, consisting of all mediated apartments by the Stockholm Housing Service during the period 2009 to 2013. The estimated market rents are further compared to the current rent levels and user costs in tenant-owned dwellings at area and district levels. This is complemented with different market participants' opinions regarding the complex issues of the housing market. The main finding of the thesis is that the estimated market rents are on average 92 percent higher than current rent levels. The results reveal that a number of factors affect demand for rental housing and households' tenure decisions, i.e. area attractiveness, travel time, income levels and the relative cost of owning versus renting, where the most important factor is area attractiveness. Finally we find that the estimated market rents are higher than current user costs in tenant-owned dwellings, mainly due to the low interest rate environment. Additionally, different demand patterns are reflected both in the estimation of market rents and user costs, which vary depending on location.

♣22003@student.hhs.se ♦22022@student.hhs.se

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TUTOR
Pehr Wissén

PRESENTATION
May, 26, 2014
Stockholm School of Economics, Sveavägen 65, Stockholm, Sweden

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I. INTRODUCTION

The prices of tenant-owned apartments in Sweden have risen sharply over the past decade, particularly in Stockholm, where prices increased by almost 133 percent[1]. Over the same period the rental housing market experienced a much more moderate increase of 24 percent[2]. While there is a high demand for housing in Stockholm, which currently increases due to continued urbanization, the housing supply is growing at a slower rate. The population in Stockholm has grown with [c.] 600,000 people since 1980 and currently increases with approximately 35,000 people a year, and the trend is forecast to continue. In 2030 the population is expected to amount to 2.6 million and it is estimated that 300,000 new homes are needed to manage this rapid population growth (Länsstyrelsen in Stockholm, Rapport 2013:2014). This could be compared to recent years' construction levels; where on average 10,600 new residents per year have been added (either through new buildings or reconstruction of existing ones). See Appendix Exhibit 1 for an illustration of the current housing shortage in Stockholm.

In contrast to houses and tenant-owned apartments, the prices of rental apartments are not set to market value by bidding auctions, but instead the rents are set through local collective negotiations between landlords and the Swedish Union of Tenants (Hyresgästföreningen) according to the *utility-value-principle* (Brukvärdesprincipen*)*. In addition to the on-going debate in Sweden regarding high debt levels among Swedish households, the housing shortage in Stockholm and the rapid increase in tenant-owned dwelling prices, there is another current debate regarding market rents and more flexible regulation (see for example SVD Opinion 23 Jan 2014 "*Marknadshyror är mer Rättvist*"). It is commonly argued that these rent controls are discouraging an optimum clearing of supply and demand, with long queues in some regions and vacancies in others (see for example Hüfner and Lundsgaard 2007; Turner 2001). A new report issued by the National Housing Board (Boverket) claims that the Swedish rental control system is a root cause to the housing shortage, particularly in Stockholm (Boverket, 2013). The report states that the rent control system for existing housing is not being used efficiently while at the same time not sufficiently enough rental apartments are being built, resulting in a shortage of 40,000 rental apartments in Sweden today, which is most noticeable in Stockholm. At year-end 2013, the queue for mediated apartments in Stockholm amounted to 431,144 people, which corresponds to an increase of 32,457 people compared to the previous year, which highlights the strong demand for apartments in Stockholm (Stockholm Housing Service).

When reviewing previous research within the field of housing finance and rental markets it is apparent that significant consideration has been given to the functioning of rent regulation (see for example; Lind 2003; Lind 2005, Ellingsen and Englund 2003). As presented by several studies

[1] Price statistics tenant-owned dwellings prices in Stockholm, 2003-2013 Mäklarstatistik.
[2] SCB. Average annual rents per square meter during the period 2003-2013.

(see for example Ellingson and Englund, 2003; Hüfner and Lundsgaard 2007) the long queues in some regions and vacancies in other imply that the current Swedish system with rent controls fails to optimally match demand and supply. Several negative effects of the system are reported, including low housing construction activity, inefficiencies in the maintenance of existing housing stock, black market contract trading and increased segregation. Since the Stockholm area has seen such a rapid growth in tenant-owned dwelling prices it is interesting to study households' tenure choices, focusing on the rental housing market and the alternative user costs in tenant-owned dwellings.

Due to the high demand for rental housing in Stockholm the housing queue for mediated apartments is long, however it varies across Stockholm with longer queues in some regions and vacant apartments in other. Since rent differences are minor in Stockholm under the current rent control system, whereas tenant-owned dwelling prices vary by location, this implies that the queue for rental housing can explain differences in demand and thus provide an indication of market rents. The queuing time is assumed to be a measure of the apartments' attractiveness and market demand and is thus functioning as 'means of payment' where attractive apartments require a longer queuing period than less attractive apartments. The queuing time is thus a proxy for the difference between current rent levels and market clearing rents.

The aim of this thesis is to use queuing time as an indication of demand to estimate market rents in Stockholm. This is done by presenting rent dynamics in the Stockholm area, conducting an OLS (Ordinary Least Square) regression and creating a proxy for market rents for each individual apartment in a comprehensive data set, consisting of all mediated apartments by the Stockholm Housing Service (Bostadsförmedlingen i Stockholm) during the period 2009 to 2013, as well as additional data on added variables. By analyzing the queue we examine demand factors (explanatory variables affecting queuing time) such as attractiveness of the area, particular apartment characteristics, income levels, type of ownership (municipal housing companies /MHCs or privately owned), and travel time to Stockholm inner city.

In order to advance our understanding of households' tenure decisions and to test the reasonableness of the market rents proxy, we compare it with current rent levels as well as with a measure of the cost in tenant owned dwellings, called user cost. Examining the user cost is also of particular interest as there is an on-going debate about low fees to the cooperative association, resulting in low user costs in general in tenant-owner dwellings[3]. Moreover, interviews with different market participants'[4] were conducted to get insights into the complex issues of the housing market. The information from these interviews serves as guidance and sense-check on

[3] http://www.svd.se/naringsliv/pengar/bostadsratter-blir-dyrare-i-langden_3419044.svd
[4] Swedish Union of Tenants (Hyresgästföreningen), National Housing Board (Boverket), Swedish Construction Federation (Sveriges Byggindustrier), Swedish Property Federation (Fastighetsägarna), Stockholm Housing Service (Bostadsförmedlingen i Stockholm), Ohlssons Fastigheter and SABO.

the reasoning of the importance of the different variables. Through this study, we hope to contribute to the current debate on market rents and the housing market in Stockholm. Furthermore, we wish to shed some light to the understanding of the housing market and households' tenure decisions.

Our findings suggest that the gap between actual rents and estimated market rents is captured by queuing time and is thus a measure of the deviation of actual rents to market rents. By running a number of regressions with a large number of explanatory variables we explore the unique data set in detail and from a number of angles. The main finding of this study is that market-clearing rent levels are achieved when current rent levels are practically doubled to today's levels (on average a 92 percent increase is required). Our results reveal that the location, measured not only by proximity to the Stockholm city center but also through area attractiveness parameters, has an important effect on market rents, and consequently actual rents underestimate these parameters.

Additionally, we extend the existing studies made on market rents by adopting a new approach, in which we compare the estimated market rents with user costs in tenant-owned dwellings. Our main contribution of this study is that different demand patterns are reflected both in the estimation of market rents as well as in user costs, which vary depending on location. This implies that the current rent regulation system fails to optimally match supply and demand. Furthermore, our results suggest that the estimated market rents are higher than current user costs in tenant-owned dwellings, which is mainly due to the current low interest environment, low fees to the cooperative association, as well as tax policies benefiting tenant owner dwellings. This study presents evidence that rent levels today are far below market-clearing levels. Our results should be of interest for practitioners who wish to advance their understanding of the housing market as well as contribute to a more sophisticated public debate regarding the housing market and in particular hypothetical market rents in Stockholm.

Outline

The remainder of the thesis is organized as follows: Section II "Theories and previous research" provides the reader with a general background on the rental housing market in Sweden, market rents and prior research conducted within the field and its adjacent research areas. Section III "Hypotheses" consists of a statement of, and discussion on, the hypotheses the thesis aims to test. In Section IV "Data and Methodology" outlines the methodologies used to test the hypotheses and address the research aim and limitations. Furthermore, the collected data set is presented, providing a detailed overview of the selected variables. Section V "Results and Analysis" presents and discusses the results obtained from the regression and the developed model of market rents. Section VI "Conclusion" concludes and discusses the implications of our results. Finally, Section VII "Future Research" discusses directions for potential future research.

A glossary appears at the end of the thesis, containing explanations of concepts and market practitioners relevant to the thesis.

II. THEORIES AND PREVIOUS RESEARCH

In this section, we present previous research relating to our field of study. First, we introduce the reader to an overview of the Swedish housing market, its tenure structure and rent regulation system as well as market participants' views. Thereafter, we review the relevant literature on market rents and its adjacent research areas. Finally, previous research that has been conducted within the field of user cost in tenant-owned dwellings is presented.

Structure of the Swedish housing market

Swedish house and tenant-owned dwelling prices have seen a continuous and rapid increase in recent decades. The growth has been especially high in the Stockholm area since the crisis in the early 1990s, when real prices fell by 30 percent (Hüfner and Lundsgaard 2007). There are however structural problems in the Swedish housing market, primary observable in the rental market, where rent controls are present and there are long waiting queues in the city areas whereas other regions have vacancies (Hüfner and Lundsgaard, 2007). The efficiency of the rental sector can have implications for the rest of the housing market, e.g. a well-functioning rental sector has the potential to reduce mobility costs and increase the liquidity of the housing market. Recent decades have seen a decline in the relative share of the rental sector to the total stock of housing in Sweden. The strictness of the rent regulation and the tax-system, which benefits tenant-owned dwellings, are common explanations for the relative decline in the rental sector. Another reason is the decrease in interest rates, which make it economically justifiable for households to buy rather than rent, despite the recent price increases in tenant-owned dwellings (ECB, 2003).

Tenure structure

The tenure structure of the Swedish housing market consists of private rental, public rental, tenant-owned dwellings[5] and owner occupation. At year-end 2012 rental dwellings and tenant-owned dwellings represented 48 percent and 52 percent respectively in Stockholm; Sweden as a whole had 63 percent rental dwellings and only 37 percent tenant-owned dwellings. The fastest growing tenure in Sweden and in particular Stockholm is tenant-owned dwellings and this is partly due to the fact that many rental apartments have been transformed, but the Swedish tax system has also contributed (Hüfner and Lundsgaard, 2007).

[5] Tenant-owned dwellings is an *indirect* form of ownership of an apartment, in which the owner can sell the "right to live" in it, but the building is collectively owned by the cooperative association (a legal entity) and the owners are members in the cooperative association that owns a multi-dwelling building.

The rental sector in Sweden has a fairly high share of public housing compared to other European countries; accounting for almost 20 percent of Sweden's housing stock and half the rental sector (SABO, 2013). Its high importance has to be understood in a historical context of the post-war decades. Several factors, such as poor housing, low construction of housing and high birth rates in 1945 caused pressure on the society to take on more responsibility and consequently a Public Housing Inquiry was appointed. The Swedish Parliament (Riksdagen) took a decision that established non-profit MHCs, owned by municipalities, providing housing to a wide range of households. The main objective with the Swedish public housing model was to implement a welfare policy; to raise the quality of housing for all citizens at decent prices, fight segregation, make up for construction shortfalls in the private sector, to restrict private landlords to take advantage of the scarcity and to equalize the distribution of housing consumption. In the 1960s the Government intervened again with public efforts to increase construction activity and decrease the acute shortage of housing in the "Million dwellings program", designed to build 100,000 dwellings per year during the period 1965 to 1974. (SABO, 2013, Ellingsen and Englund 2003 and Hüfner and Lundsgaard 2007). About 300 MHCs are active on the rental housing market today, holding an average market share of approximately 50 percent for rental housing (Hüfner and Lundsgaard 2007). Since 2011, MHCs are to operate under commercial principles according to the Act (2010:879). See Appendix (Exhibit 2) for statistics on dwellings in completed buildings by ownership, tenure and size of dwelling etc.

Rent regulation system

The Swedish rental market is regulated in accordance with the nation's longstanding goal of ensuring affordable and decent housing for all, and was introduced in Sweden during the 1940s. Reform discussions took place during the 1960-1970s, slowly leading to a slightly softer form of regulation allowing higher rents in newly constructed dwellings. However rents are still regulated, as the regulation maintains new rental contracts below the market level in certain areas (Lind, 2003). Rents for residential properties are determined through an interaction of rules, acts and principles[6]. Rent negotiations take place between landlords and local tenants' representatives, often on a yearly basis.

Rent determination is based on the *utility-value-principle*, which implies that rents for apartments that are considered similar or having an equivalent utility value, based on several factors such as size and standard, should be the same. There is a possibility to agree individually on private rents and the tenant has the choice to go to a public rent tribunal (rent committee) to evaluate if the rent is appropriate. The rent levels are compared to the levels in comparable apartments within the same municipalities. Since 2011[7] it does not matter if it is a private or

[6] 1Hyreslagen, 2 chapter jordabalken, JB and hyresförhandlingslagen (1978:304).
[7] See Jordabalken 55 och 55e §§ in chapter 12

public landlord who entered the negotiations agreements. Previously, the agreement in the public sector became the norm for negotiations in the private sector (Boverket, Rapport 2014:13). Since July 2006 "*Presumption rents*" allow rents in newly constructed dwellings to be higher and thus excluded from the *utility-value principle*. These rents shall be presumed to be reasonable for a period of fifteen years if they have been negotiated and accepted by a local tenant's association. When fifteen years have passed the ordinary *utility-value principle* applies. Tenants cannot get the rent tested in accordance with the *utility-value-principle* rules until the fifteen years have passed. These provisions are intended to stimulate the production of new dwellings.[8] However, the Swedish Property Federation argues that it is far from praxis that "*Presumption rents*" are used in new construction. A recent study demonstrates that "*Presumption rents*" only were used in 32 percent of the cases included in the study.[9]

In recent years, a reformed version of the *utility-value-principle*, the so-called "Stockholm Model" was created, in which the participants (the Swedish Union of Tenants, MHCs and the Swedish Property Federation) proposed a new way of rent setting. The basis for the model was to use the *utility-value-principle* but to let the location be of greater importance, i.e. reflecting demand to a greater extent. Extensive information collection through surveys with tenants was made, in which five parameters were identified as key in apartment attractiveness. These parameters were apartment size, apartment and property standard and modernity, building character (i.e. part of the "Million dwelling program" or turn of the century), location and management quality, property services and maintenance systems. The "Stockholm Model" has not yet been implemented due to disagreements among the market participants but aspects of the model have been incorporated into some participants' daily work.

Market participants' views on the rent regulation system

Several market participants argue that rents in attractive city locations are below market-clearing levels due to the *utility-value-principle* (see for example National Housing Board, 2013). Several studies have been made on the workings and efficiency of rent control, see for example Malpezzi and Turner, 2003; Arnott 1995. The main argument in favor of rent controls is the welfare aspect of preventing segregation between rich and poor areas, with low rents offered even in rich parts of the city. Theoretical support for rent control is commonly to protect the tenants, who face transaction and mobility costs of moving, by preventing landlords from taking advantage of their bargaining power. Theoretical rationale for rent regulation is fairly weak and Ellingson and Englund (2003) argue that the efficiency losses of rent regulation are substantial. Other adverse effects of rent regulation are low private housing construction, black market for swapping rent contracts, inefficient use of the house stock and segregation effects (Lind, 2005, Ellingsen and

[8] http://www.hyresnamnden.se/Amnesomraden/Skalig-hyra/Undantag-vid-nyproduktion/

[9] http://www.fastighetsagarna.se/aktuellt-och-opinion/nyheter/nyheter-2012/valkomna-initiativ-for-fler-bostader

Englund, 2003). There are several forms of inefficiencies that can result from rent controls, e.g. long queues or tenants "being locked" into their existing homes due to high transaction costs of moving into another apartment, or tenants renting larger places than they actually need (or could afford at market rents) (ECB, 2003 and Hüfner and Lundsgaard 2007). The disequilibrium of rental control markets is generally illustrated through long queues for new tenants coexisting with black market activities[10] and little rent variation coinciding with increasing regional house prices. Furthermore, as mentioned in the Introduction, the rent control system is said to favor insiders that are active in the market, which makes it hard for outsiders to enter it. However, it is often argued that rent control promotes social integration (Boverket, 2014:13), which is empirically supported (Enström Öst et al, 2013). Income segregation is found to be substantially lower in the current rent control system than in the non-regulated benchmark (Enström Öst et al, 2013).

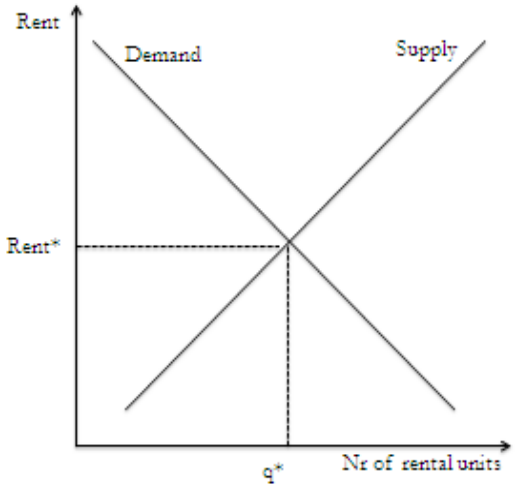
Market rents

Demand and supply model

From the above discussion regarding the Swedish housing market and the rental system one can argue for and against the rent control system. The term market rent is subject to interpretation. In economic theory, a market rent is usually the rent where demand equals supply, this corresponds to a rent situation where there are neither queues nor vacancies. Although this illustration is quite simple, it illustrates the basic tenets of the use of market rents estimation. In more pragmatic terms, market rents may be interpreted as the mean that would arise if there were no special rules on rent setting (*"EU, allmännyttan och hyrorna"* SOU 2008:38) or a rent setting, which is controlled only by minor adjustments. This thesis uses the strict economic theory definition in order to determine market rents, which implies that the market rent is the likely rent the property owner can charge when the apartment is brought to a free market where the market participants determine the rent level in an open competition. In reality, it is not likely that rent setting will be entirely let to free markets, the *utility-value-principle* and collective bargain system will likely be retained but political debates suggests that perhaps more flexible rent setting will occur in the future. When studying the housing market, the ideal situation is usually one of perfect competition, i.e. where supply and demand intersect, creating an equilibrium price (p*) and quantity (q*). This is illustrated in graph 1A below.

[10] Dagens Industri recently published an article describing the swapping of rental contracts on the black market in Stockholm. The article estimates the turnover to be approximately 1.2bn SEK a year.
http://www.di.se/artiklar/2014/2/21/snaran-dras-at-for-svartmaklare/

Graph 1A: Perfect competition on the rental market

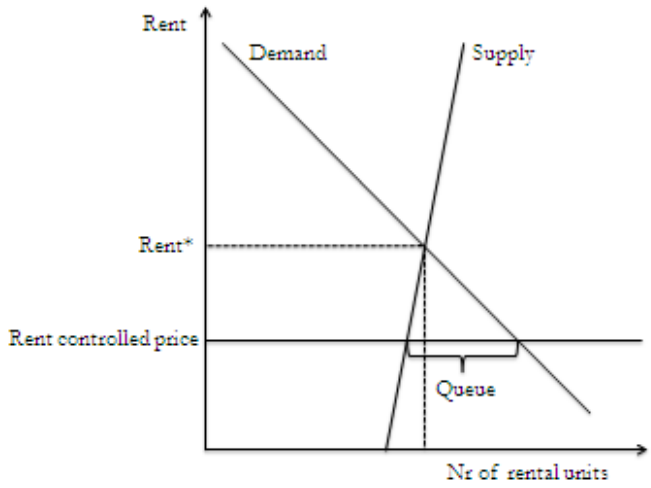


Source: Goolsbee, Levitt och Syverson

Queuing time explaining demand surplus

The illustration above does not correspond with how the image of Stockholm's inner city's supply curve looks like. In reality, this curve is significantly steeper, due to the housing shortage in the inner city. In a regulated market, where rent controls lead to lower rents than the equilibrium and the quantity of demanded apartments is greater than the quantity supplied, a shortage of apartments exists Glaesers and Luttmers (2003).

Graph 1B: Rent control



Source: Goolsbee, Levitt och Syverson

The above graph illustrates Glaesers and Luttmers (2003) basic welfare analysis of rent controls, where a shortage prevails due to regulated rents. Their analysis shows the queue as a result of the shortage and the queue is thus an indication of the excess demand. This theoretical framework is the foundation of our method for estimating market rents. In a perfect market, consumers shall according to personal preferences be able to allocate their resources between housing consumption and other consumption and decide what type of accommodation he/she is prepared to pay for (Bentzel et al, 1963). However, in reality there are mainly four imperfections

that disrupt perfect market rents. First, information acquiring costs due to asymmetric information between the landlord and the tenant. Second, long and non-flexible contracts implying that the market rent will not be adjusted as soon as the demand or supply curve is changed. Third, quasi-monopolistic situations, resulting from situations where only a few large property owners are present or from the fact that each apartment is unique. Finally, high transaction costs such as moving expenses (Lind, 1995.)

Prior research on market rents

The vast majority of studies on market rents have focused on market imperfections, such as rigid housing markets (see for example Hansson and Turner 1977). Bentzel et al (1963) did a study of pricing in the rental market and describes an equilibrium pricing that could prevail in housing markets. Their findings are that in the short run, there is a given supply of housing and the demand for those homes depends on the rent level. Market clearing rents existing on a free non-monopolized housing market will tend towards equilibrium, assuming property owners seek to maximize their net income. To obtain a market model, where rents are identical to the equilibrium structure, certain assumptions are required: no transaction costs, no lag in adjustment of rents and rational consumers, which is often not obtainable in the real world as people also act on their emotions (Bentzel et al, 1963 and Rogoff, 2014).

The subject of market rents has been actively debated in recent years in several research papers and reports. Turner (2000) finds it difficult to determine the difference between the current rent levels and hypothetical market rents. This is because one cannot directly observe a market rent, but can be estimated in a more indirect way, e.g. calculation of a notional market rent can be based on the assumption that an equivalent tenant-owned dwelling is a perfect or almost perfect substitute for tenants. The rental market is similar to the tenant-owned dwelling market; therefore one can examine the analysis and compare the results between the two. There are a number of similarities between the Turner model and this thesis method for estimating market rents. Thus, a brief explanation of Turner's model and its results are given below, followed by another method for estimating market rents.

