UNIVERSITY OF GOTHENBURG
SCHOOL OF BUSINESS, ECONOMICS AND LAW

Master´s Thesis in Economics

Does tightening lending policy put strains on the rental market? Evidence from Stockholm

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Abstract

With support from 6,288 observations of rental apartments in Stockholm, gathered from the Stockholm Housing Agency, this paper uses OLS regressions and theoretical frameworks to study and conclude that the implemented amortization financial stabilization policy, directed to the tenancy-owned market, has an indirect effect of increased demand for rental apartments in Stockholm. Furthermore, this paper also concludes that the amortization requirement is not the only variable describing the increased demand for rental apartments. Macro factors such as increasing- population and prices of tenancy-owned apartments, not controlled by the government, are also impacting and affecting the demand for rental apartments in Stockholm.

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Acknowledgements

During the Master thesis course, different hypothesis and thesis subjects was tested together with my supervisor Li Chen. Without the help and support from my supervisor, this thesis would never had been possible. Her recommendations, encouragement and especially guidance throughout the master thesis course have been of great importance.

When I decided to start writing about the effect of the amortization requirement on the rental housing market, data was of priority. I am grateful to Stockholm Housing Agency for helping me to access the data regarding rental apartments in Stockholm, and for providing me with the necessary information to understand the rental market in general.

Table of contents

1. Introduction

Rent control is one of the most debated public policy in Sweden. According to the Stockholm Housing Agency, queuing time for apartments in Stockholm has increased by a multiple of seven during the last 15 years. 556,000 agents are queuing in the region for a rental apartment, while only 7,000 contracts were mediated during 2016 (SHS, 2017), indicating that the demand for rental apartments are not met by supply. Using data of 6,288 observations from public- and hand gathered data source, I analyse the rental housing market in Stockholm, the capital of Sweden, and the implemented amortization requirement directed to tenancy-owned apartments indirect effect on the rental housing market. The variations of solutions towards the structure around the rental housing market, and the under-supply of housing is interesting enough to be analysed further. The steep increase of prices of tenancy-owned apartments, together with high debt ratios, brings curiosity surrounding the financial stabilization policies real effect on the different housing market options in Sweden. Previous literature lack information about the amortization requirement effect on the rental market, however, there have been numerous paper globally about the rent regulation effect on demand and supply of rental apartments (see Olsen (1979), Turner & Malpezzi (2003) and Arnott (1995)).

The importance to analyse the financial stabilization effects of the amortization requirement on Stockholm´s rental housing market, is emphasised when Stockholm´s population has increased significantly during 2005-2016. The population in 2005 was 1,889,945 and in 2016 the population was 2,269,060, accounting for a 20.0 percent increase during the eleven years (see Appendix Figure 1). Stockholm´s population is also expected to be increasing with 157,000 people over the next ten years (Stockholms stad, 2016), suggesting that queuing time will increase further if supply does not meet the demand for the agents. Furthermore, the tenancy-owned apartments price per square meter has resulted in a steady increase since 2005 in Stockholm with 133 percent (See Appendix Figure 2). The price increase of tenancy-owned apartments is signalling higher risks with financial debt towards the housing market, and may, if interest rates are increasing, create even more demand for rental apartments due to the financial risks. At the same time, the rent for rental apartments during 2005-2016 has only increased with 26.1 percent (see Appendix Figure 3), also indicating for increased demand of rental apartments.

This thesis main results after analysing the amortization requirement indirect effect on the rental housing market in Stockholm, is that queuing time for rental apartments in Stockholm has increased after the implementation of the amortization requirement on the 1st of June 2016. However, when controlling for agent's behaviour on the effect from the public announcement by the government the 23rd of March 2016, involving that the amortization requirement would be implemented on the 1st of June 2016, suggests that only trusting in results from analysis of queuing time for rental apartments after the 1st of June 2016, can lead to biased conclusions.