Turner model

Turner analyzes the rental market and pricing in the housing market, using a regression analysis. The study is empirically oriented, analyzing rent levels, the importance of location, the level of market rents relative to the corresponding tenant-owned dwelling prices and how the disposable income is correlated with apartment location. The dependent variable in Turner's regression analysis is the total rent per square meter, and the independent variables are the number of rooms but also dummy variables such as year of construction and type of owner (Turner, 2000). Turner's results indicate that the proximity of the apartment to the city center is given a certain

weight in rent negotiations in the *utility-value-principle*, whereas the year of construction affects rent levels significantly more. Turner also analyses the distribution of disposable income on the housing market in Stockholm and finds that the willingness to pay on the tenant-owned dwelling market is considerably higher than in the rental market. Finally, the study finds that MHCs generally charge lower rents than private property owners. For further examples of studies elaborating on Turner's model see for example Gadsjö et al (2006).

Estimating market rents using queuing time and preference factors

Several studies have been made on the topic of market rents in Sweden using various preference factors. Zahir (2005) estimated possible market rents in the Stockholm area by determining the queuing time for rental apartments in Stockholm using a regression analysis. The method consists of first using a regression analysis, explaining average queue times and then rewriting the equation for queue time into estimating market rents. Lindblad (2010) did a similar study but also added new construction in his rental model. Johansson (2012) also conducted a similar study but on the residential market in Gothenburg, evaluating which factors determine the attractiveness of an apartment.

Demand for housing

A number of factors affect the demand for rental housing and households' tenure decisions, such as income levels, housing demographics, urbanization and political decisions. In a deregulated market, equilibrium rents would result from clearing the stock of supply and demand for rental housing (Andrews et al, 2011). The relative cost of renting versus owning a house also impact the demand for rental housing, hence price developments in housing and tenant-owned dwellings affect households' tenure choice (e.g. Bourassa, 1995). For example, if house prices are too high relative to rents, potential buyers may find it more advantageous to rent. Furthermore, there are a variety of factors that households take into consideration when choosing housing consumption alternatives, e.g. the interest rate, perception and preferences for risk, tax benefits, transaction costs, property taxes, depreciation and maintenance costs, and any anticipated capital gains from owning the house. Finally, the need for security of tenure has in several studies been identified as a key driver of homeownership (e.g. Bourassa, 1995; Burgess and Skeltys, 1992). Therefore, rental regulations that increase tenure security may raise the desirability of rental housing relative to tenant owned dwellings. However, a too strict tenure protection may end up distorting tenure choice (Andrews et al, 2011). Finally, a very large number of empirical studies conclude that the demand for housing services increase roughly in proportion to income (Englund, 2011 and Girouard et al 2006).

Consumer preferences

Consumers' preferences in the housing market are a rather explored topic and previous studies

have applied different methods to study the preferences. There are important trade-offs that households make in housing decisions, because housing constitutes a complex bundle of attributes, such as dwelling space, public amenities and location (Ball, 2012). Even if consumers' preferences differ at individual levels, research and empirical evidence imply that a few general conclusions can be made. Several studies, including Fransson, Rosenqvist and Turner (2002) have reached the conclusion that the dwelling's geographical location is of particular importance. There are variations in individual preferences, but some locations are generally regarded as more attractive than others. This is reflected in a high demand for housing in these locations. The areas that are considered particularly attractive is the inner city but also areas with proximity to water (Fransson and Magnusson, 2000). The investigation "*EU, allmännyttan och hyrorna*" (SOU 2008:38) suggests that the geographical position is reflected in the pricing of other parts of the housing market such as the tenant-owned dwellings market but not on the rental market. According to the investigation, the importance of geographical location is not sufficiently appreciated in collective negotiations. However, the Swedish Union of Tenants argue that they to a greater extent today take the location into consideration in rent negotiations, which is supported by SABO (M. Hofverberg, pers. comm., 2014-02-19 and R. Sernlind, pers. comm, 2014-04-10).

A study conducted by the Swedish Property Federation suggests that two out of three are willing to pay more for housing in an attractive area[11]. It is clear that a majority of respondents, 73 percent, believe that it is reasonable to pay a higher rent for an accommodation in an attractive location than for one in a less attractive location. According to a new study on young citizens' housing preferences in Stockholm, developed by NCC together with Swedbank and the Swedish Property Federation, proximity to public transportation is the most important aspect when choosing a new home.[12]

Supply of housing

Supply is determined by several factors, such as land scarcity and restrictiveness of zoning permissions as well as landlords maximizing profits and comparatively low productivity growth in construction. According to several studies it can be assumed that equilibrium prices are determined from a given stock of supply and demand in the short run because of sluggish adjustment of the stock of housing to desired demand. Thus, there exist a mismatch between demand and the given stock of housing, which in the long-run leads to an adjustment of the growth rate in housing stock through investment in new housing (Andrews et al, 2011). Furthermore the supply adjusts gradually through new construction and conversions in response

[11] The study was conducted by YouGov on behalf of the Swedish Property Federation in 2011, consisting of >1000 respondents (men and female aged 18-74).

[12] The study *"How do young people in Stockholm Living in the Future"* was based on a comprehensive market analysis, expert interviews and a survey of over 1000 young locals (18-35 years) conducted by research firm United Minds on behalf of NCC, Swedbank and The Swedish Property Federation.

to movements in the expected rate of return of investments in rental property, analogous to the owner-occupied segment (Andrews et al, 2011). The supply of tenant owner dwellings and private rental housing are mostly influenced by the same market factors driving demand, e.g. demographics and income, factors affecting the profitability and yield of different types of housing alternatives and other investment choices and also political decisions such as tenant controls and rental regulations (Andrews et al, 2011).

In the Stockholm region it is common knowledge that a housing shortage exists as the population continues to increase while new construction of properties has been at low levels. The supply of rental housing continues to decline as landlords find it more profitable to convert formerly government-subsidized units into tenant-owned dwellings. It is estimated that the average new construction of housing per year is 10,600 units in the Stockholm County. The vacancy rate is practically zero on rental housing, which our obtained data set confirm. One should note that politicians in Stockholm and adjacent municipalities are involved in extensive urban development planning in order to meet the increasing demand. E.g. politicians in the city of Stockholm recently presented a plan of four new subway routes and 78,000 new homes in Stockholm to better meet demand.[13]

User cost in tenant-owned dwellings – "Shadow rents"

As discussed above, households' tenure decisions are influenced by the cost of owning versus renting housing services. The cost in tenant-owned dwellings can be measured by the user cost of housing, which depends on the purchase price, interest rates, tax policies, and also current and future expected transaction costs and capital gains/losses. The user cost can be derived from a simple model of the shadow price of housing services (Díaz et al 2011 and Englund, 2011). The method is based on the assumption that the cost of living in rented accommodation is a natural benchmark for the price of tenant-owned dwellings. This is supported by prior research suggesting that in a competitive market with 'tenure neutral' taxes and subsidies, there is a clear and simple long-run relationship between rents and the prices of tenant-owned dwellings, in that prices are the discounted values of future net rent[14] streams (DiPasquale and Wheaton, 1996). Looking at the long run gives an important insight into the essential point that the cost of housing is broadly the same for either renting or owning. (Ball, 2012). In summary, the shadow price of tenant-owned dwelling housing services or the user cost contains current transaction costs, the cost of mortgage payments plus future expected transaction costs, maintenance and property taxes minus expected capital gains (Díaz et al 2011).

[13] http://www.regeringen.se/sb/d/4902/a/228273

[14] Where 'net rents' take into account administration, transaction costs and adequate repair costs to maintain dwellings.

The market's willingness to pay for a tenant-owned dwellings depends on the user cost, e.g. with lower user costs homebuyers can afford to pay higher house prices. If there was a well-functioning rental market, this would be a good substitute for tenant-owned dwellings, and consequently, the cost of housing consumption for the two forms of tenure should follow each other closely. For a tenant, the cost of housing services is simply the rent she pays to the landlord. For a person who owns their housing the cost of housing services consist of the user cost. Thus, the user cost would be the factor to which the market capitalized the current rent level. At a given rent level, this relationship would thus show how market prices are affected by changes in the cost of capital and the various tax parameters affecting user cost.

III. HYPOTHESES

In this section, we present and motivate the hypotheses that we aim to study in this thesis. These are based on the theoretical framework and previous research earlier presented as well as findings from our conducted interviews.

Following on from the discussion above, market rents are determined by supply and demand in the rental housing market and can be illustrated by queuing time, which varies across different areas. Since market-clearing levels can be determined from a given stock of supply and demand in the short run, our focus is on demand, e.g. consumer preferences affecting queuing time. Demand depends on a variety of variables, such as demographics, willingness to pay, rents, comparative cost for tenant-owned dwellings and personal preferences. In reality, the market adjusts slowly due to market imperfections and actual vacancies might therefore not be equal to the optimal vacancies. This leads us to the following hypotheses:

1. *Market rents will increase rent levels in all areas, due to the housing shortage in Stockholm*

The insights from the literature (e.g. Lindblad, 2010) as well as opinions from market participants led us to develop hypothesis one; market rents will be significantly higher than current rent levels. The fact that the current rent regulation maintains rent levels below market clearing levels in combination with the high demand for housing in Stockholm, imply substantially higher market equilibrium levels. Furthermore, this is in accordance with the classic demand and supply frameworks, illustrated in graphs 1A-B.

2. *Market rents will better reflect demand than regulated rents*

Intuitively, we expect visible differences between locations, depending on their attractiveness, which the queuing time is assumed to reveal in the regression analysis. We estimate a substantial "undervaluation" of rent levels in the attractive areas in Stockholm and more moderate increases in more remote areas. This is in accordance with the findings of Turner (2000) who estimated a 40 percent "undervaluation" of rent levels in the city center of Stockholm. This is also confirmed

by other research, e.g. the study conducted by the Swedish Property Federation, as well as prior literature (e.g. Fransson, Rosenqvist and Turner, 2002 and Fransson and Magnusson, 2000).

3. *Areas characterized by new construction will see lower rent increases, due to "Presumption rents" and because of increased supply of rental housing*

As discussed in the literature section, *"Presumption rents"* allow landlords to charge higher rents in newly constructed dwellings. Therefore, we expect areas characterized by new construction to have higher actual rents and therefore will see lower rent increases when market rents are estimated. Furthermore, new construction increases supply and several similar apartments are being mediated at the same time, which according to market participants (e.g. Stockholm Housing Service) lowers the demand. Finally, this is in line with the results Lindblad (2010) obtained.

4. *When comparing user costs in tenant-owned dwellings to the estimated market rents, hypothetical market rents are projected to be higher than the user cost, due to the current low interest environment and favorable tax policies*

In order to validate the reasonableness of the estimated market rents, we compare the proxy of market rents with user costs in tenant-owned dwellings. We expect market rents to be higher than user costs in tenant-owned dwellings due to the current tax policies and low interest rates. This is in line with research (ECB, 2003, Hüfner and Lundsgaard, 2007 and Englund 2011), illustrating the importance of low interest rates as well as the tax system affecting user costs. Furthermore, in our interviews, market participants have expressed that hypothetical market rents should in theory be higher than user costs, due to the service offering inhibited in rental housing, e.g. maintenance. However, this may not be the case, as the risk in invested capital and potential value increase from investing in tenant-owned dwellings are ignored.

5. *Market rents and user costs will in general reflect different demand patterns to a larger extent than current rent levels*

Following the discussion in the literature section, we expect market equilibrium rents and user costs in tenant-owned dwellings to reflect different areas and apartments' attractiveness, which is not seen in the current rent regulation system. This result would be in line with prior research such as the investigation "*EU, allmännyttan och hyrorna*" (SOU 2008:38), which suggests that the area attractiveness is reflected in the tenant-owned dwelling market but not in the rental market.

IV. DATA AND METHODOLOGY

This section consists of two parts. Firstly, we discuss and motivate the applied method used to investigate the theories and hypotheses outlined in section II and III. We also address potential limitations of the method. Secondly, we present the data and the respective data sources used in

our study. We also discuss and summarize the descriptive statistics of the sample to provide the reader with an overview of the data.

New approach

In this thesis, a different method is adopted compared to other papers within the field, which provides new results and insights. Specifically, this thesis incorporates additional new variables or improved variables included in previous research. These variables are area attractiveness (*Area A-K*), ownership structure, apartment characteristics, a more accurate travel time variable and a more precise average income variable. Furthermore, market rents are estimated for each specific apartment and not on a general area level. Second, the predicted hypothetical market rents are compared with actual rent levels and user costs in tenant owner dwellings and lastly, we expand the framework by incorporating market practitioners' views. Following the comprehensive collection of data, this thesis thus relies on a large sample that is sufficiently large to support a significant analysis.

Conceptually, this approach is inspired by papers of Turner (2000), Zahir (2005) and Lindblad (2010). The setting in these papers is similar to this thesis; in that hypothetical market rents in Stockholm are estimated using explanatory demand variables such as size, travel time and area. However, these papers consider less accurate explanatory variables, and the focus is on estimating market rents based on these. In that setting, the performance of any regression depends on the accuracy of the variables. In contrast, this thesis focuses on the out-of-sample predictive performance as the extended demand variables included make this regression more in line with tenants' demand. Therefore supply and vacancy rates are not in focus.

Furthermore, a related direction of research of user cost in tenant-owned dwellings was initiated by Englund (2011), which further is explored in this thesis. Instead of solely attempting to estimate market rents, this thesis analyze how reasonable the results are by adding a comparison with user costs in tenant owner dwellings. Finally, this thesis has chosen another time-period, which makes it possible to capture the effect on rents of the introduction of "*Presumption rents"* and the proposed "Stockholm Model".

Technically, this thesis uses an extensive data generating process and data is sorted using Microsoft Excel and STATA. The data set includes data between 3rd of January 1994 and 10 of January 2014, but from the analysis above the period 19 February 2009 to 30 December 2013 has been selected. This provides 21,417 observations, which is more than enough to run regressions with statistical significance.

Four-step method:

Based on the above-described new approach, we arrived at a modified and uniquely developed model for estimating market rents with queuing time, taking all the above relevant factors into

account. The method consists of four steps (all summarized in detail below) where an out-of-sample forecast[15] is used to aid the selection of our statistical model. Using out-of-sample implies that the data used in the model fitting (regression) differs from the one used in forecasting evaluation (estimation of market rents). Using out-of-sample is thus useful for getting predicted values for the case of hypothetical market rents with non-existing queuing time (see for example Lee, 2008, Baum, 2006).

Step one consists of an OLS regression model, where the dependent variable *Queue*, depends on a number of explanatory factors. The regression is performed in STATA as it is an important tool financial researchers use to understand the relationship among two or more variables. Regression is particularly useful in cases where there are many variables and the interactions between them are complex (see further information below). The second step consists of testing the statistical significance of the regression model, using t-tests, F-tests, VIF-tests as well as a correlation analysis. The third step consists of estimating market rents by adding the results from the OLS regression to a rent-model. In the final fourth step the relationship between market rents and actual rents in Stockholm is examined, divided into area attractiveness level and district level, as well as compared to user costs in tenant-owned dwellings.

Step one – OLS regression

The first step consists of model fitting, using OLS regression and includes the model selection, which later is used when forecasting market rents, i.e. the estimation subsample. The purpose of step one is to construct a model functioning as a proxy explaining queuing time for apartments in Stockholm. This is achieved by using actual observations of the queuing time for each specific apartment obtained from the Stockholm Housing Service in a linear multiple regression model. The dependent variable is *Queue*, a variable assumed to be a measure of the demand for each specific apartment. The explanatory variables are expected to affect the equation in various degrees. After the regression model is developed and analyzed, the purpose is to estimate market rents i.e. model specification with a hypothetical queue using the results from the regression analysis. The regression model looks as follows:

$$Queue = \beta_0 + \beta_1 * Rooms + \beta_2 * Floor + \beta_3 * Yearly\ rent/sqm + \beta_4 * Income2011 + \beta_5 * Travel\ time + \beta_6 * Ownership + Areaattractivenessdummy\ (A - K) + Yeardummy\ (2009 - 2013)$$

After running the regression, each above variable's effect is analyzed and compared to the hypotheses and expected results (see section V "Results and Analysis").

[15] In this thesis 'out-of-sample prediction' means forecasting of new responses given hitherto unobserved explanatory variables (Leeb, 2008).

Model specification – regression analysis

To be able to use the variable *Queue* as a proxy for market rents, a multiple linear regression model is used. This model studies the relationship between the dependent variable and one or more independent variables. The generic form of the linear regression model is as follows:

$$y = f\ x_1, x_2, \dots, x_k\ + \varepsilon\ where = x_1\beta_1 + x_2\beta_2 + \cdots + x_K\beta_K + \varepsilon$$

Where y is the dependent or explained variable and $x_1, \dots, x_K$ are the independent or explanatory variables. The term ε is a random disturbance. The disturbance arises for several reasons, primarily because we cannot hope to capture every influence on an economic variable in a model, no matter how we elaborate. The net effect, which can be positive or negative, of these omitted factors is captured in the disturbance. A multiple regression called the Ordinary Least Square regression (OLS) is used to analyze the selected variables. OLS is the simplest and the most common estimator and is commonly used to analyze both experimental and observational data. The OLS method minimizes the sum of squared residuals and leads to a closed-form expression for the estimated value of the unknown parameter β:

Step two - statistical significance tests

In order to test whether the regression model and coefficients are statistically significant in the regression several tests are performed. To analyze the significance level and if the explanatory variables have explanatory power for the dependent variable (*Queue*) we use t-tests and F-tests. These tests enable us to carry out hypothesis tests on our regression coefficients, where we calculate the test statistics and compare them to a critical value, corresponding to a level of significance[16].

Furthermore, the risk of multicollinearity is analyzed since some of the variables are quite similar. Multicollinearity is a statistical issue that arises if some or all of the explanatory variables are highly correlated with one another. If it is present, the performance of OLS estimates can be poor. However, our data sample consists of 21,417 observations, which suggests a low risk of a multicollinearity problem. In a multiple regression, the variance inflation factor (VIF) is used as an indicator of multicollinearity and we therefore perform VIF tests. This test is performed in STATA, applying the VIF function since there is a risk of certain variables being highly correlated, e.g. area attractiveness (A-K) variables.

Following the above discussion of multicollinearity, it is important to investigate correlations between the explanatory variables. The importance of correlation between variables has been analyzed in prior research e.g. Fransson, Rosenqvist and Turner (2002). Therefore, the correlation between all variables is investigated to address a potential multicollinearity problem.

Finally, we use the Breusch–Pagan test to test for heteroscedasticity in the linear regression model. It tests whether the estimated variance of the residuals in a regression are dependent on

[16] For further descriptions of the statistical methods and techniques see for instance Greene, 2012 and Koop, 2006.

the values of the independent variables. The test is easily performed in STATA using the function estat hettest after running the regression. If the Breusch–Pagan test shows that there is conditional heteroscedasticity, we must either adjust for robustness, or re-arrange the regression equation to correct the results. In STATA the Robust function is used to solve a potential heteroscedasticity after the regression.

Step three –estimation of market rents

The third step consists of using the results from the regression to forecast the market rents i.e. using out-of-sample in the forecasting subsample. As the queuing time is an indicator of the demand and attractiveness of the specific apartment, the *Queue* is set to 1 year, illustrating a market rent scenario in a non-regulated market. In reality, the actual queuing times are not zero/one but in the equation for hypothetical market rents, the queuing time is set to one, which implies that the data used in model fitting (regression) differs from those used in forecasting evaluation[17] (estimation of market rents). The market rent is calculated by adding the rent to the left hand side and divide the right hand side with the rent coefficient. The *Queue* is set to one year, which means a person will be mediated a desired apartment in one year. Recall that it is assumed that long queuing times reflect high demand in a regulated rental market, and the queue will be non-existent in a non-regulated market, in which demand for apartments equals the supply. However, market imperfections such as long and non-flexible contracts and transaction costs may disrupt market clearing levels and therefore, it is reasonable to assume almost a zero queuing time of one year. In order to calculate *Yearly market rents per sqm* the variables used in the regression model are inserted into the equation below multiplied with the coefficients resulting in an implicit market rent for each mediated apartment per year-end 2013:

$$Yearly\ market\ rent/sqm = (\beta_0 - Queue * 1 + \beta_1 * Rooms + \beta_2 * Floor + \beta_4 * Income + \beta_5 * Travel\ time + \beta_6 * Ownership + Areaattractivnessdummy\ \ A-K + Yeardummy\ \ 2009-2013\ )/\beta_3$$

Step four – comparison

In the final step actual rents are compared to the above calculated market rents. The analysis consists of three comparisons, first at area attractiveness (A-K) level, second at district level and lastly with the non-regulated market, i.e. user costs in tenant-owned dwellings. The results are then illustrated in tables showing percentage differences, illustrating how far the estimated market rents are from actual rent levels and from user costs in tenant-owned dwellings. The findings are also analyzed in relation to prior studies.

[17] Note that it is only the variable *Queue* that is changed, all other variables are kept.

To compare and illustrate the difference between market rents and user costs in tenant-owned dwellings the alternative user cost in tenant owned dwellings are calculated according to the following formula:

*User cost = (Tenant-owned dwelling purchase price*0.85)*Average mortgage interest rate*standard tax (Sw: "Schablon skatt") + Average Yearly Expenditure*

Tenant-owned dwelling purchase prices, calculated on each zone, are averages of the sample period and are multiplied by 0.85, which is a simplification since it is assumed that people borrow up to the mortgage ceiling. The average interest rate applied is calculated from data obtained from SEB, using the average one-year mortgage rate in the sample period 2009 to 2013. The standard tax (Sw: "Schablon skatt") is assumed to be 30 percent. The average yearly expenditure per sqm is assumed to be SEK 500. The fee typically covers real estate taxes, financing costs the association has from mortgage loans and other maintenance and operating costs. (H. Tufvesson, pers. comm., 2014-03-19). See Exhibit 13A-D for a sensitivity analysis, where we elaborate on these assumptions. Finally, the user cost calculation is compared with actual rents, functioning as a robustness check to see if the difference between estimated market rents and actual rents and the difference between calculated user costs and actual rents follow the same pattern. This is a simplified version of user cost, as future expected capital gains/losses are not included (see Díaz, 2011 et al; Englund, 2011). Mortgage repayments are not a cost per se, instead comprise savings, but affect consumers' cash flows; however this is indirectly accounted for in the purchase price. E.g. in a scenario with increased amortization requirements, it is likely that consumers can afford to pay less for a tenant-owned dwelling.

Data

As the objective of this thesis is to use queuing time as an indication of demand to estimate market rents in Stockholm and compare and analyze the findings with current rent levels today as well as relative to the corresponding user costs in tenant owner dwellings, the data generating process and selection of explanatory variables are critical. An elaboration of the data sample and its variables are presented below.

Sample period

In order to test our hypotheses and validate the results, the data required must cover a sufficient time period but also accurately represent the true effects of the variables. In order to capture accurate consumer preferences but still generating a sufficient period of time, excluding adverse effects of the recent financial crisis, this thesis focuses on the period 2009 to 2013. Throughout the sample period, there has been a rapid price development in the housing market in Sweden, especially for tenant-owned dwellings in Stockholm, where prices have increased by 16.4

percent[18]. The discussion whether Sweden, and Stockholm in particular, is facing a housing bubble is a lively on-going debate. The increased indebtedness of Swedish households', which is fueled by record low interest rates, has raised concerns about banks' vulnerability to losses on consumer loans (Johansson and Persson, 2006). The Swedish Financial Authority has suggested several measures to limit the indebtedness of the household sector and the effects on the financial system. Banks are subject to several recent regulations on capital requirements and liquidity. Consequently, all these factors are likely to affect households' tenure decisions.

Finally, the conducted interviews with market practitioners, e.g. the Swedish Union of Tenants, indicate that major changes have occurred since 2000 in the rental market in Stockholm, e.g. the introduction of *"Presumption rents"* in 2006 and the proposed Stockholm Model. The Swedish Union of Tenants argues that in recent years they have started to give more importance to location, accommodation standard and apartment characteristics in their rent negotiations with landlords (M. Hofverberg, pers. comm., 2014-02-19).

The data has been collected from Stockholm Housing Service from the 3rd of January 1994 to the 10th of January 2014 but due to the importance and correlation between the housing market and the overall economy together with above stated arguments, it is most interesting and relevant to study the period from 2009 to 2013. This time period captures many micro- and macroeconomic events as well as the change the rent system has gone through since 2000, but excludes the financial crisis 2008 and hence the adverse effects from it. By selecting this time period the dataset will reflect the situation today and increase the probability of significant results running the regressions in STATA.

Data set

The data set contains data obtained from the Stockholm Housing Service (see Exhibit 5 for included areas), which we have extended with data adding explanatory power, included in consumer preferences as well as data on the purchase price of tenant-owned dwellings in Stockholm. There are a few prior Master theses that have collected and used similar data from the Stockholm Housing Service for the purpose of estimating market rents i.e. Zahir (2005) and Lindblad (2010). The accessibility of reliable data is key to estimating market rents and to our knowledge, the accessible data has since earlier theses improved and can nowadays be obtained at a very precise level, including variables such as number of rooms, square meters, floor levels, address and area, mediating date, ownership structure, rent level and years of queuing time. However, our collected data set from the Stockholm Housing Service does not include all variables with potential explanatory power, e.g. households' willingness to pay (measured by average income), travel time and area attractiveness. These variables are added to extend previous

[18] Price statistics tenant-owned dwellings prices in Stockholm, Mäklarstatistik.

analyzes and perform a more detailed and accurate analysis. Finally, purchase prices of tenant-owned dwellings from 2009 to 2013 are added, as they have a direct effect on mortgage costs (together with interest rates), which is the major component in the user cost of tenant-owned dwellings. The other major component is the monthly fee to the cooperative association, which we obtained the current average from the Swedish Property Federation. By extending the analysis with user costs, this study contribute to the overall understanding of the housing market in Stockholm.

By adding these variables, we believe a closer alignment of queuing time to the factors that are important to tenants could be met and contribute to a more efficient study of market rents than analyzed in previous research. As described in Section II, the location is considered to be of great importance to tenants. It is therefore interesting to analyze the effect of the market area variables *Area A-K,* where each letter represents a type of neighborhood in Stockholm, defined by its attractiveness. This is particularly interesting since several market practitioners find it important, illustrated by the "Stockholm Model", in which the geographical division A-K initially was made. Furthermore, the effect of the explanatory factor "*Travel time*" variable is of great importance and this thesis will add valuable information with this variable, as previous studies have not included exact proximity to the Stockholm City center. We believe that estimating travel time from each specific address rather than estimating it on a district level improves the explanatory power. Finally, average income contributes with an indication of willingness to pay for certain areas and most likely how attractive an area is.

Data credibility and comparability

The advantage of receiving data directly from the Stockholm Housing Service, Mäklarstatistik and databases such as SCB is the credibility and size of the data obtained, which increases the probability for significant analysis and decreases the risk for multicollinearity. To ensure comparability a few adjustments were made. For instance, the rents were adjusted to rents per sqm to exclude the natural effect that larger apartments cost more both in terms of rent and acquisition value. Furthermore, data from the Swedish Property Federation was used to increase the rents at mediating date with the annual average rent increase, hence representing current rent levels. Finally, the income levels were also adjusted using the real income growth of 3 percent in 2012 (SCB).

Comprised data set

The above data generating process has resulted in a comprehensive data set of 21,417 observations. From the collection of tenants' consumer preferences associated with renting an apartment, the data set contains the variables expected to explain queuing time and indicate hypothetical market rents. In summary, the final data set comprises number of rooms, square

meters, floor level, the rent-level at mediating date, address, district, municipality, queuing time, mediating date, average income, travel time, area attractiveness A-K, ownership structure and tenant-owned dwelling prices.

Description of selected variables

The variables number of rooms (*Rooms)*, square meter (*Sqm*) and floor level (*Floor*) are straightforward and do not need any further explanation. The variables, rent level (*Yearly rent/Sqm*), years of queuing (*Queue*), average income (*Income*), travel time (*Travel time*), area attractiveness (*Area A-K*), accommodation standard, house character, year dummies and tenant-owned dwelling prices will be described and discussed in brief below.

Queue

The queue, measured in years, is a metric measuring the length of time a tenant had to wait to be mediated the apartment in question. Since the rental housing market is regulated, actual rents do not adjust to market clearing levels and analyzing the queuing time is thus a strong indicator of the demand and attractiveness for the specific apartment. A longer queue implies a higher attractiveness. When a tenant signs the contract the queuing time for the particular apartment is set to zero again. Since there are vacant rental units the spread of queue time is between 0 to 32 years, indicating that some people standing in the queue lack an urgent need for an apartment. This group rather waits for a few or even many years to find the apartment they actually want and from a study made by Stockholm Housing Service almost 84 percent[19] of the people queuing already have some kind of accommodation. In summary, the dependent variable *Queue* is a function of the independent variables representing what research and interviews with market practitioners believe are the most important factors affecting demand in households' tenure decisions[20].

Rent level

The rent levels given in the data set are the original rents on the mediating date. There are several ways the rent can be set, e.g., in direct negotiations between the landlord and the tenant's association according to the *utility-value-principle, "Presumption rents"*, the yearly review between the landlord and the tenant's association (were the most likely decision is an increase due to inflation), and finally through rent increases due to refurbishments of apartments. Unfortunately the data lack information on how the rents were set and therefore a simplification was made where all rents have been adjusted to an average annual rent increase obtained from the Swedish Property Federation in order to make the data comparable at today's levels.

[19] http://www.bostad.stockholm.se/templates/Standardsida.aspx?id=1603

[20] Preference factors include variables such as number of rooms, floor level, rent level, market area, travel time to the city central, average income, owner characteristics etc.

To develop a proxy of potential market rents we must carefully understand what factors affect the rents set in negotiations and in accordance to the *utility-value-principle*. From research and interviews it is evident that several factors are taken into consideration (apartment size, apartment and property modernity and standard, building character, location, management quality, property services and maintenance). It is assumed that these factors are incorporated into the current rent levels, but for some factors only to a certain level. As discussed above, selected variables have been given more importance in rent negotiations since 2000. The conducted interviews conclude that the current rent levels do not fully account for all possible preference factors as some rents remain at unreasonably low levels and hence further variables are needed.

Based on our conducted interviews we assume that certain factors are reflected in current rent levels, i.e. standard and house characteristics, and hence should not be tested separately in the regression analysis. On the contrary, other variables are not given sufficient importance in current rent negotiations and the analysis thus requires these to be added since these are likely to affect the rent levels in a deregulated market. The variables either added or improved, to better reflect market rents are described in detail below. These variables are *Rooms, Sqm, Floor*, *Willingness to pay*, *Travel time*, ownership type *(Municipality* and *Private*), Area attractiveness *(A-K)* and tenant-owned dwelling prices.

Average income

Data of the average income 2011 at area levels was received from USK (Statistics of Stockholm). Due to publication time lag, this is the most updated income statistics USK has available and therefore, a proxy was applied using the real income growth in 2012 in Sweden of 3 percent (SCB). For a few areas where USK could not provide any data a simplification was made, where the average income at municipality level is used. For other areas, for instance Östermalm, there are two small assemblies included, i.e. Oscars and Hedvig Elenora and therefore an average is used. Moreover, Hjorthagen/Värtahamnen will be the proxy for Norra Djurgården and Jakob for Skeppsholmen.

Analyzing the data set, average income includes both genders and shows a great deal of variation depending on geographical location. For example in Rinkeby, a suburb to Stockholm, the average pre-tax income is SEK 173,628 per year or SEK 14,469 per month. This could be compared to Höglandet in Bromma where the average pre-tax income is SEK 671,454 per year or SEK 55,955 per month. This indicates that a person living in Höglandet earns almost three times more than a person living in Rinkeby. The average rent for a 40 sqm apartment in Rinkeby is SEK 2,880 per month whereas the rent for a similar apartment in Höglandet is SEK 7,960. The *Willingness to pay* variable, measured as average income, is an interesting variable as research, prior literature and conducted interviews indicate that it has an effect on housing choices, e.g. two thirds are willing to pay more for housing in attractive areas. Several studies suggest that

income has an effect on housing consumption choices (see for example Englund, 2011 and Girouard et al 2006).

Travel time

The data set received from the Stockholm Housing Service includes specific addresses for each apartment. This made it possible to manually create a variable using Stor Stockholm's Lokaltrafik's (SL) journey planner to estimate the exact travel time from each apartment in the data set to the Stockholm Central, calculated in number of minutes, resulting in a more precise estimation than prior studies. For a few addresses there were no exact communication and stops available, hence a simplification was made through SL's map to locate the closest stop available. Moreover, to make the data homogenous Monday 9:00 am on the 29th of January was selected.

In order to use *Travel time* as a variable a linear relationship between the demand for rental units and the travel time to T-Centralen is assumed. The longer travel time, the lower rent people are willing to pay. In reality this relationship is probably not linear, as other factors might affect rent levels. We have added additional variables to catch the difference in attractiveness between areas, and not just location and travel time, these variables are *Area A-K* described below.

Ownership type

Type of ownership is divided into two main categories i.e. MHCs and privately owned (including both private members of the Swedish Property Federation and other private property owners). The different type of owners can potentially have different objectives affecting attractiveness and is therefore important to add as an explanatory variable. However, the Act (2010:879) was applied in 2011 in order to create equal conditions for MHCs and private landlords and hopefully decrease current gaps between rents for MHCs and privately owned apartments. The aim was also to get the Swedish legislation in line with EU competition law. Therefore it is expected that the gap will narrow overtime but since the law came into force 2011 the adjustment effect will most likely be small, yet interesting to analyze. Furthermore, the Swedish Construction Federation stated that most privately owned apartments are looking for the same type of tenants i.e. stable, long-term contracts instead of maximizing the rents (B. Wellhagen, pers. comm., 2014-02-28).

Area attractiveness

As discussed above, it is of great importance to capture attractiveness related to specific areas and not just proximity to the city center. E.g. households may see it more attractive to queue for apartments in areas with appealing service offerings, public amenities, better eldercare, new construction and proximity to shopping areas, green areas and closeness to water.

There are two common ways market practitioners divide Stockholm into different geographical areas. The first deviation comes from Stockholm Housing Service and is made at a

very general level where Stockholm is divided into three zones; the suburban area, the nearby suburbs and the inner city. The second geographical division is based on the system and accepted framework used in the "Stockholm Model" by the Swedish Union of Tenants, the Swedish Property Federation and MHCs. The division into certain areas are made by the letters A-K where region A represent the most attractive areas (i.e. Östermalm, Södermalm, Vastastan, Kungsholmen etc.) and K is the least attractive part e.g. Husby and Rinkeby in the western part of the city and Skärholmen and Vårberg in the south (See Exhibit 3 for the geographic area division, including a map). The model's purpose is to capture more detailed information on demand (M. Hofverberg, pers. comm., 2014-02-19). It can be argued that the Stockholm Housing Service's model of three zones does not explain attractiveness in an accurate way due to the wide spread in standard, location, travel time, green areas, services, average income, queuing time etc. between the suburban area, the nearby suburbs and the inner city (M. Hofverberg, pers. comm., 2014-02-19). Furthermore, it is argued that the three zones division variable is functioning more as a travel time variable rather than as an attractiveness variable (M. Hofverberg, pers. comm., 2014-02-19).

Accommodation standard

From the conducted interviews with market practitioners, accommodation standard is concluded to reflect a large portion of the rent (M. Hofverberg, pers. comm., 2014-02-19 and H. Tufvesson, pers. comm., 2014-03-19), which is reasonable. Unfortunately, due to confidentiality, the Swedish Union of Tenants and the Swedish Property Federation could not provide us with data on this. Therefore, in accordance with the findings from the conducted interviews it is assumed that current rent levels takes accommodation standard into account, at least to a certain extent.

House character

According to market practitioners, the house characteristics should be reflected in the rent (the Swedish Union of Tenants and the Swedish Property Federation). However the Swedish Union of Tenants pointed out that the building's character's impact on the rent is set in each case, and thus there are no statistics performed on how much it actually affects. What is known is that the charm of turn of the century apartments is valued higher and consequently a higher rent is set than in the "Million dwellings program" apartments (M. Hofverberg, pers. comm., 2014-02-19).

Year dummies

The year dummies are used to separate between events affecting the regression factors on specific years. For example, the year 2009 was highly affected by the financial crises and will probably differ compared to 2013, when the Swedish economy was more stable (i.e. the stock

market +23 percent[21]). Separating the data set with a year dummy also enables fixed effects using panel data to exclude correlation effects.

Purchase prices of tenant-owned dwellings

At year-end 2013, the average purchase price for tenant-owned apartments in Stockholm was SEK 4.2 million; this corresponds to a percentage increase by eleven percent over the last twelve months[22]. The increase in prices recent years has created an ongoing debate whether Stockholm faces a housing bubble. As it is assumed that a tenant owned dwelling is a perfect or almost perfect substitute for a rental apartment, a comparison of the estimated market rents and user costs (including mortgage costs and yearly expenditures) can be made, indicating if the estimated market rents are somewhat reasonable. In order to conduct the analysis, data was obtained from Mäklarstatistik, containing the yearly prices per sqm on tenant-owned dwellings in eight zones, Kungsholmen, Södermalm, Vasastan/Norrmalm, Östermalm, Southern suburbs, Southern outer suburbs, Western suburbs, Western outer suburbs for 2009 to 2013.

Comparability is ensured as the data already is adjusted for size. But due to lack of detailed districts, the analysis will be somewhat simplified by using the eight zones. This means that it is assumed that all properties within the different zones around Stockholm have somewhat similar price per sqm and year even though the prices obviously differs between e.g. Hässelby and Bromma which are different districts but part of the same zone.

Selected summary statistics

Table 1A reports the selected summary statistics of the regression variables. The selected sample period 2009-2013 includes more observations in 2009-2011, indicating that the Stockholm Housing Service mediated fewer rental apartments in recent years. Furthermore, the mean and median are similar for all variables, suggesting a comprehensive and robust data set. Worth noting is that the dummy-variables only take either 0 or 1 and therefore the mean, median and standard deviation are not applicable for these variables. Figure 1A presents the average queuing time and the number of observations at eight zone levels. Most observations are from the zones 'Western and Southern outer suburbs', which also had the shortest length of queuing. The longest queuing time is found on Östermalm. The overall average length of queuing was 9.6 years during the sample period. The data shows that there is a large spread in number of mediated apartments across different parts of the inner city; e.g. Södermalm accounts for more than half of the mediated apartments in the inner city.

[21] http://www.svd.se/naringsliv/pengar/smabolagsfonder-utklassade-borsen_8911832.svd
[22] http://www.maklarstatistik.se/maeklarstatistik/kommun.aspx?Main=Stockholms l?n&LK=1&Months=24&Extra1=3001&Extra2=3001&Typ=Boratter&Ant=7245

Table 1A: Selected summary statistics over regression variables

This table reports the sample descriptive statistics for the regression variables.

Variable	Obs	Mean	Median	Std. Dev.	Min	Max
Queue (years)	21,417	9.62	8	3.98	0.00	32.00
Rooms	21,417	2.43	2	0.94	1	7.00
Floor	21,417	2.35	2	2.22	-3.00	22.00
Yearly rent/sqm	21,417	1,412	1,368	360	773	2,796
Sqm	21,417	65.24	64.00	19.85	17.00	235.00
Municipality	21,417	N/A	N/A	0.00	0.00	1.00
Private	21,417	N/A	N/A	0.00	0.00	1.00
Income (SEK)	21,417	283,671	279,074	63,731	173,628	731,946
Traveltime	21,417	19.96	19.00	9.11	1.00	124.00
Year 2009	4,952	2009	2009	0	0.00	1.00
Year 2010	4,493	2010	2010	0	0.00	1.00
Year 2011	4,571	2011	2011	0	0.00	1.00
Year 2012	3,964	2012	2012	0	0.00	1.00
Year 2013	3,437	2013	2013	0	0.00	1.00
Area A	1,596	N/A	N/A	N/A	0.00	1.00
Area B	1,844	N/A	N/A	N/A	0.00	1.00
Area C	1,337	N/A	N/A	N/A	0.00	1.00
Area D	1,460	N/A	N/A	N/A	0.00	1.00
Area E	1,421	N/A	N/A	N/A	0.00	1.00
Area F	3,804	N/A	N/A	N/A	0.00	1.00
Area G	2,820	N/A	N/A	N/A	0.00	1.00
Area H	1,356	N/A	N/A	N/A	0.00	1.00
Area J	3,515	N/A	N/A	N/A	0.00	1.00
Area K	2,264	N/A	N/A	N/A	0.00	1.00

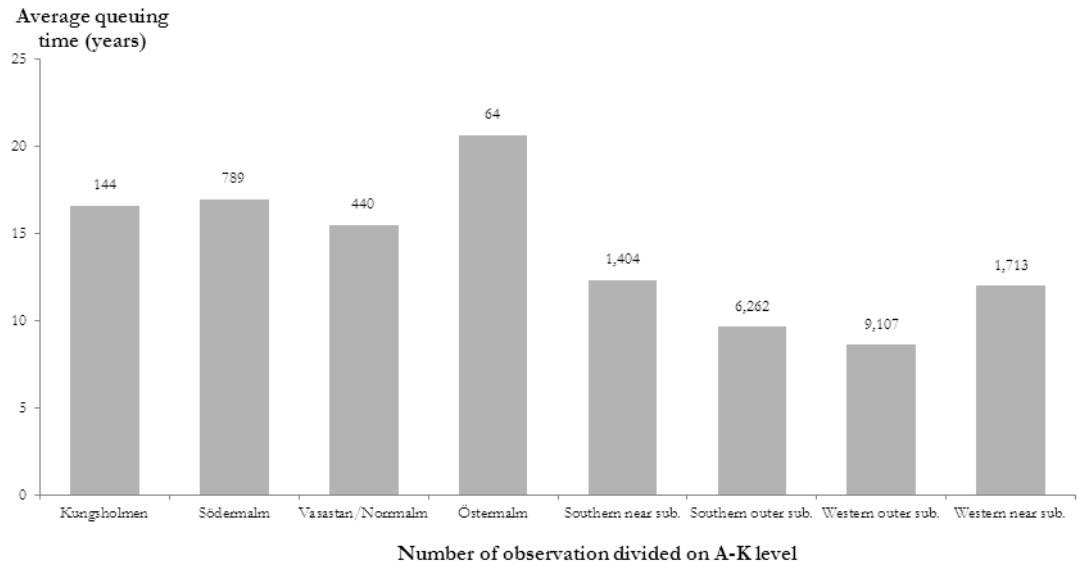
Note: A - All values are denominated in SEK

B - Due to a few but large outliers, all variables are winsorized by replacing the 5% highest and lowest values

Source: Stockholms Bostadsförmedling, USK, SL, Swedish Union of Tenants

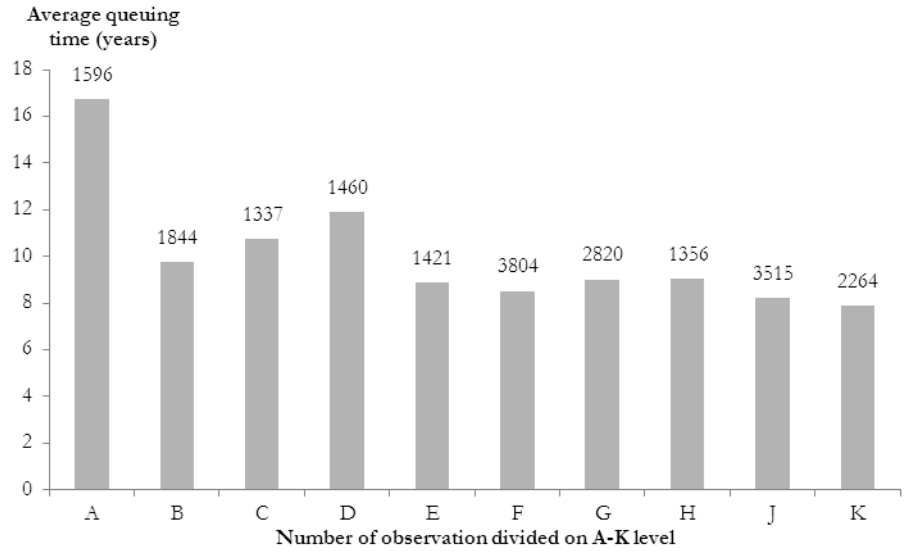
Figure 1A: Selected summary statistics of queuing time

This figure reports average queuing time and the number of observations on eight zones level



Similarly, figure 1B reports the average queuing time and number of observations in area A-K. Area A shows the longest queue. Area F and J are the two areas with most observations, i.e. mediated apartments, during the sample period.

Figure 1B: Selected summary statistics of queuing time
This figure reports average queuing time and the number of observations on A-K level.



Note: No mediated apartments for area I, see exhibit 3

Exhibit 4A, displayed in the Appendix, present the variables assembled from Mäklarstatistik for the analysis of tenant-owned dwellings. The exhibits 4A-B include purchase prices of tenant-owned dwelling in eight zones in Stockholm and interest rates during the sample period 2009-2013. The areas included in the eight districts are shown in Appendix, see Exhibit 5.

Limitations

Since our model selection and analysis are based on a hypothetical scenario in which the Swedish rental market is deregulated, a few simplifications have been made. For instance, it has been assumed that consumer preferences are identical and that they will prevail. One example of where consumer preferences might differ is *Travel time,* which is solely based on metro commuting time, and therefore does not take into account other transportation methods such as walking, cycling or driving a car. However, the variables we have developed are assumed to explain market rents to the most accurate extent possible.

We could neither receive access to data describing which year each respective apartment was constructed or potentially refurbished, nor the house characteristics. This is partly due to confidentiality, partly due to it has not been collected. It is instead assumed that apartment refurbishments and house characteristics are adjusted for in the current rents. This will give a margin of error in the estimation of market rents. Moreover, Mäklarstatistik could not provide detailed data describing tenant-owned dwelling prices for all districts and consequently the eight zones are used in the analysis (See Exhibit 5). This will be a limitation since the difference in

tenant-owned dwelling prices could vary a great deal even within zones, for example in Hässelby versus Bromma. Regarding average income, the data collected from USK gives a detailed insight into the income levels in different areas. However it suffers from publication lags and the latest available data is from 2011, which affects the credibility. This was adjusted for using the real income growth of 3 percent in 2012.

As discussed in the Introduction, *Queue* is assumed to be a measure of the attractiveness of the apartments and market demand and is thus functioning as 'means of payment', where attractive apartments require a longer queue than less attractive apartments. The queuing time is however not as precise measure of attractiveness as for example the purchase price for tenant-owned dwellings. This is due to the fact that it is not possible to use only a fraction of the queue time (as one can when only putting in the down payment in tenant-owned dwellings), and the queue is set to zero once the apartment is accepted. This increases the coincidence impact, which decreases the statistical model's explanatory power. A secondary criticism in the analysis is that many variables interact and can be interpreted differently.

Further, the fact that the annual average rent increase from the Swedish Property Federation is used when calculating the increase in rents from the mediating date to today is a limitation, but there is no more accurate data available. Finally, user costs are estimated with a proxy for yearly housing expenditures as well as an average for interest rates on mortgage loans since the conditions are different depending on each person's credit rating. The final simplification was made for calculating user costs in tenant owner dwellings, e.g. using average mortgage interest rates. In reality, user costs vary across households because of differences in mortgages and loan-to value ratios etc.

V. Results and Analysis

This section starts by providing an assessment of the results and analysis of the regression model. The next part examines the constructed model of market rents in relation to actual rents at area and district level. This is followed by a comparison of the estimated market rents and actual rents with user costs in tenant-owned dwellings. The three sections are structured to first present detailed results of the performed tests followed by a thorough analysis of the findings, which are discussed and compared to relevant literature.

Results and analysis of regression model

In order to evaluate hypotheses 1-3 a regression model examining queuing time as an indicator of apartment attractiveness and market demand was constructed in the Methodology section. The regression analyzes what factors determine the queuing time for different apartments. The more attractive an apartment is, the longer queuing time it will require. The variables *Yearly rents per sqm*, proximity to the Stockholm city center (estimated *Travel time*), *Willingness to pay* (estimated with

average annual income), *Area attractiveness (A-K)*, ownership structure (*Municipality or Private*) and year dummies were incorporated in the model to capture the importance of all these variables in the analysis of queuing time.

+++ See Exhibit 6A-G +++

Exhibit 6A includes results from our statistical analysis such as OLS coefficient estimates, together with t-statistics, p-values and R^2 for testing the significance of the regression as a whole. The results show that all parameters are important in explaining the *Queue* for rental apartments in Stockholm and we find support for our hypotheses 1-3. Further arguments behind this were found in practitioners' opinions expressed in interviews, relevant research and media. That is, the results are confirmed when expanding the framework to the real world. The rationality of these arguments is tested for on the basis of data and logical reasoning. The most important variables are *Area attractiveness* (A-K) and *Rooms* as they reveal large coefficients in the regression analysis as well as strong predictive power. Each of the explanatory variables has different impact on the regression and the results and analysis are presented below.

Apartment characteristics

Results

The variable *Rooms* has a value of 0.922, indicating a positive effect on *Queue,* illustrated in Exhibit 6B. The variable's t-stat at 15.62 and p-value of 0.00 clearly indicates that the variable affects *Queue* and is highly significant at 99 percent confidence level. Contrary to the *Rooms* variable, the *Sqm* variable, as measured in square meters, shows a negative and quite weak relationship with *Queue*, -0.056, shown in Exhibit 6C. The variable's t-stat of -18.39 and its p-value of 0.00 seem to indicate that the variable affects *Queue* and is highly significant at 99 percent confidence level. Finally, the *Floor* variable represents the floor the apartment is located on and reveals a quite weak relationship with the *Queue*, of 0.078, exemplified in Exhibit 6D. The variable's t-stat of 9.49 and its p-value of 0.00 clearly indicate that the variable affects the *Queue* and is highly significant at 99 percent confidence level.

Analysis

The regression reveals that apartments with an extra room tend to have longer queues than those without the extra room, *ceteris paribus*. The fact that *Rooms* has a positive impact on queuing is supported by market participants' views, although demand for 1-room apartments is high in Stockholm, many prefer to have 1.5 rooms or 2-rooms if possible, even if the apartment's size is smaller. The positive effect especially holds for outer suburban apartments "Million dwellings program", where families and households typically live in apartments housing more people than the average household in Stockholm (H. Tufvesson, pers. comm., 2014-03-19). This variable indicates that demand increases as number of rooms increases, all else being equal. When the

apartment has more rooms, potential tenants find it more advantageous to rent, which should in turn exert upward pressure on queues.

Perhaps not surprisingly, the size of the apartment as measured by the *Sqm* variable is an important variable, revealing a negative relationship. The Swedish Property Federation and SABO, both stressing the importance of high demand for small apartments in Stockholm, support the fact that *Sqm* has a negative impact on queuing. Since Stockholm has many single households the demand for small sized apartments is high. One interpretation of the negative size coefficient is that it illustrates the inefficiencies resulting from the present rent regulation, as tenants present on the market can rent larger apartments than they actually need or could afford at market rents, reported by Hüfner and Lundsgaard (2007).

The fact that *Rooms* is positive and *Sqm* negative is in line with practitioners' reasoning, arguing that tenants find it very important to have an 'area efficient' apartment, implying that more rooms on a smaller area is more attractive than a large apartment with fewer rooms (R. Sernlind, pers. comm., 2010-04-10). Further, prior academic literature has also found this result and pointed towards similar conclusions (see for example Johansson, 2012), indicating that both size and rooms are important parameters. Furthermore, the *Sqm* and *Rooms* variables may be strongly tied to age and life situation. A household with children obviously needs a larger apartment than a student.

The *Floor* variable shows a quite weak relationship with *Queue,* 0.078. This indicates that it is not the most important variable tenants take into consideration when choosing apartment. A possible explanation for this is the large demand surplus in Stockholm, which might make households lower their desired preferences slightly. The *Floor* variable coefficient can be interpreted as the added queuing time for receiving an apartment on a specific floor, instead of a comparable apartment on the entrance floor. The positive relationship suggests that an apartment located on a higher floor requires more years of queuing than a similar apartment located on the entrance floor. With regards to the *Floor* variable Johansson (2012) also found a weak positive relationship. From our conducted interviews it is evident that market practitioners do not consider the floor variable to a large extent (A. Sandvall, pers., comm. 2014-04-28). Further, the "Stockholm Model" takes size and rooms into account but not the floor variable, this thesis contributes to the overall analysis, analyzing all important apartment characteristics that are possible to obtain data on.

All apartment characteristics variables are significant when conducting the regression. However, one can also discuss the fact that all these parameters reflect consumer preferences regarding apartment characteristics and thus may capture similar information. Obviously, there is a high correlation between the size of an apartment and how many rooms it has (0.913). This

increases the risk of multicollineratiry, but the results indicate no signs of this and hence should not affect their significance power.

Yearly rent per sqm

Results

This variable has a negative coefficient of – 0.007 and is a significant and negative determinant of *Queue,* illustrated in Exhibit 6E. The variable's t-stat of -86.86 and p-value of 0.00 clearly indicates that the variable affects the queue and is highly significant at 99 percent confidence level.

Analysis

Yearly rent per sqm indicates a negative relationship with *Queue*, which is indeed as financial reasoning anticipated and in line with theoretical expectations, illustrated in Exhibit 6E. If we consider apartments that vary in *Yearly rent per sqm*, but are comparable in other aspects, those with higher *Yearly rent per sqm* tend to have shorter queues, which is reasonable as demand typically decreases when prices increase in a standard demand and supply setting. This result is very much in line with the general findings presented by Zahir (2005), Lindblad (2010) and Johansson (2012), which was expected given the proximity of the studies in terms of sample periods. Relating the results to prior research, the rent coefficients are almost at the same level, e.g. in Lindblad's paper (2010) it amounts -0.009, compared to -0.007 in this thesis. In contrast to Englund (2011) demand does not appear to be unaffected by developments in rent levels. To conclude, this variable is important for the analysis of variables affecting queuing time.

Willingness to pay (average income)

Results

This variable's coefficient of 0.000005 indicates a small positive impact on *Queue,* illustrated in Exhibit 6F. The interpretation of the result is that higher income in the area will tend to increase queuing time. The variable's t-stat of 7.98 and p-value of 0.00 clearly indicate that the variable affects *Queue* and is highly significant at 99 percent confidence level.

Analysis

The results of this variable shows that disposable income tends to affect the dependent variable *Queue* positively, which is intuitive as people can afford to spend more on housing expenditures if their disposable income increases. This is also theoretically supported by Englund's findings (2011), revealing that the demand for housing services roughly increases in proportion to income. Several studies indicate that income has a clear effect on the housing market. Girouard et al (2006) shows that the income elasticity of demand in the housing market is about one. This implies that a one percent increase in income leads to one percent increase in price, assuming that supply is kept constant. Furthermore, the result is in line with the Swedish Property Federation's published report, suggesting that more attractive residential areas have higher

disposable incomes (Fastighetsägarna, 2008). Although the results from various research reports may differ slightly, it is reasonable to believe that income has an effect on the housing market. The magnitude of this effect seems to be fairly large. E.g., increasing the income from the lowest district level (Rinkeby) of SEK 173,628, to the highest level (Höglandet) of SEK 671,454, *ceteris paribus*, results in a market rent of SEK 2,302, corresponding to an increase of approximately 21 percent. Again, this cross-area finding is validated by evidence based on the Swedish Property Federation report showing that income is lower in less attractive areas with corresponding lower rents than in attractive areas. Overall, the statistical significance is very strong in this parameter.

Our findings confirm the results of Enström Öst et al (2013) that households' disposable income decreases with distance from the city center, hence indicating a more segregated market with respect to income if market rents were present. The proximity to the city center as well as area attractiveness is thus important in explaining the geographical income distribution. The results above are much in line with prior research, e.g. Lindblad (2010) and Zahir (2005). The variable *Willingness to Pay* is however found to have a higher impact in Lindblad's study than in this thesis (0.0000107 versus 0.000005). It should be emphasized however, that it is difficult to explain the difference since only four years have passed between the two measuring points, therefore no substantial difference should have occurred.

Travel time

Results

This variable has a negative coefficient of -0.035 and is significant and a negative determinant of the *Queue* variable, similar to rents, illustrated in Exhibit 6G. The variable's t-stat of -13.86 and p-value of 0.00 clearly indicates that the variable affects the queue and is highly significant at 99 percent confidence level.

Analysis

The regression result is consistent with what was expected. A longer travel time to Stockholm's city center reduces queuing time, as it is considered more attractive to live closer to the city center where most jobs and social activities are located. Travel expenditures are also reduced dramatically when living in the inner city. This is line with the results from the Swedish Union of Tenants' report "*Hyresrättens betydelse för en dynamisk arbetsmarknad*" arguing that time is a scare and valuable resource. Living closer to work both saves time and money, and for some consumers it can also be a question of sustainability and environmental impact since long commuter trips increases pollution. Furthermore, this is consistent with previous research on consumer preferences, e.g. the analysis of young citizens' housing preferences in Stockholm, which reported that young people are demanding accommodation with close proximity to commercial offerings and short travel time to work/study (Swedbank, NCC and the Swedish Property

Federation, 2013) as well as the findings of Lindblad (2010), reporting the same fundamental trend, even if the variable was less precisely estimated in his analysis.

The variable's coefficient is not strong, which implies that *Travel time* is not the most influencing variable for *Queue* and hence the estimated market rent, but it indicates that increasing travel time is unattractive. However, we wish to highlight the fact that in reality the relationship is probably not linear. The importance of travel time on queuing decreases the further away from the city center the mediated apartment is situated (L. Lövgren, pers. comm., 2014-04-24).

Prior research studies have found similar results, although we find a lower coefficient of the *Travel time* variable than for example Lindblad (2010) and Zahir (2005). Lindblad obtained a coefficient of -0.117, whereas we received a *Travel time* coefficient of -0.035. Zahir obtained a coefficient of -0.361 but he did not estimate the exact travel time from each specific address. Instead Zahir estimated the average aerial distance between Sergelstorg and the area in question. We believe that this thesis has succeeded in increasing the level of detail of the variable by measuring the travel time from each specific address and not generally on district level. Thus, the results suggest that the travel time does not affect the queuing time as much as previous studies claim.

Ownership structure

Results

The dummy variable ownership structure has a positive effect on *Queue* of 0.088 for municipality owned apartments, and the opposite negative effect of -0.088 on *Queue* for privately owned. The variable's t-stat of 2.40 and p-value of 0.016 indicate that the variable affects *Queue* and is significant at 95 percent confidence level.

Analysis

The regression results indicate that the ownership structure matter for queuing time. The low coefficients however, suggest that the ownership structure is not the most important variable explaining queuing time. The finding indicates that municipal property owners will tend to increase queuing time and it looks like as private property owners have a small negative effect on queuing time. The results can be exemplified by comparing a municipally owned apartment with a market rent of SEK 1,842 to a privately owned apartment, *ceteris paribus*, resulting in a market rent of SEK 1,816, corresponding to a decrease of 1.42 percent. We should stress, however, that this explanatory variable is the least significant variable, with a p-value of 0.016. Furthermore, the interpretation of the result is not straightforward, as subjective, individual and political aspects might affect tenants' views on the matter.

The fact that private property owners have a negative coefficient was surprising to certain market practitioners, e.g. the Swedish Property Federation and Ohlssons Fastigheter, as they do

not see any large differences in standard, maintenance etc. between the two types of owners (A. Sandvall, pers., comm. 2014-04-28 and H. Tufvesson, pers. comm., 2014-03-19). One possible explanation is that MHCs use the queue from the Stockholm Housing Service when mediating apartments and hence prospective tenants might find it worthwhile to stand on the waiting list for municipality owned apartments whereas private owners are not obliged to use the Stockholms Housing Service and consequently can mediate apartments through contacts etc. This implies that prospective tenants are not guaranteed an apartment if standing in the queue for privately owned apartments and therefore prefer to queue for municipality owned apartments (R. Sernlind, pers. comm., 2010-04-10). The argument of tenants believing MHCs is more secure, is also supported by the Stockholm Housing Service (L. Lövgren, pers. comm., 2014-04-24). This implies that more people are eligible to apply for municipality owned apartments, which increases the demand for these types of apartments. It is also possible that the variation in maintenance is larger among private players than MHCs and hence tenants may face a higher risk of omitted maintenance if choosing a private player (A. Sandvall, pers., comm. 2014-04-28).

Another possible explanation could be that prospective tenants believe it is more common for private owners to charge higher rents than MHCs, in line with Turner's (2000) findings, due to the historical legacy of MHCs operating non-profit and private property owners taking risks when investing. It is possible that landlords have different objectives, with some less result-oriented than others. Following the new Act (2010:879) enforced in 2011, MHCs are to operate according to commercial principles with normal rate of return and therefore it is likely that this view will diminish. As the Act aims to decrease the rent differences, we expect this variable to effect less in the future. However, in the National Housing Board's assessment of the effect of the new legislation, they have not yet seen any significant changes in the rental housing market (Boverket, 2014). Another reason could be that municipality owned properties are considered more secure as they for instance are more frequently mediated through organizations securing tenants' rights such as the Swedish Union of Tenants. This reasoning is in line with Andrews et al's findings (2011) suggesting that a rent regulation system that increase tenure security may increase the desirability of rental housing. Finally, different requirements from the property owners differs between MHCs and private property owners, the latter commonly do not accept tenants with social assistance and livelihood support (L. Lövgren, pers. comm., 2014-04-24). To conclude, there are likely several plausible explanations for the observed coefficients and it is consequently difficult to provide a correct interpretation of the ownership structure variable without further examine the two. The results indicate that the ownership structure matter and it may be observed within the market that particular tenants queue for properties owned by specific types of landlords, but the effect is unlikely to alter market outcomes much.

Area attractiveness

Results

As is evident from Exhibit 6A, the regression result is clear; the area attractiveness is well captured with the *Area A-K* variables, which all exhibit high statistical significance. For example studying *Area A, B, C* and *D,* the coefficients were 11.11, 5.70, 5.12 and 5.18 respectively, whereas *H, J* and *K* had coefficients of 1.32, 0.39 and -0.80. The high attractiveness of *Area A* is illustrated by high positive values and hence affecting *Queue* more than *Areas B, C, D, E* and *F*. On the contrary, G, *H, J* and *K* are not affecting *Queue* in a strong positive way, instead low positive coefficients are found for *G* and *H*, and a negative coefficient is found for *Area K*. Given the magnitude of the *Area A* coefficient, one can discern a high attractiveness for *A* as opposed to the other areas in the Stockholm city. Furthermore, *Area K* shows unique variable characteristics, which greatly affects the regression analysis greatly (see section "Robustness tests – Interpretation of Significance tests" for a further analysis and elaboration on the variable). Given the low p-values (0.00) and high t-statistics we conclude the results to be both economically and statistically significant. Hence, one can infer Hypothesis 1, 2, and 3 to be supported by the data.

Analysis

The results obtained in this section are very much in line with what was expected, reflecting the varying attractiveness of different areas in the city of Stockholm. The fact that *A, B, C* and *D* have strong positive effects on the queuing time for rental housing whereas *G, H* and *J* have low and *K* even negative is far from surprising, given the fact that these areas have different characteristics. These variables thus capture different areas' attractiveness more precise compared to using a less thorough split, such as in Lindblad's (2010) paper, where only three classifications were used (inner city, suburbs and outer suburbs). The high positive coefficients for *Area A* and *B* imply that receiving an apartment in these particular areas require longer queuing time than a similar apartment in another area, whereas the negative coefficient for *Area K* implies that fewer queuing years are required in *Area K*.

Since it is commonly known that *Areas A* and *B* are considered very attractive, it was not surprising to find that these areas have high coefficients. However, the attractiveness could be due to both area characteristics and because of low actual rents, substantially below market clearing rents. By analyzing the coefficients and parameters, it is obvious that these areas have a strong impact on the dependent variable *Queue*, as rent is controlled for separately in the regression. T-tests of the estimates reject the null hypothesis and conclude that the effects of these areas are significant. The impact of different variables can be illustrated by changing the area from *Area K*, corresponding to a market rent of SEK 1,877 to *Area A*, resulting in a market rent of SEK 3,551, corresponding to a 89 percent increase, all else held equal.

As previously reported in academia by Fransson, Rosenqvist and Turner (2002) and Fransson and Magnusson (2000), the results once again confirm that location is of great importance in determining queuing time for apartments. It is also in line with the results of the study conducted by the Swedish Property Federation, NCC and Swedbank.

Year dummy

Results

The dummy variable years represent the period 2009 to 2013 with different values for each year (-0.96, -0.93, -0.53, -0.54 and -0.48) and show a negative impact on *Queue* throughout the sample period. The t-stat fluctuates between -17.06 and -7.25 and the p-value representing all five dummies is equal to 0.00, which clearly indicate that the variables affect the queue and are highly significant at 99 percent confidence level.

Analysis

The year dummies indicate that the queuing time was shorter in 2009 than it was in 2013, as the negative effect of the year dummy was larger in 2009 (-0.96) than in 2013 (-0.48). One economic interpretation is that the housing shortage in Stockholm has increased in recent years as a result of the rapid urbanization, which has increased the housing queue for mediated apartments at the Stockholm Housing Service. Throughout the sample period, it is also likely that the queue for mediated apartments in Stockholm has varied; the year dummy variables are intended to illustrate the different effects. It is evident that the effect varies, for instance 2009-2010 had a strong negative effect on *Queue* whereas 2011-2013 affected almost half that of 2009-2010.

In addition to the rapid urbanization in Stockholm, it is also possible that other economic factors throughout the sample period have affected the queuing time, e.g. the financial crisis or the low interest rate environment, the latter have made lending and buying increasingly attractive as tenure choice. The favorable mortgage markets in combination with rapidly increasing tenant-owned dwelling prices might have encouraged households' to buy rather than rent apartments, expecting capital gains. However, the rapid increase in tenant-owned dwelling prices might also be a reason for renting rather than buying, which increases the queuing time and this illustrates once again that different individual preferences might affect the tenure choice.

The effects of the year dummy variables can be illustrated comparing an apartment mediated in 2009 with a market rent of SEK 3,724 to an apartment mediated in 2013, which results in a market rent of SEK 3,790, corresponding to an increase of 2 percent. Relating the results to previous literature is somewhat problematic as few other studies have analyzed the variable and to our knowledge no one has looked at the specific time period 2009-2013 in Stockholm. However, Lindblad (2010) also found overall negative coefficients for the year variables (2005-2009), with the exception of 2008 which had a positive impact on queuing time,

revealing the adverse effects of the financial crisis, which we decided to exclude from the sample period and analysis.

Robustness tests

Winsorzing

In order to create a dataset as credible as possible and to validate our results, it was decided to remove the extreme outliers for each explanatory variable. The rationale behind this is to exclude values not accurately representing the variables explanatory power of the dependent variable. This was done in STATA using the function summarize, where the number of observations falling outside the norm are revealed and then excluded. The results remain almost the same to the original regression, indicating strong robustness.

Interpreting significance tests

As mentioned in the Methodology section, T-tests, F-tests, VIF-tests and a correlation matrix were used to analyze the significance power of the regressions. The t-tests and p-values presenting each variable's significance power are discussed above and it is evident that all variables are highly significant at a 99 percent confidence level, with the exception of the ownership variable, which is significant at a 95 percent confidence level. Further analyzing the model fit, we obtained high levels of R^2 for all performed regressions, which indicate a good model fit. Controlling for years lowers the explanatory power of the regression, whereas controlling for area attractiveness increases the explanatory power (Exhibit 6A Reg. 3-6).

+++ See Exhibit 7, 8, 9A, 9B, 9C and 10 +++

In order to analyze the significance of the regression, F-tests were performed and the results further indicate strong significance power. The main regression including all variables and using a confidence interval of 99 percent yielded a test statistic (F-value) of 825, which clearly is above the critical value of 2.36. Thus, we can reject the null hypothesis that the explanatory variables fail to provide any explanatory power for the dependent variable at a one percent level of significance. This means that the explanatory variables are all jointly significantly different from zero with explanatory power (Exhibit 8).

Analyzing multicollienarity, the VIF-test and correlation matrix are appropriate. Higher levels of VIF are for instance known to adversely affect the results associated with a multiple regression analysis and a good benchmark is to exclude variables with a VIF higher than 10. Interpreting the VIF-test we found that *Area K* both affects and decreases the explanatory power. Regressing both *Area B* and *Area K* together, *Area B* becomes omitted and the VIF-test results in a VIF of 6.14 for *Area K* as a consequence of multicollinarity. Regressing *Area K* separately from the other areas, the VIF-test instead yields a value of 1.28 (Exhibit 9A-C). One practical consequence of omitted variable bias is that one should always try to include all explanatory

variables that affect the dependent variable, but unfortunately, in practice, this is rarely possible. A common practice is to begin with as many explanatory variables as possible, then discard those that are not statistically significant and then re-run the regression with the new set of explanatory variables. We used this method to solve the multicollienarity issue between *Area B* and *Area K* and therefore performed a regression with *Area K* separately from all the other areas, in order to find a coefficient and significant variable more in line with the other areas (Exhibit 6A). This is a limitation, however when performing the regression with *Area K* together with all other explanatory variables (except the other area attractiveness variables), we received a coefficient in line with the other areas and a statistical significant variable at a 99 percent confidence level, hence we believe *Area K* reflects the reality and has explanatory power.

Furthermore, high correlation increases the risk for multicollienarity and it is therefore worth highlighting the correlation of 0.913 between *Rooms* and *Sqm*. When performing regressions including both variables *Rooms* has a positive effect on queue and *Sqm* a negative effect. However, we draw the conclusion that performing separate regressions of the variables will exclude the true predictive power even though the correlation between the two is high. Two other variables with high correlation are *Area A* and *Queue* (corr 0.478) illustrating that *Area A* already has a high queuing time. Finally the variable *Willingness to pay (Income SEK)* and *Yearly rent per Sqm* (corr 0.526) shows a quite high correlation.

The final significance test performed is the Breusch-Pagan test, which tests for heteroskedasticity (Exhibit 10). A high chi-squared means that we can reject the null hypothesis that homoscedasticity is present. From our results we receive a chi-squared of 4,736 and a probability of chi-squared > 0, which clearly shows heteroskedasticity is present. The Robust function in STATA was used to take this into account.

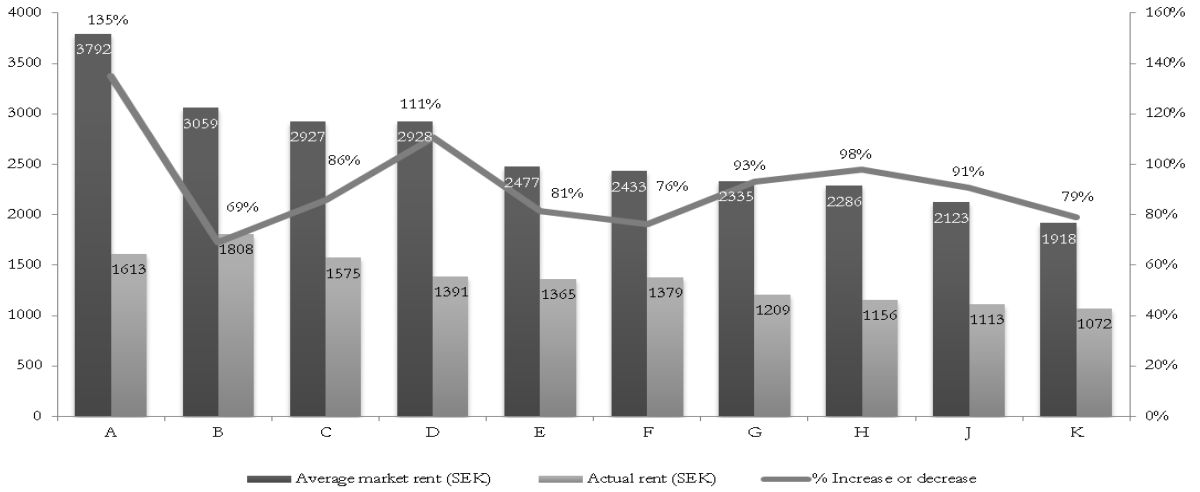
Results and analysis of estimated market rents

Analysis at area attractiveness A-K level

Results

The inputs from the above discussed regression model were inserted in the constructed equation for market rents and the results are presented and analyzed in this section, divided into area attractiveness, A-K. The results of the calculated market rents and percentage differences to actual rents are found in graph 3 below.

Graph 3: Comparison between estimated market rents and actual rents (A-K)
This graph reports the result of the estimated market rents, the actual current rent levels and percentage increases/decreases on area A-K level. The estimated market rents are average yearly rents per sqm estimated at year-end 2013.



To illustrate an example of the differences between estimated market rents and actual rents a standard apartment of 3 rooms and 77 sqm is used, presenting the following differences in rents when varying apartment location, area (A-K):

Number of rooms	Sqm	District	Area (A-K)	Actual rent (Yearly rent/sqm)	Market rent	Difference %
3	77	Vasastaden	A	2050	3775	84
3	77	Liljeholmen	C	1524	2963	94
3	77	Tensta	J	917	2130	132

Analyzing the graph above, all areas A-K see an increase in rents with an average of 92 percent. Area A sees the highest increase in rents of 135 percent corresponding to an average yearly market rent per sqm of SEK 3,792. Area B sees the lowest increase of 69 percent corresponding to an average yearly market rent per sqm of SEK 3,059, closely followed by area F and K. Area G-J show almost the same percentage increase, slightly higher than area C and E. Finally, area D follows area A closely with a 111 percent increase. The results indicate that area A seems to be the most attractive area, which is intuitive since the area covers the most central parts of Stockholm. The results reveal that area K is the least attractive area with an average yearly market rent per sqm of SEK 1,918.

Analysis

In competitive markets, rents will be substantially higher than the current rents as landlords can charge higher rents until supply equals demand. The overall effect of such a scenario is that rents will be significantly higher than current rent levels. The first point worth stressing is that the

results support hypotheses 1-2, rent levels will rise in all areas (A-K) if market rents were present and visible differences between the areas are found. This pattern of rent change is illustrated in graph 3 and Exhibit 11, please see Appendix for Exhibit 11. No evidence of "overvaluation" in any areas could be found. However, certain areas are worth looking at into detail.

The results indicate that area A sees a high increase of 135 percent when comparing market rents with actual rents. The demand surplus illustrated by long queues is thus larger in area A than other areas. This implies that the current mispricing is greater in area A. The main and most obvious reason derives from the fact area A represents attractive locations, in central parts of Stockholm. Another aspect boosting the results and worth taking into consideration is the fact that different areas have seen different increases in rents in recent years due to different outcomes in rent negotiations. The Swedish Tenants Association on Östermalm for instance, which belongs to area A, has a strong bargaining power and as a consequence a history of keeping low rents (B. Wellhagen, pers. comm., 2014-02-28). Since the initial rents are kept low the percentage increase will be larger on Östermalm if market rents were applied. Continuing, area B does not see a dramatic increase in rents compared to the other areas i.e. 69 percent and increases the least, this despite belonging to an attractive area, with close proximity to the city center, good public communications and amenities etc. One reason could be that the area is characterized by new construction, e.g. Stadshagen and Södra Hammarbyhamnen and thus increased supply and possible "*Presumption rents"*, allowing higher rents in new construction suggest lower rent increases. These results hence indicate support of hypothesis 3.

It is also interesting to investigate area D as the area is found to increase with 111 percent, which is not far from the level in area A. What characterizes area D is that the area is becoming more attractive with better communications due to the rapid urbanization and development of Stockholm. Furthermore, a large part of D belongs to Norra Djurgårdsstaden, an area close to green areas and water, which is highly attractive for tenants, according to the literature. But a more interesting investigation is that of exploring the fact that area D is also an area currently undergoing much new construction i.e. Norra Djurgårdsstaden and refurbishments of existing properties, but in contrast to area B, area D is found to increase dramatically. The use of *"Presumption rents"* should obviously affect the results, as the increase from the initial rents to market rents will be lower if *"Presumption rents"* are used, allowing higher initial actual rents. In a recent study conducted by The Swedish Property Federation it was stated that "*Presumption rents*" were only used in 32 percent of the cases, either because the landlords and the Swedish Tenants Association agree to apply the ordinary *utility-value principle*, or that the landlord has no interest in negotiating with the tenants association and as a consequence sets the rents himself. This indicates that it is possible that certain areas reveal higher percentage increase when market rents are applied compared to actual rents because the areas do not use *"Presumption rents"*. With

regards to areas characterized by new construction it is known that these are less attractive. This is most likely due to the process of mediating new construction apartments, where several similar apartments are mediated at the same time. Furthermore, the apartments are shown with pictures and the prospective tenants cannot visit the apartments (L, Lövgren, pers comm., 2014-04-24).

Another important aspect of attractiveness is to live close to nearby commercial and service offerings. Area H, including districts such as Kista, supports this statement as the area increases 98 percent, compared to area E and F, which increase 81 percent and 76 percent, respectively. The latter areas are somewhat closer to the inner city but with less nearby commercial and servings offering as well as less green areas and water, e.g. Långbro or Västberga, all factors decreasing the attractiveness. One should though be careful when limiting the valuation to commercial offerings, green areas and water. One example of this is area K, which represents all of the above factors but it only increases 79 percent due to factors such as travel time, area status and willingness to pay. Finally area C, G and J all see quite high rent increases of 86, 93 and 91 percent. It is hard to draw any general conclusions regarding area C since it both includes new constructions such as Liljeholmen and older properties in areas such as Stora Essingen or Gröndal. Area G and J probably see a relative high increase due to having a quite central location, and low actual rents.

Relating the results to previous literature we find that the findings are in line with prior research and for example illustrate the fact that tenants have to do a trade-off between other consumer preferences (Ball, 2012). Fransson, Rosenqvist and Turner's (2002) conclusion that the dwelling's geographical location is of particular importance is clearly shown from the difference between market rents and actual rents in the different areas A-K. The analysis also confirms the study performed by Swedish Property Federation (2011) where the location is stated to be the most important factor and two out of three are willing to pay more for housing in an attractive area.

Analysis at district levels

This section presents and analyzes the estimated market rents on district levels in Stockholm. The results of the calculated market rents and percentage difference compared to actual rents are found in table 2. As evident in table 2, all districts experience rental increases, with a median of 93 percent. The results confirm the analysis above on A-K, suggesting that areas close or within the inner city obtain the highest market rents.

Table 2: Comparison between actual rents and estimated market rents (district level)
This table reports the result of the actual rent levels, the estimated market rents and the percentage increases/decrease on district level. The estimated market rents are average yearly rents per sqm estimated at year-end 2013.

District	Actual rent (SEK)	Average market rent (SEK)	% Increase or decrease
Abrahamsberg	1,517	2,911	92%
Akalla	1,047	2,148	105%
Alvik	1,475	2,916	98%
Aspudden	1,518	2,912	92%
Bagarmossen	1,174	2,308	97%
Bandhagen	1,339	2,348	75%
Beckomberga	1,277	2,433	91%
Björkhagen	1,472	2,942	100%
Blackeberg	1,537	2,401	56%
Bredäng	1,011	2,123	110%
Bromsten	1,438	2,198	53%
Djurgården	1,211	3,846	218%
Enskede Gård	1,305	2,984	129%
Enskededalen	1,244	2,544	104%
Enskedefältet	1,403	3,086	120%
Fagersjö	1,228	1,894	54%
Farsta	1,357	2,320	71%
Farsta Strand	1,096	2,333	113%
Flysta	1,292	2,443	89%
Fredhäll	1,626	3,033	86%
Fruängen	1,602	2,488	55%
Gamla Enskede	1,365	2,878	111%
Gamla Stan	1,433	3,746	161%
Grimsta	1,196	2,223	86%
Gröndal	1,277	2,910	128%
Gubbängen	1,304	2,448	88%
Hagsätra	1,149	2,155	87%
Hammarbyhöjden	1,528	2,990	96%
Hjorthagen	2,258	2,912	29%
Husby	1,171	1,977	69%
Hägersten	1,341	2,532	89%
Hägerstensåsen	1,430	2,463	72%
Hässelby Gård	1,251	2,111	69%
Hässelby Strand	1,167	2,116	81%
Hässelby Villastad	1,033	2,001	94%
Högdalen	1,251	2,358	88%
Höglandet	1,251	3,184	155%
Hökarängen	1,214	2,313	90%
Johanneshov	1,585	2,931	85%
Kista	1,579	2,379	51%
Kristineberg	1,337	3,062	129%
Kungsholmen	1,700	3,828	125%
Kärrtorp	1,376	2,450	78%
Ladugårdsgärdet	1,760	3,852	119%
Larsboda	1,504	2,354	57%
Liljeholmen	1,709	2,928	71%
Lilla Essingen	1,594	3,088	94%
Långbro	1,184	2,545	115%
Långholmen	1,555	3,790	144%

Table 2: Comparison between actual rents and estimated market rents (district level)
This table reports the result of the actual rent levels, the estimated market rents and the percentage increases/decrease on district level. The estimated market rents are yearly rents per sqm estimated at year-end 2013 (cont'd).

District	Actual rent (SEK)	Average market rent (SEK)	% Increase or decrease
Marieberg	1,392	3,117	124%
Mariehäll	1,669	2,478	48%
Midsommarkransen	1,578	2,926	85%
Mälarhöjden	1,053	2,525	140%
Nockeby	1,712	3,213	88%
Nockebyhov	1,228	2,898	136%
Norra Djurgården	1,736	2,971	71%
Norrmalm	2,012	3,866	92%
Nälsta	1,213	2,372	96%
Riksby	1,431	2,933	105%
Rinkeby	1,087	1,917	76%
Råcksta	1,456	2,416	66%
Rågsved	1,169	2,116	81%
Skarpnäcks Gård	1,124	2,328	107%
Skeppsholmen	1,274	4,073	220%
Skärholmen	1,143	1,921	68%
Sköndal	1,193	2,327	95%
Smedslätten	1,437	3,194	122%
Solberga	1,254	2,410	92%
Solhem	1,257	2,438	94%
Stadshagen	2,030	3,099	53%
Stora Essingen	1,661	2,978	79%
Stora Mossen	1,342	3,021	125%
Stureby	1,349	2,510	86%
Sundby	1,172	2,360	101%
Svedmyra	1,183	2,494	111%
Sätra	1,103	2,118	92%
Södermalm	1,656	3,779	128%
Södra Hammarbyhamnen	1,865	3,023	62%
Tallkrogen	1,146	2,503	118%
Tensta	1,187	1,903	60%
Traneberg	1,539	2,925	90%
Ulvsunda	1,341	2,920	118%
Ulvsunda Industriområde	1,221	2,902	138%
Vasastaden	1,776	3,747	111%
Vinsta	1,481	2,157	46%
Vårberg	990	1,881	90%
Vällingby	1,633	2,369	45%
Västberga	1,633	2,487	52%
Västertorp	1,247	2,464	98%
Åkeshov	1,127	2,910	158%
Åkeslund	1,574	2,947	87%
Årsta	1,342	2,897	116%
Älvsjö	1,818	2,605	43%
Örby	1,245	2,419	94%
Örby Slott	1,390	2,393	72%
Östberga	1,342	2,345	75%
Östermalm	1,621	3,917	142%

Note: Please note that the outliers Djurgården and Skeppsholmen have few observations.

Source: Stockholm Housing Service, USK, SL, Swedish Union of Tenants

The estimation results show a wide spread between the districts, which varies from Hjorthagen (29 percent increase) to Skeppsholmen (220 percent increase). To gain some insights into the distribution of possible estimation outcomes, Exhibit 12 presents the entire distribution in a histogram. The histogram shows a bell-shaped normal distribution with higher frequency centered around the mean, with Skeppsholmen, Djurgården and Hjorthagen as the only outliers. It should be mentioned that Skeppsholmen is a small district, with only a few residential properties; similarly Djurgården has few rental apartments. Consequently, we only have a few observations on these districts and these distort the analysis as the average is affected. Therefore, the median of 93 percent is more appropriate for the overall analysis since it is unaffected by the outliers.

Analysis

The overall results are similar to the analysis at area level (A-K) as the findings also support hypotheses 1-2. Rent levels will rise in all districts if market rents were present and analogous to the area A-K analysis noticeable differences between districts are found. No district presents any evidence of "overvaluation" and certain districts are worth paying considerable attention to.

The districts increasing the most are situated in the inner city, such as Östermalm, Gamla Stan and Djurgården, which is in line with previous literature, market practitioner's' views and research. Nearby suburbs also see high increases, such as Smedslätten, Ulvsunda and Åkeshov. Some areas reveal more moderate increases; Hjorthagen for instance only increases 29 percent. This is most likely due to the relative high current rent levels, resulting in relatively lower rent increases, which supports hypotheses 3. Another reason could be the potential lower attractiveness of these areas resulting from fear of noise from new construction as well from lack of service offerings and infrastructure. This is confirmed by exploring Norra Djurgårdsstaden, situated next to Hjorthagen, which underwent new construction in 2012 and reveals a high increase of 71 percent, but considering its closeness to water etc. the increase is not as impressive. The explanation for this is probably that the area has limited access to public transportation, which is reflected in consumer preference factors, as proximity to public transportation is important, in line with the study conducted by NCC, Swedbank and the Swedish Property Federation. The district Fagersjö, which has limited public transportations and consequently obtains an increase of 54 percent, further exemplifies this.

Furthermore, analyzing the area around Hjorthagen, one finds it is situated near a large industrial zone, which might further reduce the attractiveness. Similar to Hjorthagen, Stadshagen also reveal a moderate rental increase of 53 percent, which most likely is due to the current high rental levels, again supporting hypothesis 3. Finally, another possible reason could be that it is somewhat harder to mediate apartments in new areas, which is empirically justified, e.g. Hammarby Sjöstad (L. Lövgren, pers comm., 2014-04-24).

A general conclusion can be made that districts farther from the city center show more moderate rental increases, e.g. Vinsta, Vällingby and Västberga which experience 46, 45 and 52 percent respectively. Another overall conclusion is that western suburbs experience higher rental increases than southern suburbs, perhaps due to closer proximity to work and public railway transportation. (L, Lövgren, pers comm., 2014-04-24).

Since the district level analysis is a more detailed analysis of the A-K analysis, the literature discussed under the A-K analysis also apply here and we once again find evidence that geographical location matters (Fransson, Rosenqvist and Turner, 2002). The findings also suggest that areas with recently completed new construction generally see a smaller increase in rents than districts that either have no new construction or alternatively are currently being constructed, confirming hypothesis 3. The reason for why these areas have lower rents could be that they were constructed before "*Presumption rents*" entered into force or because they have chosen not use the "*Presumption rents*" option and instead have used the ordinary rent control for existing properties, or decided to set the rents by themselves. The results are much in line with prior research, although we find substantially higher percentage increases in market rents compared with for example Lindblad (2010) and Zahir (2005), where a large part of the higher results are derived from variables such as *area attractiveness A-K*, *Rooms*, *Sqm* and *Floor*.

Comparison market rents versus user costs in tenant-owned dwellings

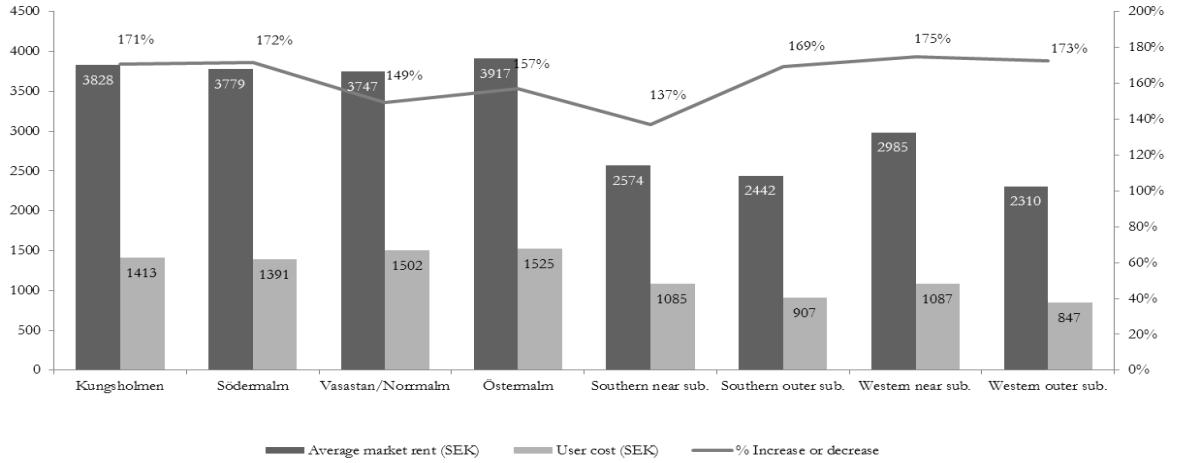
In order to estimate how accurate and reasonable the estimated market rents are a comparison between the user costs in tenant-owned dwellings at area level in Stockholm was made during the same sample period, using micro data from Mäklarstatistk. The area levels consist of eight zones i.e. Kungsholmen, Södermalm, Vasastan/Norrmalm, Southern near suburbs, Southern outer suburbs, Western outer suburbs, Western near suburbs and finally Östermalm.

Results

The base case scenario (graph 4) applies an interest rate of 2.76 percentage (estimated by the average one year mortgage loan for each year 2009-2013) and a yearly expenditure of SEK 500/sqm as input variables. The results reveal that estimated market rents are substantially higher in all zones in comparison to the average user cost of tenant-owned dwellings during the sample period, on average 163 percent higher in the base case scenario. This indicates that it is less expensive to buy rather than rent if rents were deregulated in the current economic environment. The difference is most noticeable in Western near suburbs, in which market rents are 175 percent higher than user costs. The lowest difference is found in Southern near suburbs, where market rents are 137 percent higher than user costs.

Graph 4: Comparison between estimated market rents and user costs

This graph reports the result of the estimated market rents, the calculated user costs in tenant-owned dwellings and percentage increases on the eight zones at the base case scenario, at year-end 2013.



Note: A - Interest rate mortgage loans at 2.76% and yearly expenditure at 500/sqm
B - District division based on Mäklarstatistik (See Exhibit 4A)
C - Market rents and user costs are calculated at yearly costs per sqm
D - The user costs are calculated according to the formula on page 22

In order to assess how the user costs vary with financial conditions we conduct several scenario analyses, which reveal different results.

+++ See Exhibit 13A-C +++

For instance, an increase of interest rates to the extreme level of 10 percent and expenditures of SEK 2,000/sqm increases the user cost so that it instead is preferable to rent rather than buying an apartment in all zones (Exhibit 13A). In this case, user costs in Southern near suburbs would be 30 percent higher than the estimated market rents. Moreover, the difference between user costs and market rent rents is largest in Vasastan/Norrmalm, where user costs are calculated to be 33 percent higher than market rents. On the contrary, Kungsholmen, Södermalm and Western near suburbs saw the smallest percentage difference between market rents and user costs, as user costs are 28 percent higher than market rents.

The other part of the scenario analysis, with extremely low interest rates of 0.5 percent and yearly expenditure of SEK 100/sqm reveal the opposite picture, with significantly higher market rents in comparison to user cost, the highest difference was 1,348 percent higher market rents than user costs in non-regulated tenant-owned dwellings in Western near suburbs (Exhibit 13B).

Analysis

The assessment here is based on looking, first, to some of the choices consumers have in their tenure choices and then expanding the analysis on the eight zones level. The emphasis is on the market-driven rental provision versus user cost in tenant-owned dwellings. At the simplest level, the analysis reveals that user costs varies with interest rates and fees, in accordance with hypothesis 4. It appears that the user costs in tenant-owned dwellings are lower in the base case

scenario, but it depends on the level of interest rates and yearly expenditures. A scenario analysis illustrates the low interest rates and average fees to the cooperative association currently present, implying that it is actually cheaper to buy than renting housing services. This result is consistent with market practitioners' views, discussing households' favorable loan terms in recent years, as well as low fees to the cooperative association and the tax system benefiting owning (e.g. "Schablon skatteavdrag"). In addition, other arguments in line with the results indicate that renting generally is more expensive than buying (excluding the risk of capital investment and potential value increase), all else being equal, since renting involves a service offering, such as maintenance and facilities management (R. Gustafsson, pers. comm., 2014-03-26). This is also interesting as the Swedish Union of Tenants increasingly incorporate the property service of the rental apartment in their negotiations, which also was intended to be a part of the point system in the "Stockholm Model" (M. Hofverberg, pers. comm., 2014-02-19).

As for the dispersion of the user cost across the eight zones, we report that it ranges widely from SEK 847 in the western outer suburbs to SEK 1,525 on Östermalm. We find that variations in demand are influenced by general consumer preference factors but also by what is happening in other housing tenures (A. Sandvall, pers., comm. 2014-04-28). The results are in line with theoretical arguments that homebuyers' willingness to pay for a tenant owner dwelling depends on both the capital costs of owning the housing as well as on operating and maintenance costs for the housing services. With lower user costs, homebuyers can afford to pay higher tenant-owned dwelling prices Englund's (2011). In contrast, in the context of rising user costs, market rents would be lower and homeowners would naturally prefer this (assuming the two are perfect or almost perfect substitutes). As described by Bourassa (1995), Burgess and Skeltys (1992) there are a variety of factors that households take into account when choosing between housing alternatives, which makes it inherently difficult to assess the overall picture. Yet the overall conclusion strongly suggest that the relative cost of renting versus owning impact the demand for rental housing and hence price developments in tenant-owned dwellings affect households' tenure choice (e.g. Bourassa, 1995).

Before concluding the current low user costs in tenant-owned dwellings, it is also important to highlight that actual rent levels are only slightly higher than the calculated user costs, see Exhibit 13C. This suggests that different demand patterns are reflected in user costs, as the user costs vary depending on location, whereas rent differences are minor in Stockholm under the current rent system, and hence do not illustrate different demand in a comprehensive and accurate way, see Exhibit 13D-E. This is in line with prior studies, e.g. "*EU, allmännyttan och hyrorna*" (SOU 2008:38), suggesting that the rents in the regulated rental market does not reflect area attractiveness, which confirms our hypothesis 5. This holds particularly true when considering apartments situated in the inner city, were the prices of tenant-owned dwellings have

increased strongly in recent years. Actual rents are only 6 percent higher than current user costs in Vasastan/Norrmalm, whereas Southern outer suburbs see almost a 59 percent difference. The low percentage difference found on Östermalm exemplifies the strong bargaining power of Östermalm's local tenant association, keeping actual rents at low levels. To validate the estimation model of market rents and calculation of user costs, it is also important to look at the pattern of change in both these analyses. Exhibit 13E reveals the same demand pattern for market rents and user costs, which vary depending on location, but current user costs are at a lower level than estimated market rents. This gives a strong indication of that our estimated market rents reflect current market demand patterns seen in tenant-owned dwellings, hence robustness check. We therefore conclude that the estimated market rents are reasonable if the rental housing market would be somewhat deregulated.

In addition, the findings are important as they suggest that the current below-market clearing rent levels may encourage conversions of rental apartments into tenant-owned dwellings in response to the expected profitability and yield of different types of housing alternatives, in line with Andrews et al (2011). If market rents instead were allowed, the expected yield and profitability of rental housing would increase and perhaps deter the current high levels of conversions. This reasoning is supported by market practitioners, arguing that less regulation in combination with rent levels being more aligned with market rents would likely make conversions of rental housing into tenant-owned dwellings less frequent (A. Sandvall, pers., comm. 2014-04-28).

VI. Conclusion

In this paper, we aimed to estimate market rents using queuing time as an indication of demand. The main finding of our study is that market-clearing rent levels would require practically doubling current rent levels. The estimated market rents are on average 92 percent higher than current rent levels, with the frequency of outcomes centered on the mean. One important conclusion is that the location, measured not only by proximity to the Stockholm city center but also through area attractiveness parameters, has an important effect on market rents and consequently actual rents underestimate these parameters. In fact, all areas saw an increase when comparing market rents to actual rent levels. Further, we conclude that the estimated market rents portray the variation of current mispricing in rents, as the gap from actual rents to market rents varies in different areas. The most dramatic effect in implied rent increase to reach market-clearing levels was found in area A, which revealed a 135 percent increase, while the least dramatic was found in F with a 76 percent increase.

Similar to previous studies (e.g. Lindblad, 2010), we find that all districts experienced high increases when conducting the analysis on district levels and the median reveals a 93 percent

increase. A general conclusion is that districts situated in the inner city experience high rental increases whereas districts farther from the city center show more moderate increases. There are a few exceptions where the increases are lower, such as Stadshagen, which is explained by the introduction of "*Presumption rents*" in 2006 that allows higher rents in newly constructed dwellings. Significance tests (T-test, F-test, VIF tests etc.) were also conducted presenting overall high predictive power. Thereby, this paper contributes to the understanding of the rental market in Stockholm.

Additionally, a comparison between market rents and user costs in tenant-owned dwellings was made in order to test the reasonableness of the proxy of market rents. Considerable differences were found between different zones, again validating the importance of area attractiveness in housing consumption, in line with prior studies such as Fransson, Rosenqvist and Turner (2002). We conclude that different demand patterns are reflected both in the estimation of market rents as well as in user costs, which vary depending on location. Our results suggest that the estimated market rents are higher than current user costs in tenant-owned dwellings, which is mainly due to the current low interest environment, low fees to the cooperative association as well as tax policies benefiting tenant owner dwellings. It is also in line with market practitioners' views, as rental housing involves a service offering as well as a secure and accessible form of tenure, avoiding the fund requirements and risks associated with capital investments. This result provides insight on the housing market in Stockholm and adds to the debate regarding low fees to the cooperative associations. In accordance with Andrews et al (2011) and Bourassa (1995) we conclude that a number of factors affect the demand for rental housing and households' tenure decisions, i.e. area attractiveness, travel time, income levels and the relative cost of owning versus renting.

Although, a completely deregulated rental housing market in Sweden is unlikely at present, it is clear that the rent levels in at least Stockholm today are far below market-clearing levels. Since the tenant-owned dwelling market is booming, this implies an increased risk of rental apartments being converted into tenant owned dwellings. This puts pressure on the proposal of a more unregulated market since the creation of a functioning housing market in Stockholm is one of the key issues for the future development of the region. Thus, this thesis contributes to the understanding of the housing market with a proxy indicating market-clearing rent levels, divided into different areas and districts. Overall, our findings contribute to the current debate on market rents and the housing market in Stockholm.

VII. Future Research

As housing markets are of great importance to the overall economy it is a well-studied subject but also a politically complex one. There are several on-going debates about rent levels, rapidly increasing house prices and households' indebtedness. Additionally, the access to accurate data becomes better each year and therefore, it is interesting to follow the development in the housing market and thus perform a similar study in the future, conditional upon the accessibility of accurate data.

In undertaking this study, a number of potential areas for further exploration became evident. First of all, some of our findings, indicate that standard and house character are two factors that are increasingly important in rent negotiations and hence of great importance to the calculation of a hypothetical market rent. With more time it would be valuable to extend this study by collecting data on housing characteristics and if possible to obtain data on the accommodation standard, which we could not obtain. Thereby a more precise perspective of consumer preferences in explaining queuing times can be formed.

A completely different track for future research is to explore the method described in Hüfner and Lundsgaard (2007). The process is to create a proxy for market rents by capitalizing the difference between market and regulated rents when converting a rental building into a tenant-owned dwelling whose price is not regulated and can be sold on the free market.

Finally, another possible research field is to analyze the effects of market rents, if they contribute to a more efficient housing market, with shorter queues, a reduction in black-market trade in rental housing, fewer conversions of rental housing to tenant-owned dwellings and some new construction of rental apartments (see e.g. "*EU, allmännyttan och hyrorna*", SOU 2008:3).

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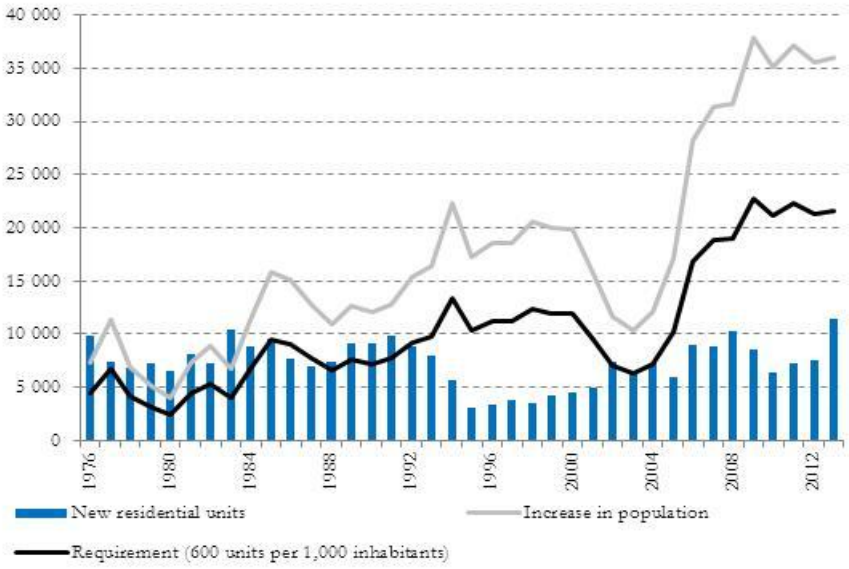
IX. APPENDIX

Exhibit 1: Residential market in Stockholm



Source: SCB

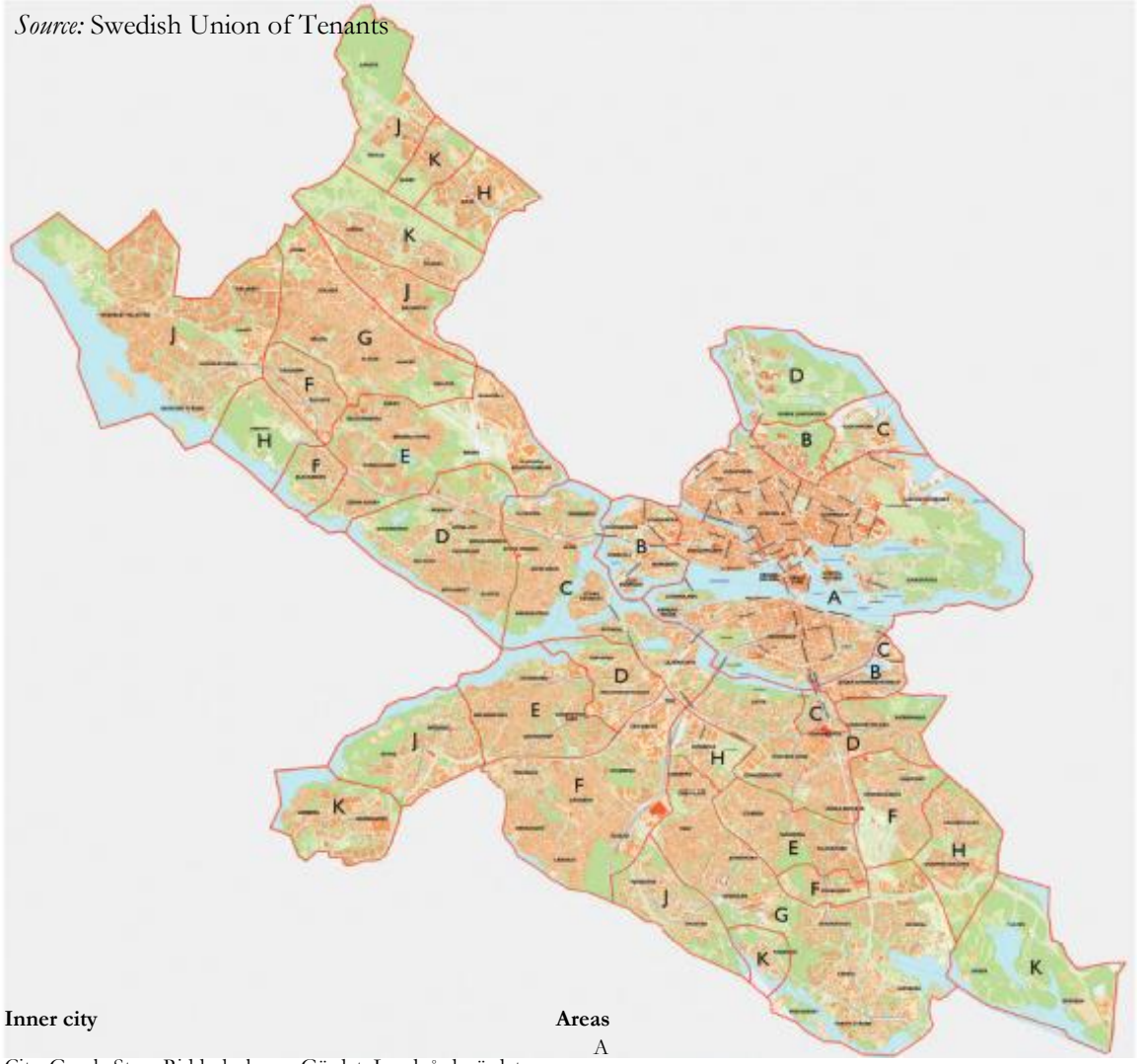
Exhibit 2: Dwellings in completed buildings by ownership and tenure

	2009	2010	2011	
	Sweden	Sweden	Sweden	Greater Stockholm Area
All dwellings	22,821	19,500	20,064	7,254
Of which in one- or two-dwelling buildings	8,374	8,875	7,477	1,556
Type of ownership				
State and local authorities	489	325	581	93
Semi-public housing companies	3,359	2,516	2,420	1,028
Housing co-operatives	8,275	5,777	7,079	3,074
Private bodies, private persons	10,698	10,882	9,984	3,059
Tenure				
Owner-occupied dwelling	7,840	8,239	6,830	1,473
Tenant-owned dwelling	8,049	5,561	6,867	2,946
Rented dwelling	6,932	5,700	6,367	2,835

Source: SCB

Exhibit 3: Geographic area division (A-K)

Source: Swedish Union of Tenants



Inner city	Areas
City, Gamla Stan, Riddarholmen, Gärdet, Laudgårdsgärdet, Norrmalm, Vasastan, Södermalm, Reimersholme, Långholmen, Södra Djurgården, Skeppsholmen, Beckholmen, Östermalm, Östra Kungsholmen	A
Hammarby Sjöstad	B
Ruddammen	B
Västra Kungsholmen, Lilla Essingen	B
Danvikskllippan	C
Hjorthagen	C
Stora Essingen	C
Norra Djurgården, Ekhagen, Frescati	D
Southern Suburbs ("Söderort")	
Gröndal, Liljeholmen, Årstadal	C
Gullmarsplan, Globen	C
Gamla Enskede, Enskede Gård, Enskedefältet, Johanneshov, Hammarbyhöjden, Björkhagen, Årsta	D
Midsommarkransen, Aspudden	D
Hägerstensåsen, Hägersten, Västertorp, Mälarhöjden	E
Stureby, Svedmyra, Tallkrogen	E
Kärrtorp, Enskededalen	F
Västberga, Solberga, Älvsjö, Långbro, Långsjö, Herrängen, Fruängen	F
Gubbängen	F
Bandhagen, Högdalen, Liseberg, Örby Slott, Örby, Hökarängen, Farsta, Farsta Strand, Larsboda, Sköndal	G
Östberga	H
Bagarmossen, Skarpnäck	H
Bredäng, Sätra	J
Hagsätra, Rågsved, Snösätra	J
Skärholmen, Vårberg	K
Fagersjö	K
Skrubba	K
Western suburbs ("Västerort")	
Traneberg, Ulvsunda, Stora Mossen, Alvik, Äppelviken, Smedslätten	C
Nockebyhov, Nockeby, Höglandet, Ålsten, Riksby, Åkeshov, Åkeslund, Abrahamsberg, Olovslund	D
Bromma kyrka, Norra Ängby, Södra Ängby, Beckomberga, Eneby, Mariehäll, Johannesfred	E
Vällingby	F
Blackberg	F
Solhem, Lunda, Nälsta, Flysta, Sundby, Bällsta	G
Kista	H
Grimsta	H
Akalla	J
Bromsten	J
Strand, Vinsta Kälvesta	J
Husby	K
Rinkeby, Tensta, Hjulsta	K

Exhibit 4A: Tenant-owned dwelling price SEK/sqm

This table reports average tenant-owned dwelling price statistics for tenant-owned apartments from 2009 to 2013 at district level.

District	2009	2010	2011	2012	2013	Total no of obs.
Kungsholmen	49,225	54,007	55,900	56,932	61,660	12,198
Södermalm	47,827	53,006	54,246	55,511	60,424	14,670
Vasastan/Norrmalm	54,101	59,039	61,035	62,515	67,879	10,174
Östermalm	56,203	60,937	62,917	63,753	67,724	10,206
Southern near suburbs	30,385	34,306	35,328	37,180	40,639	18,817
Southern outer suburbs	21,319	23,458	24,412	25,896	28,702	10,366
Western near suburbs	31,903	34,078	35,905	36,173	40,337	7,974
Western outer suburbs	18,407	20,199	20,406	21,832	24,637	6,992

Source: Mäklarstatistik

Exhibit 4B: Annual average interest rate on mortgage loans

This table reports the average annual interest rate on mortgage loans in Sweden.

Year	Rate
2009	1,9%
2010	2,1%
2011	3,6%
2012	3,5%
2013	2,6%

Source: SCB

Exhibit 5: District Division

This table reports the district division, which is used in the district analysis.

Inner city	Western outer suburbs	Southern outer suburbs	Western near suburbs	Southern near suburbs
Djurgården	Beckomberga	Bagarmossen	Abrahamsberg	Björkhagen
Fredhäll	Blackeberg	Bandhagen	Alvik	Enskede Gård
Gamla Stan	Bromsten	Enskededalen	Aspudden	Johanneshov
Hjorthagen	Flysta	Enskedefältet	Gröndal	Södra Hammarbyhamnen
Kristineberg	Grimsta	Fagersjö	Hägersten	Årsta
Kungsholmen	Hässelby Gård	Farsta	Höglandet	
Ladugårdsgärdet	Hässelby Strand	Farsta Strand	Liljeholmen	
Lilla Essingen	Hässelby Villastad	Gamla Enskede	Midsommarkransen	
Långholmen	Mariehäll	Gubbängen	Mälarhöjden	
Marieberg	Nockebyhov	Hagsätra	Nockeby	
Norra Djurgården	Nälsta	Högdalen	Riksby	
Norrmalm	Råcksta	Hökarängen	Smedslätten	
Reimersholme	Solhem	Kärrtorp	Stora Mossen	
Skeppsholmen	Sundby	Larsboda	Traneberg	
Stadshagen	Vinsta	Rågsved	Ulvsunda	
Stora Essingen	Vällingby	Skarpnäcks Gård	Ulvsunda Industriområde	
Södermalm	Bredäng	Sköndal	Åkeshov	
Vasastaden	Fruängen	Stureby	Åkeslund	
Östermalm	Hägerstensåsen	Svedmyra		
	Långbro	Tallkrogen		
	Skärholmen	Älvsjö		
	Solberga	Örby		
	Sätra	Örby Slott		
	Vårberg	Östberga		
	Västberga			
	Västertorp			
	Rinkeby			
	Tensta			
	Akalla			
	Husby			
	Kista			

Source: Stockholm Housing Service

Exhibit 6A: Regression of queuing time on the explanatory factors

The table reports the relationship between queuing time and the independent variables. To capture the factors affecting the dependent variable, 23 independent variables were created and tested for significance in eight standard OLS regressions. Reg 1 and Reg 2 both test for all explanatory variables except area K and differs in the dummy variable of Ownership, where Reg 1 tests the effect of Municipality and Reg 2 tests the effect of Private. In Reg 3 and Reg 4 fixed effects were used controlling for area attractiveness and Reg 5 and Reg 6 controlled for years. Finally, Reg 7 and 8 include all variables except for area attractiveness (A-J) The lower part of the table reports when the control variables years (2009-2013) and area attractiveness (A-K) are used as well as the number of observations and R^2.

	Dependent variable: Queue							
Independent varibles	**Reg 1**	**Reg 2**	**Reg 3**	**Reg 4**	**Reg 5**	**Reg 6**	**Reg 7**	**Reg 8**
Rooms	**0.922*** **	**0.922*** **	**0.975** **	**0.975** **	**0.925** **	**0.925** **	**0.357*** **	**0.357*** **
Std	0.060	0.059	0.183	0.183	0.112	0.112	0.077	0.077
T-statistics	15.62	15.62	5.32	5.32	8.23	8.23	4.63	4.63
P-value	0.000	0.000	0.013	0.013	0.004	0.004	0.000	0.000
Floor	**0.078*** **	**0.078*** **	**0.034**	**0.034**	**0.082**	**0.082**	**0.116*** **	**0.116*** **
Std	0.008	0.008	0.033	0.033	0.052	0.052	.010	.010
T-statistics	9.49	9.49	1.04	1.04	1.59	1.59	11.48	11.48
P-value	0.000	0.000	0.376	0.376	0.2111	0.2111	0.000	0.000
Yearly rent/sqm	**-0.007*** **	**-0.007*** **	**-0.007** **	**-0.007** **	**-0.007** **	**-0.007** **	**-0.005*** **	**-0.005*** **
Std	0.000	0.000	0.002	0.002	0.001	0.001	0.000	0.000
T-statistics	-86.86	-86.86	-4.06	-4.06	-6.18	-6.18	-53.25	-53.25
P-value	0.000	0.000	0.027	0.027	0.009	0.009	0.000	0.000
Sqm	**-0.056*** **	**-0.056*** **	**-0.064*** **	**-0.064*** **	**-0.056** **	**-0.056** **	**-0.037*** **	**-0.037*** **
Std	0.003	0.003	0.011	0.011	0.010	0.010	0.004	0.004
T-statistics	-18.39	-18.39	-5.82	-5.82	-5.16	-5.16	-9.18	-9.18
P-value	0.000	0.000	0.010	0.010	0.014	0.014	0.000	0.000
Income	**0.000005*** **	**0.000005*** **	**0.000007**	**0.000007**	**0.000006** **	**0.000006** **	**0.000019*** **	**0.000019*** **
Std	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
T-statistics	7.98	7.98	1.04	1.04	4.50	4.50	34.04	34.04
P-value	0.000	0.000	0.376	0.376	0.020	0.020	0.020	0.020
Travel time	**-0.035*** **	**-0.035*** **	**-0.075** **	**-0.075** **	**-0.033** **	**-0.033** **	**-0.147*** **	**-0.147*** **
Std	0.002	0.002	0.018	0.018	0.008	0.008	0.005	0.005
T-statistics	-13.86	-13.86	-4.06	-4.06	-4.02	-4.02	-30.86	-30.86
P-value	0.000	0.000	0.027	0.027	0.028	0.028	0.000	0.000
Municipality	**0.088** **		**0.004**		**0.126**		**0.011**	
Std	0.087		0.055		0.061		0.045	
T-statistics	2.40		0.08		2.06		-0.24	
P-value	0.016		0.940		0.132		0.812	
Private		**-0.088** **		**-0.004**		**-0.126**		**-0.011**
Std		0.087		0.055		0.061		0.045
T-statistics		2.40		0.08		2.06		-0.24
P-value		0.016		0.940		0.132		0.812

"T statistics in parentheses"

*** p<0.05. ** p<0.01. *** p<0.001**

Exhibit 6A: Regression of queuing time on the explanatory factors (cont'd)

	Dependent variable: Queue							
Independent varibles	**Reg 1**	**Reg 2**	**Reg 3**	**Reg 4**	**Reg 5**	**Reg 6**	**Reg 7**	**Reg 8**
Area A	**11.113*** **	**11.113*** **			**7.948*** **	**7.948*** **		
Std	0.146	0.146			0.428	0.428		
T-statistics	75.89	75.89			18.54	18.54		
P-value	0.000	0.000			0.000	0.000		
Area B	**5.697*** **	**5.697*** **			**2.438*** **	**2.438*** **		
Std	0.158	0.158			0.443	0.443		
T-statistics	35.88	35.88			5.50	5.50		
P-value	0.000	0.000			0.012	0.012		
Area C	**5.105*** **	**5.105*** **			**2.890*** **	**2.890*** **		
Std	0.136	0.136			0.471	0.471		
T-statistics	37.51	37.51			6.13	6.13		
P-value	0.000	0.000			0.009	0.009		
Area D	**5.177*** **	**5.177*** **			**3.469*** **	**3.469*** **		
Std	0.120	0.120			0.467	0.467		
T-statistics	43.11	43.11			7.42	7.42		
P-value	0.000	0.000			0.005	0.005		
Area E	**2.110*** **	**2.110*** **			**1.972*** **	**1.972*** **		
Std	0.177	0.177			0.297	0.297		
T-statistics	17.93	17.93			6.62	6.62		
P-value	0.000	0.000			0.007	0.007		
Area F	**2.083*** **	**2.083*** **			**2.060*** **	**2.060*** **		
Std	0.077	0.077			0.357	0.357		
T-statistics	26.88	26.88			5.77	5.77		
P-value	0.000	0.000			0.010	0.010		
Area G	**1.478*** **	**1.478*** **			**1.449*** **	**1.449*** **		
Std	0.067	0.067			0.208	0.208		
T-statistics	21.92	21.92			6.94	6.94		
P-value	0.000	0.000			0.006	0.006		
Area H	**1.319*** **	**1.319*** **			**1.295*** **	**1.295*** **		
Std	0.073	0.073			0.139	0.139		
T-statistics	17.93	17.93			9.25	9.25		
P-value	0.000	0.000			0.003	0.003		
Area J	**0.389*** **	**0.389*** **			**0.384*** **	**0.384*** **		
Std	0.049	0.049			0.035	0.035		
T-statistics	7.92	7.92			10.75	10.75		
P-value	0.000	0.000			0.002	0.002		
Area K							**-0.797*** **	**-0.797*** **
Std							0.056	0.056
T-statistics							-14.22	-14.22
P-value							0.000	0.000

"T statistics in parentheses"

*** p<0.05. ** p<0.01. *** p<0.001**

Exhibit 6A: Regression of queuing time on the explanatory factors (cont'd)

	Dependent variable: Queue							
Independent varibles	**Reg 1**	**Reg 2**	**Reg 3**	**Reg 4**	**Reg 5**	**Reg 6**	**Reg7**	**Reg 8**
Year 2009	**-0.955*** **	**-0.955*** **	**-0.948*** **	**-0.948*** **			**-1.201*** **	**-1.201*** **
Std	0.056	0.056	0.068	0.068			0.068	0.068
T-statistics	-17.06	-17.06	-13.91	-13.91			-17.71	-17.71
P-value	0.000	0.000	0.001	0.001			0.000	0.000
Year 2010	**-0.930*** **	**-0.930*** **	**-1.080*** **	**-1.080*** **			**-1.205*** **	**-1.205*** **
Std	0.058	0.058	0.094	0.094			0.072	0.072
T-statistics	-15.93	-15.93	-11.49	-11.49			-16.78	-16.78
P-value	0.000	0.000	0.001	0.001			0.000	0.000
Year 2011	**-0.527*** **	**-0.527*** **	**-0.735*** **	**-0.735*** **			**-1.186*** **	**-1.186*** **
Std	0.060	0.060	0.045	0.045			0.074	0.074
T-statistics	-8.71	-8.71	-16.05	-16.05			-16.03	-16.03
P-value	0.000	0.000	0.001	0.001			0.000	0.000
Year 2012	**-0.536*** **	**-0.536*** **	**-0.626***	**-0.626***			**-1.306*** **	**-1.306*** **
Std	0.062	0.062	0.240	0.240			0.078	0.078
T-statistics	-8.59	-8.59	-2.60	-2.60			-16.83	-16.83
P-value	0.000	0.000	0.080	0.080			0.000	0.000
Year 2013	**-0.484*** **	**-0.484*** **	**-0.624**	**-0.624**			**-1.375*** **	**-1.375*** **
Std	0.066	0.066	0.302	0.302			0.081	0.081
T-statistics	-7.25	-7.25	-2.06	-2.06			-16.90	-16.90
P-value	0.000	0.000	0.131	0.131			0.000	0.000
Intercept	**17.399*** **	**17.399*** **	**21.060** **	**21.060** **	**17.560*** **	**17.560*** **	**16.203*** **	**16.203*** **
Std	0.196	0.196	4.108	4.108	0.146	0.146	0.247	0.247
T-statistics	88.75	88.75	5.13	5.13	119.54	119.54	65.65	65.65
P-value	0.000	0.000	0.014	0.014	0.000	0.000	0.000	0.000
FE years	No	No	No	No	Yes	Yes	No	No
FE area attractiveness	No	No	Yes	Yes	No	No	No	No
Observations	21417	21417	21417	21417	21417	21417	21417	21417
R Squared	0.529	0.529	0.591	0.591	0.430	0.430	0.785	0.785

"T statistics in parentheses"

*** p<0.05. ** p<0.01. *** p<0.001**

Exhibit 6B: Regression analysis how Number of Rooms affects queuing time

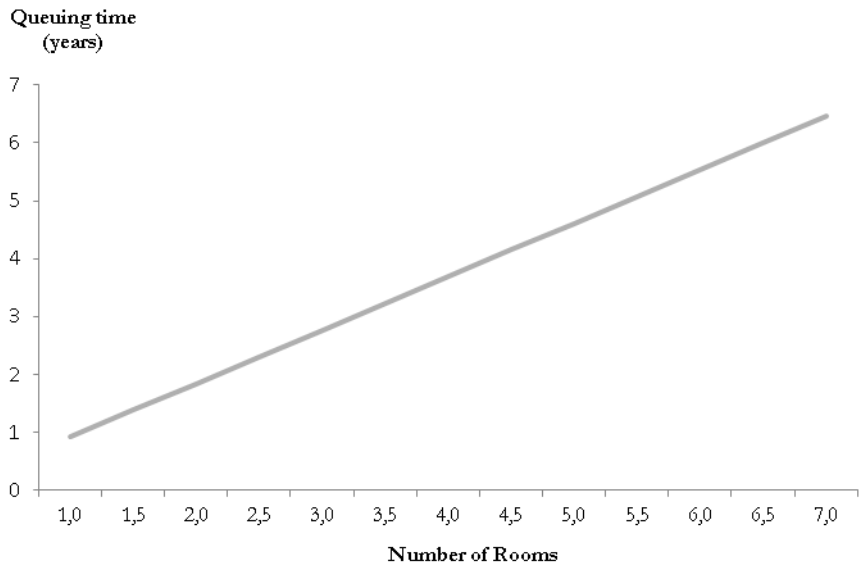


Exhibit 6C: Regression analysis how Sqm affects queuing time

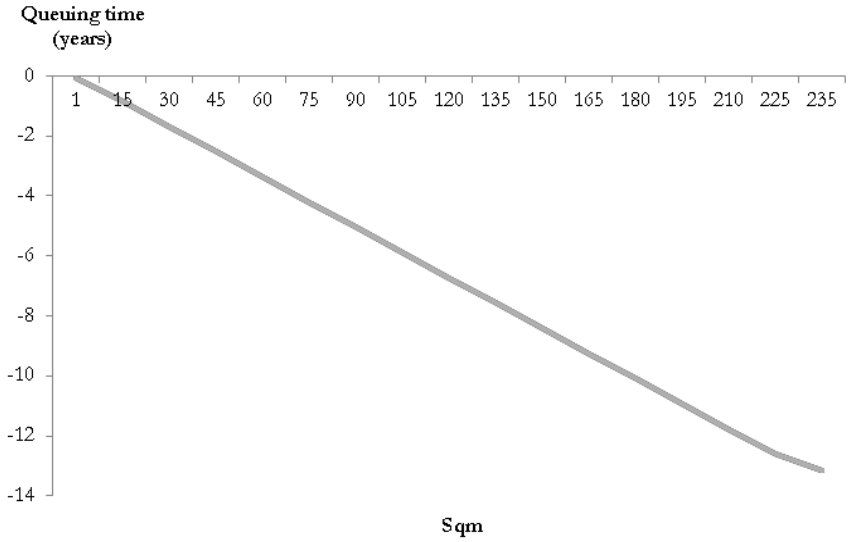


Exhibit 6D: Regression analysis how Floor affects queuing time

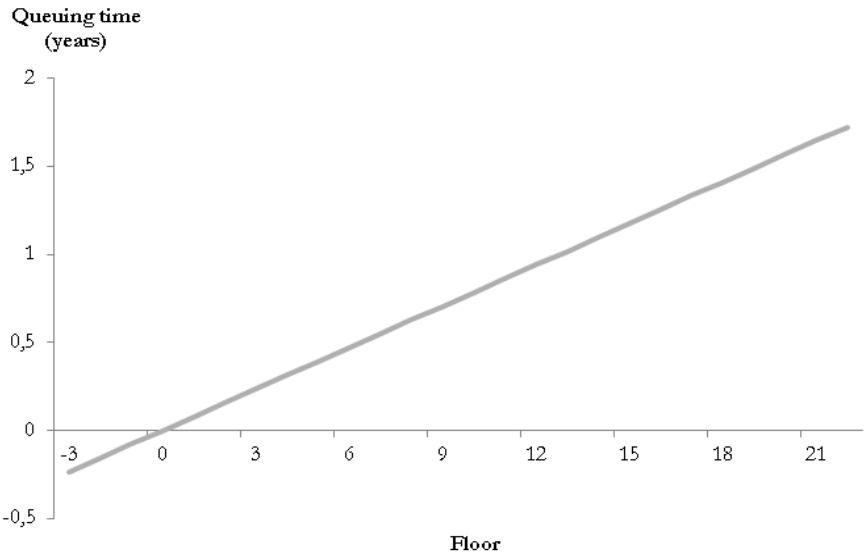


Exhibit 6E: Regression analysis how Yearly rent per sqm affects queuing time

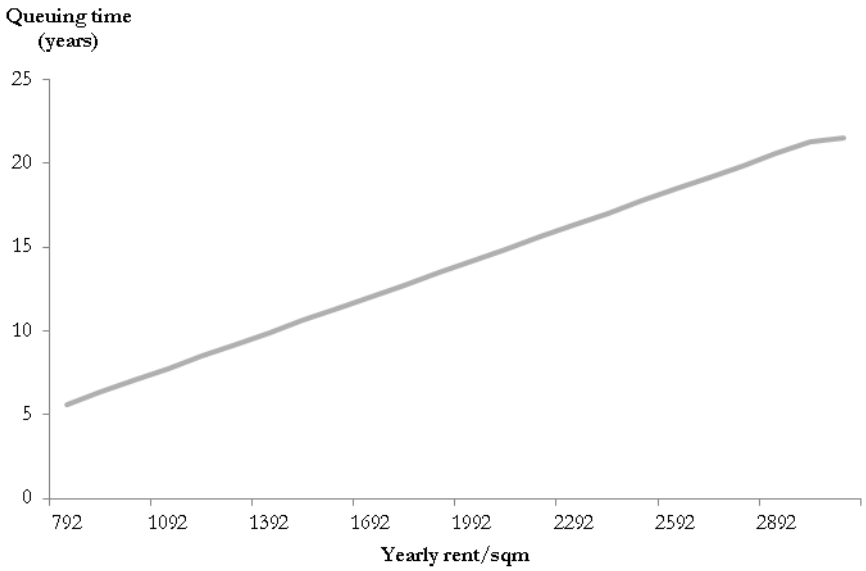


Exhibit 6F: Regression analysis how Willingness to pay affects queuing time

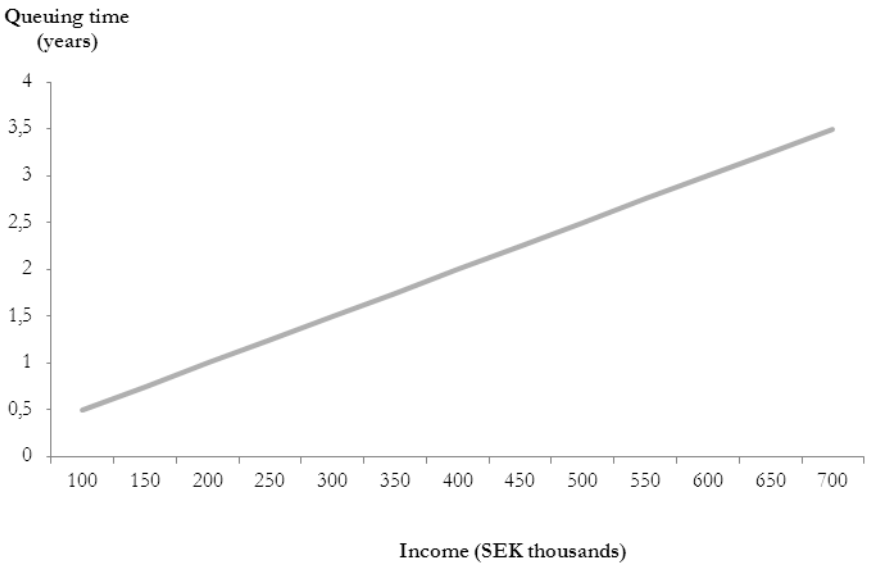


Exhibit 6G: Regression analysis how Travel time affects queuing time

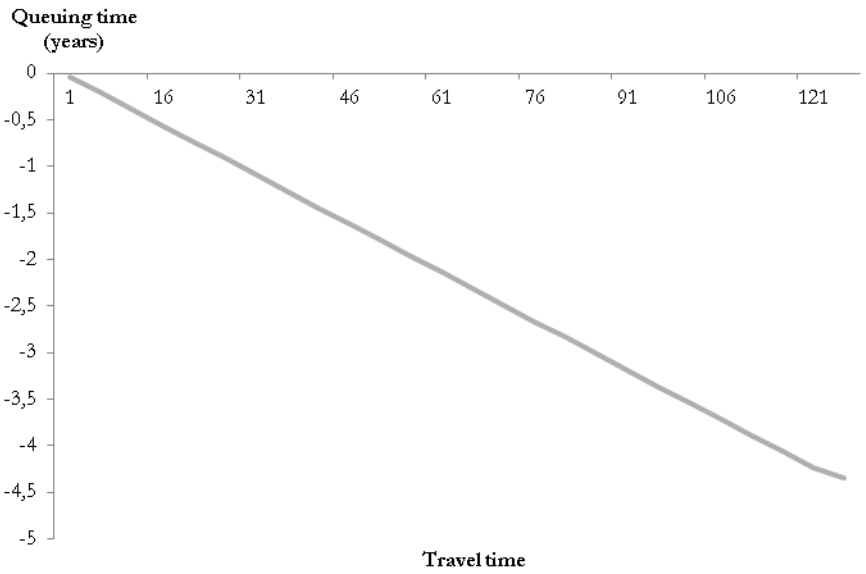


Exhibit 7: Correlation table:

This table reports the correlation coefficients between the regression variables. A coefficient close to zero implies no/weak correlation, whereas a coefficient close to one suggests a high correlation and a risk of multicollinearity.

	Queue	Rooms	Floor	Yearly rent/sqm	Sqm	Municipality	Private	Income (SEK)	Travel time	Year 2009	Year 2010	Year 2011	Year 2012	Year 2013	Area A	Area B	Area C	Area D	Area E	Area F	Area G	Area H	Area J	Area K
Queue	**1.000**																							
Rooms	-0.034	**1.000**																						
Floor	0.008	0.142	**1.000**																					
Yearly rent/sqm	-0.129	-0.145	0.204	**1.000**																				
Sqm	-0.039	0.913	0.147	-0.181	**1.000**																			
Municipality	0.014	0.015	0.001	-0.033	-0.033	**1.000**																		
Private	-0.014	-0.015	-0.001	0.033	-0.017	-1.000	**1.000**																	
Income (SEK)	0.231	-0.019	0.088	0.526	0.526	-0.005	0.005	**1.000**																
Travel time	-0.328	0.026	-0.071	-0.311	-0.311	0.006	-0.006	-0.346	**1.000**															
Year 2009	0.028	-0.013	-0.048	-0.101	-0.101	0.012	-0.012	0.001	-0.030	**1.000**														
Year 2010	-0.026	0.009	-0.006	-0.028	-0.028	0.005	-0.005	0.006	0.042	-0.218	**1.000**													
Year 2011	-0.028	0.011	0.057	0.073	0.073	-0.032	0.032	0.032	-0.028	-0.221	-0.208	**1.000**												
Year 2012	-0.075	0.026	0.028	0.121	0.121	0.004	-0.004	0.007	-0.013	-0.203	-0.191	-0.193	**1.000**											
Year 2013	-0.097	-0.002	0.011	0.149	0.149	-0.047	0.047	-0.003	0.005	-0.186	-0.176	-0.178	-0.163	**1.000**										
Area A	0.478	-0.128	0.085	0.261	0.261	-0.026	0.026	0.168	-0.388	0.014	-0.003	-0.016	-0.003	-0.012	**1.000**									
Area B	0.014	0,018	0.180	0.403	0.035	0.021	-0.021	0.518	-0.181	-0.026	0.041	0.097	-0.006	-0.053	-0.084	**1.000**								
Area C	0.073	0,033	0.032	0.180	0.403	0.030	-0.021	0.277	-0.123	0.004	0.012	-0.060	0.007	0.001	-0.077	-0.078	**1.000**							
Area D	0.164	-0,047	-0.067	0.052	0.180	-0.027	0.027	0.125	-0.169	0.029	-0.022	-0.019	-0.035	0.012	-0.080	-0.082	-0.074	**1.000**						
Area E	-0.040	-0,027	-0.063	0.022	0.022	-0.030	0.030	0.214	-0.003	-0.019	-0.024	0.022	0.041	0.021	-0.074	-0.078	-0.069	-0.072	**1.000**					
Area F	-0.120	0.028	-0.053	0.055	0.055	-0.010	0.010	0.001	0.116	-0.004	-0.017	0.028	0.024	0.011	-0.131	-0.133	-0.120	-0.126	-0.117	**1.000**				
Area G	-0.057	0.015	-0.068	-0.131	-0.131	-0.011	0.011	-0.098	-0.002	0.021	-0.007	-0.020	0.000	0.014	-0.112	-0.113	-0.103	-0.108	-0.100	-0.176	**1.000**			
Area H	-0.038	0.020	-0.063	-0.126	-0.126	0.003	-0.003	-0.120	0.057	0.002	0.001	0.010	-0.029	0.017	-0.075	-0.076	-0.069	-0.072	-0.067	-0.118	-0.101	**1.000**		
Area J	-0.157	0.009	0.028	-0.284	-0.284	0.035	-0.035	-0.361	0.32	-0.021	0.006	-0.024	-0.005	0.001	-0.131	-0.023	-0.184	-0.126	-0.117	-0.206	-0.176	-0.118	**1.000**	
Area K	-0.154	0.050	0.003	-0.257	-0.257	0.006	-0.006	-0.447	0.161	0.004	0.014	-0.014	-0.001	-0.033	-0.101	-0.018	-0.143	-0.098	-0.091	-0.159	-0.136	-0.091	-0.159	**1.000**

Exhibit 8: F-test

The F-test is used to test whether the coefficients are statistically significant in the regression or not. The table below shows that the coefficients are highly significant and can be rejected from the null-hypothesis F-value>2.36 at the F-value of 824.82.

F-test	
1)	Rooms = 0
2)	Floor = 0
3)	Yearly rent/sqm =0
4)	Sqm = 0
5)	Municipality = 0
6)	Private = 0
7)	Income (SEK) = 0
8)	Travel time = 0
9)	Year 2009 = 0
10)	Year 2010 = 0
11)	Year 2011 = 0
12)	Year 2012 = 0
13)	Year 2013 = 0
14)	Area A = 0
15)	Area B = 0
16)	Area C = 0
17)	Area D = 0
18)	Area E = 0
19)	Area F = 0
20)	Area G = 0
21)	Area H = 0
22)	Area J = 0
23)	Area K = 0
F(21, 21417) = 824.82	
Prob > F = 0.0000	

Exhibit 9A: VIF-test

This exhibit reports the variance inflation factor, VIF, used as an indicator of multicollinearity, for all variables in the regression except Area K. This is due to the higher risk of multicollinarity between Area B and K.

Variable	VIF	1/VIF
Rooms	6.34	0.16
Floor	1.12	0.89
Yearly rent/sqm	2.06	0.48
Sqm	6.51	0.15
Municipality	1.01	0.99
Private	1.01	0.98
Income (SEK)	3.49	0.28
Traveltime	1.51	0.66
Year 2009	1.64	0.61
Year 2010	1.62	0.68
Year 2011	1.69	0.59
Year 2012	1.65	0.61
Year 2013	1.63	0.62
Area A	3.12	0.32
Area B	4.57	0.22
Area C	3.13	0.32
Area D	2.49	0.40
Area E	2.47	0.41
Area F	3.13	0.32
Area G	2.43	0.41
Area H	1.63	0.61
Area J	2.26	0.44
Area K	N.A	N.A
Mean	**VIF**	**2.09**

Exhibit 9B: VIF-test

This exhibit reports the variance inflation factor, VIF, used as an indicator of multicollinearity, for all variables in the regression except Area B. This is due to the higher risk of multicollinarity between Area B and K.

Variable	VIF	1/VIF
Rooms	6.34	0.16
Floor	1.12	0.89
Yearly rent/sqm	2.06	0.49
Sqm	6.51	0.15
Municipality	1.01	0.99
Private	1.01	0.99
Income (SEK)	3.49	0.28
Traveltime	1.51	0.66
Year 2009	1.64	0.61
Year 2010	1.62	0.62
Year 2011	1.69	0.59
Year 2012	1.65	0.60
Year 2013	1.63	0.62
Area A	2.27	0.44
Area B	N.A	N.A
Area C	1.91	0.52
Area D	2.41	0.42
Area E	2.13	0.47
Area F	4.80	0.21
Area G	4.61	0.22
Area H	3.14	0.38
Area J	7.21	0.14
Area K	6.14	0.16
Mean	**VIF**	**3.09**

Exhibit 9C: VIF-Test

This exhibit reports the variance inflation factor, VIF, used as an indicator of multicollinearity, for part of the variables in the regression, only including Area K of the area variables. This reveals a lower level of VIF for Area K compared to Exhibit 10B.

Variable	VIF	1/VIF
Income (SEK)	1.74	0.57
Yearly rent/sqm	1.68	0.59
Sqm	6.32	0.16
Year 2011	1.66	0.60
Year 2009	1.64	0.61
Year 2012	1.62	0.62
Year 2010	1.61	0.62
Year 2013	1.59	0.63
Area K	1.28	0.78
Travel time	1.18	0.85
Floor	1.09	0.92
Rooms	6.12	0.16
Municipality	1.01	0.99
Private	1.01	0.99
Mean	**VIF**	**2.2**

Exhibit 10: Breusch-Pagan

This exhibit reports the result of the Breusch-Pagan test, which is used to test for heteroskedasity. The Chi square of 4736.33 implies that heteroskedastictity is present.

Breusch-Pagan/Cook-Weisberg for heteroskedasticity	
Ho: Constant variance	
Variables: fitted values of queue	
chi2(1)=	4736.33
Prob>chi2=	0.0000

Exhibit 11: Comparison between estimated market rents and actual rents (A-K)

This graph illustrates average market rents at area attractiveness level.

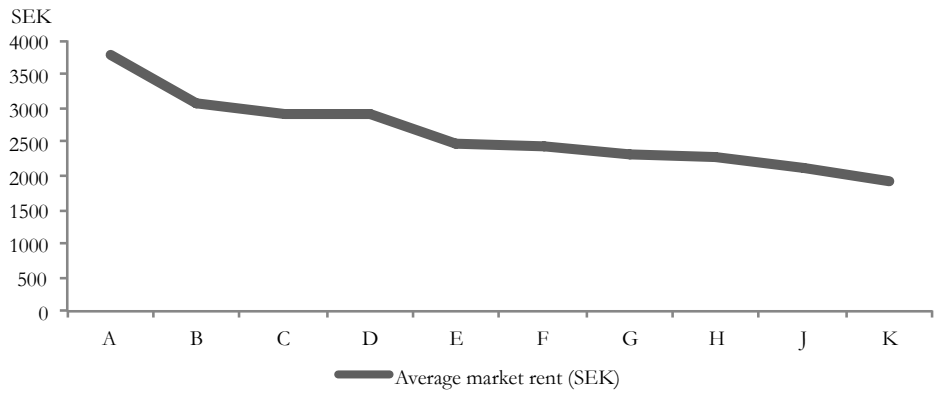


Exhibit 12: Histogram presenting the distribution of estimation outcomes

This histogram reports the distribution of estimation outcomes at percentage increase/decrease in rent levels at district level.

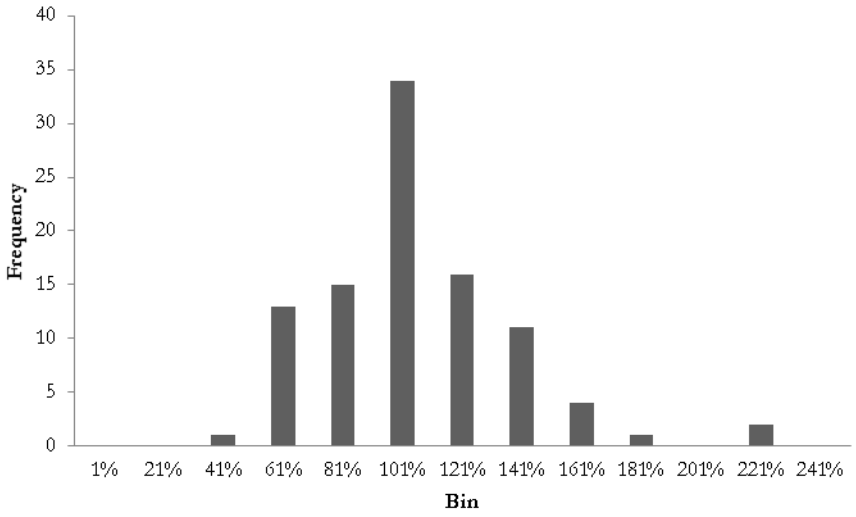
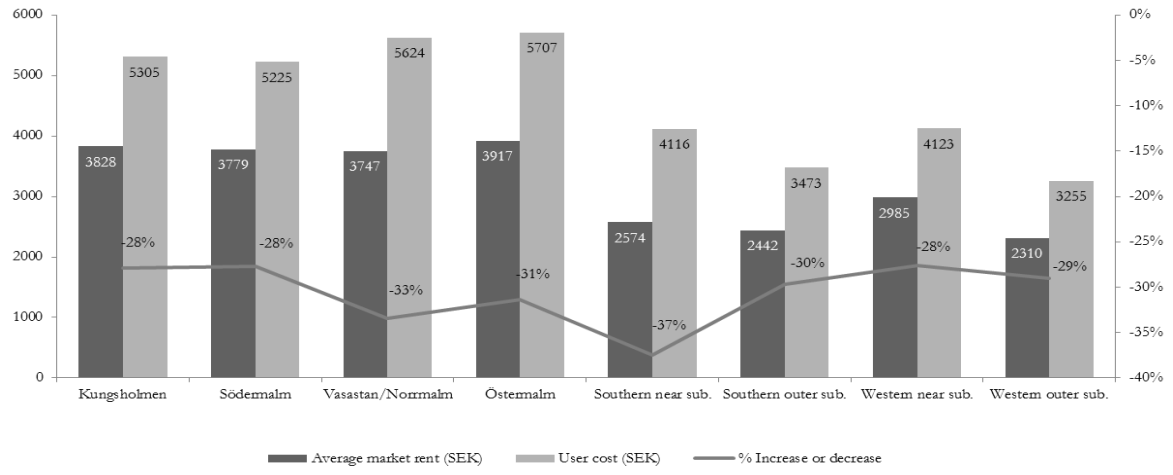


Exhibit 13A: Scenario analysis comparing estimated market rents and user costs

This graph reports the result of the estimated market rents, the calculated user costs in tenant-owned dwellings and percentage increases on the eight zones at the high user cost scenario, at year-end 2013.



Note: A - Interest rate mortgage loans at 10% and yearly expenditure at 2000/sqm

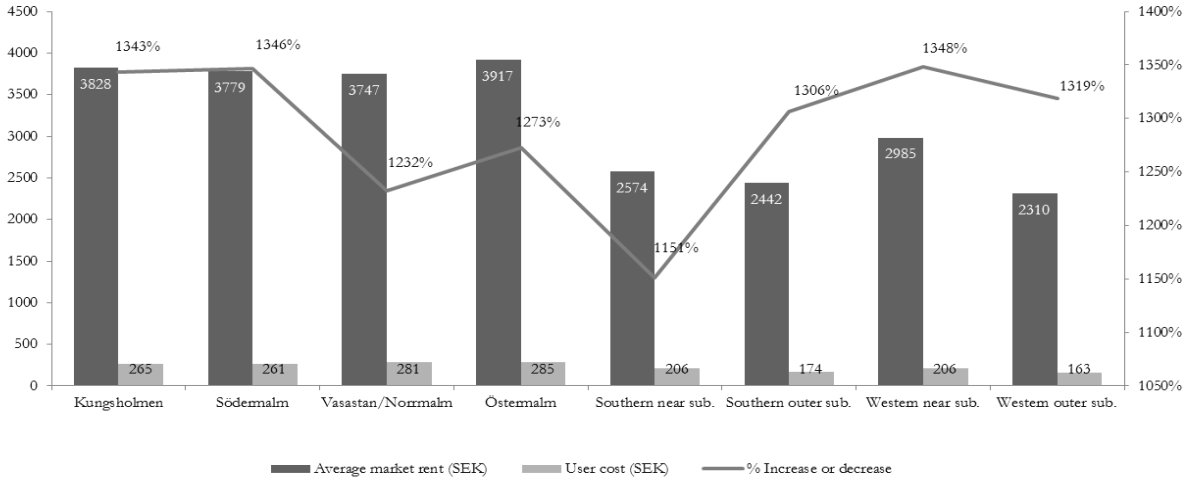
B - District division based on Mäklarstatistik (See Exhibit 4A)

C - Market rents and user costs are calculated at yearly costs per sqm

D - The user costs are calculated according to the formula on page 22

Exhibit 13B: Scenario analysis comparing estimated market rents and user costs

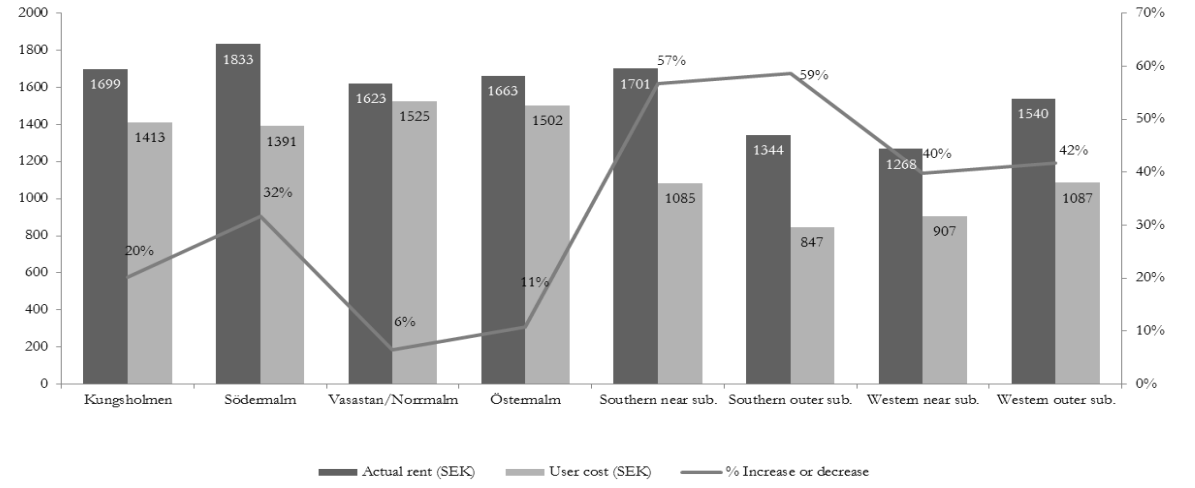
This graph reports the result of the estimated market rents, the calculated user costs in tenant-owned dwellings and percentage increases on the eight zones at the lower user cost scenario, at year-end 2013.



Note: A - Interest rate mortgage loans at 0.5% and yearly expenditure at 100/sqm
B - District division based on Mäklarstatistik (See Exhibit 4A)
C - Market rents and user-costs are calculated at yearly costs per sqm
D - The user costs are calculated according to the formula on page 22

Exhibit 13C: Comparison between actual rents and user costs

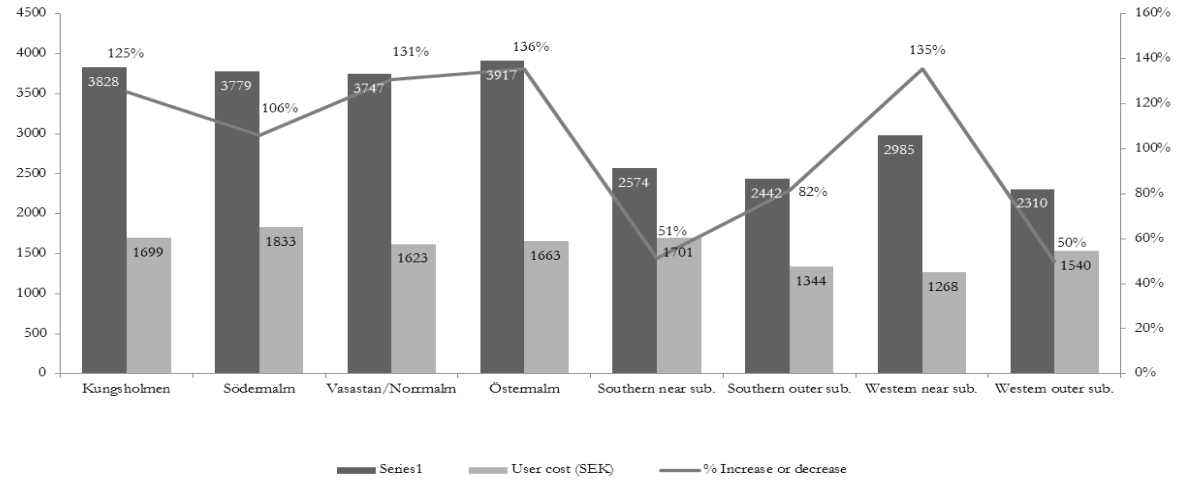
This graph reports the result of actual rents, the calculated user costs in tenant-owned dwellings and percentage increases/decreases on the eight zones at the base case scenario, at year-end 2013.



Note: A - Interest rate mortgage loans at 2.76% and yearly expenditure at 500/sqm
B - District division based on Mäklarstatistik (See Exhibit 4A)
C - Market rents and user-costs are calculated at yearly costs per sqm
D - The user costs are calculated according to the formula on page 22

Exhibit 13D: Comparison between estimated market rents and actual rents

This graph reports the result of estimated market rents, the actual rents and percentage increases/decreases on the eight zones at the base case scenario, at year-end 2013.



Note: A - Interest rate mortgage loans at 2.76% and yearly expenditure at 500/sqm

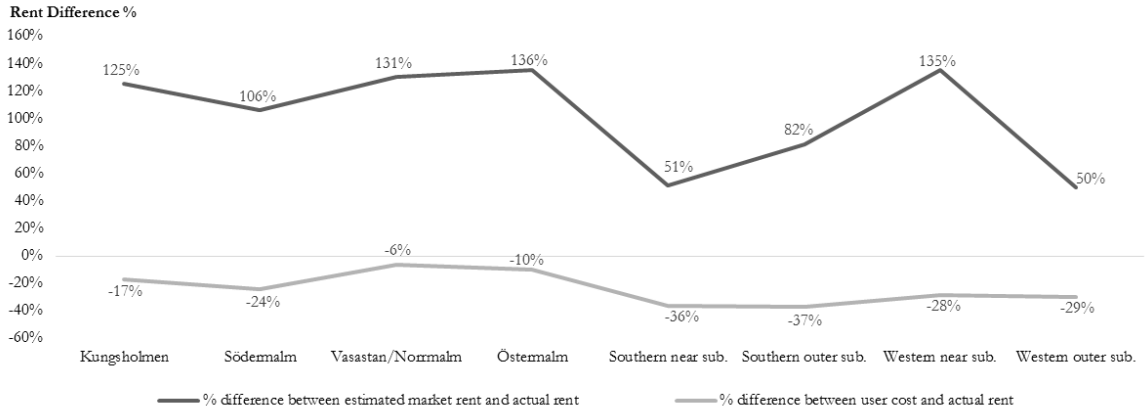
B - District division based on Mäklarstatistik (See Exhibit 4A)

C - Market rents and user-costs are calculated at yearly costs per sqm

D - The user costs are calculated according to the formula on page 22

Exhibit 13E: Percent rent differences between actual rents- market rents and actual rents-user costs

This graph reports the percent rent difference between actual rents and the estimated market rents and the difference between actual rents and calculated user-costs.



Interview questions:[23]

- What is the role of your organization/company?
- Your view on the current rent control system, market rents and "*Presumption rents*"?
- What factors affect supply and demand of housing?
- How does the rent level affect new construction?
- Would less regulated rents encourage more construction of rental housing? How should the rents be set in order to increase construction of rental housing?
- Have/how much have "*Presumption rents*" affected new construction?
- How does the current rent control system affect the black market?
- What is the reason for the low levels of new construction in Stockholm? (Expensive land costs, taxes, zoning permissions etc.)
- What factors determine rents?
- Regarding demand preferences: What would you say is the most important factor a tenant looks for when renting an apartment? E.g. green areas, proximity to the city center, size, floor levels, average income (status) etc.
- Why do different areas differ in queuing time?
- How does new construction affect queuing?
- Which factors affect queuing time?
- How come the spread of the queue in Stockholm is so wide, e.g. Östermalm 34 years whereas vacant apartments in Kista for example?
- Do you see any difference in demand for rental units as the prices of tenant-owned dwellings have increased dramatically the last couple of years and banks have become more restrictive in their lending?
    - How do you think households' choice of tenure, rent vs. buying, will change if the interest rates are raised again? A boom towards rental units or will people be able to afford their tenant-owned dwellings?
    - Tell us about the rent development in Stockholm, have you seen any difference during the last year/years?
- How do you think a change in regulation to market-rate rents will develop in Stockholm? Will we see a change in regulation closer to market rents?
- What factors would affect hypothetical market rents? E.g. income levels, queuing times, etc.
- Natural vacancies, what is the natural vacancy rate in the City, is it near the optimal level?
- How does the type of owner affect rent levels, bargaining power etc.?
- What is the impact of the new Act applied in 2011?
- Are there any differences in MHCs and private property owners that would affect hypothetical market rents? E.g. more long-term perspective, refurbishments and ongoing maintenance

[23] Each interview consisted of two parts; one generic with questions asked in all interviews and one part with tailored questions to the particular organization. The questions were used as a starting point and followed by discussions.

X. GLOSSARY

MHCs: Municipal Housing Companies, owned by municipalities. Since 2011, MHCs are to operate under commercial principles according to the Act 2010:879

Owner-occupied dwellings (Äganderätt): This tenure form means direct ownership. Dwellings occupied by the owners, not just the right to live in the apartment as in tenant-owned dwellings. This is possible in Sweden since 2009

Ohlssons Fastigheter: Private Property Company

Presumption rents: Since 2006, new constructed apartments are excluded the *utility-value-principle* and landlords are allowed to charge higher rents, see Act 12 kap. 55 c § jordabalken, JB

SABO, the Swedish Association of Public Housing Companies (Sveriges Allmännyttiga Bostadsföretag): Is the organization of the municipality owned public housing companies in Sweden. Has approximately 300 member companies managing about 725,000 dwellings all together

Stockholm Housing Service (Bostadsförmedlingen i Stockholm): Allocates apartments in Stockholm. Citizens can register for the housing queue on the first day of the month they turn 18, paying a yearly fee of SEK 225. Allocates senior and student apartments as well. All vacant apartments get posted, and eligible people can register for the vacant apartment in which he/she is interested. After the registration period, approximately 10 to 20 people who have been standing in the housing queue the longest get invited to view the apartment

The City of Stockholm (Stockholms Stad): The area included in Stockholms Stad, the municipality of Stockholm and not Stockholm County (Stockholms län)

Tenant-owned dwellings (Condominiums, Housing cooperatives or Bostadsrätter): This vehicle constitutes an indirect form of ownership. It differs from direct ownership in that the building is collectively owned by a legal entity, the cooperative association, of which the tenants are members. Usually there exists a separate association for each apartment building. The tenant acquires a share of the entity that represents his right to live in the apartment

The Stockholm Model: A proposed reformed version of the *utility-value-principle* with respect to the location premium. The model is an action plan for systematic rent setting, established by market players (the Swedish Union of Tenants, the Swedish

Property Federation and MHCs). The negotiations have stranded because the players did not agree about the value points in the model

The Swedish Construction Federation (Sveriges Byggindustrier): The Swedish Construction Federation is the trade and employers' association of the private construction companies and represents the interests of the construction industry in Sweden. Among its more than 3,200 member companies there are only about twenty groups with more than one hundred employees and just over 1,400 companies with ten or fewer employees

The Swedish National Board of Housing, Building and Planning (Boverket), abbreviated as The Swedish National Housing Board: The Swedish National Board of Housing, Building and Planning is a central government authority and is the national agency for planning, the management of land and water resources, urban development, building and housing. Boverket monitors the function of the legislative system under the Planning and Building Act and related legislation and proposes regulatory changes

The Swedish Property Federation (Fastighetsägarna): The Swedish Property Federation is a highly pro-active trade organization promoting an efficient real estate market in Sweden. Almost 20,000 property owners are members. The members represent the entire spectrum of the property industry, owning or managing premises and rental apartment buildings, industrial properties and tenant-owneds' associations

The Swedish Union of Tenants (Hyresgästföreningen): A membership organization with no party political affiliations. Negotiates with landlords concerning rents and terms and conditions of housing. Also work with opinion-shaping and lobby policymakers to improve conditions for tenants

User-value principle, utility-value principle or "Bruksvärdesprincipen": Rents are set according to this principle, the rent shall be equivalent to the rent of other apartments of similar standard, see Act chapter 12 jordabalken, JB

User cost: The housing costs for persons living in condominiums/tenant-owned dwellings. In this thesis the concept is simplified and consists of mortgage costs, derived from the purchase price and interest rates, and the expenditure/fee to the association