Moreover, this thesis first uses a rent control model to offer further insights on the theoretical predictions, and to present the consequences for the rental housing market from financial stabilization measures directed to the tenancy-owned market. Second, to test the predictions of the data gathered from Stockholm Housing Agency, hitta.se, sl.se, mäklarstatistik.se, hemnet.se google maps and Statistics Sweden (SCB), OLS regression techniques are used to study and analyse the effect of the amortization requirement on queuing time for rental apartments in Stockholm. The results suggest 138 days increase of queuing time for rental apartments in Stockholm, after the implementation of the amortization requirement and 182 days increase when controlling for the effect from the public announcement in March 2016.

In addition, when controlling for seasonal effects in the OLS regressions, the conclusion is that the amortization requirement can explain some part of the increased queuing time for rental apartments. However, macro variables such as increasing population and increasing prices of tenancy-owned apartments, not controlled by the government, are also impacting and affecting the demand for rental apartments in Stockholm.

With this thesis, I hope to bring more awareness to the issues Sweden has with supply of rental apartments and the effect financial stabilization policies directed to tenancy-owned apartment has indirect on the rental housing market. This thesis suggests the potential stress that financial policies can bring to the rental market. Given the under-supply of housing and increasing demand for rental apartments, if we only evaluate the effectiveness of amortization requirement on mortgages, our conclusion can be biased. After all, given increasing demand and under-supply of housing, a negative shock on demand for mortgage is translated into a positive shock on demand for rental apartments. The demand for apartments in Stockholm is high, but the supply of rental houses is regulated by rent regulations. Increasing prices for tenancy-owned apartments together with financial stabilization to control the personal debt ratio, has also an effect for the rental apartments, suggesting that policy makers should take into consideration the indirect effect towards the rental housing market of financial stabilization measure.

The thesis is structured in the following way: Section 2 is presenting related literature; Section 3 presents the background about the Swedish housing market and the amortization requirement; Section 4 is presenting the theoretical framework; Section 5 is presenting the data selection and the methodology used for this thesis; Section 6 is presenting the empirical results; In Section 7 the conclusions are drawn from the analysis and the empirical results.

2. Related literature

The rental housing market is a heavily debated subject in both public and academic literature. However, previous literature about the indirect effect of credit lending policies directed towards the tenancy-owned market is scarce. My paper connects two related and yet separate literature on housing, where the first strand of literature is focusing on rent control and the second strand of literature is focusing on establishing housing bubbles on household indebtedness. The purpose of rent control is to prevent high rent increases for tenants, and thus preventing agents from financial stress situations and unfair rent agreements. The majority of the literature focuses on the welfare consequence of rent control regimes.

Olsen (1979) analysed the benefits and costs of rent regulation with help from econometric techniques and data gathered from the New York City Housing Survey in 1968. He found that tenant's total benefits of rent controlled units in New York is estimated to have been 270 MUSD in 1968, which should be compared to the costs of 514 MUSD for the landlords, suggesting a net benefit towards the tenants. Turner and Malpezzi (2003) also analysed the benefits and costs of rent regulations effect on the rental market, where they surveyed selected literature with an even closer focus on empirical literature. They conclude in their findings that the welfare results of rent controlled regimes differ when studying multiple regions. Furthermore, Turner and Malpezzi (2003) concludes that the effect of rent controls depends on what type of rent control regime is implemented and that the effect also depends on market conditions.

Arnott (1995) also studied the rent control market and analysed if there was a change of opinion regarding rent controls during the 1990´s. Arnott (1995) discover that the second generation rent controls, which is later described in section 3, should be dependent on a case-by-case principle of the tenants. He also detects empirical evidence from that rent controls have been imperceptible, and that the effects that are perceptible have had uncertain efficiency and welfare implications. Arnott (1995) also performed an interesting study in 1990 from a random selective sample of agents. The agents were asked if they agreed or disagreed with 40 different economic statements. The greatest degree of consensus of any question, was on the statement *"A ceiling on rents reduces the quantity and quality of housing available"*. 93.5 percent agreed on the former statement. In the years following the above study, the housing economists' opinion about rent controls changed to the opinion that a well-designed rent control program can be beneficial, and thus generating more benefits than costs for the society welfare.

Furthermore, segregation effects of rent control regimes are also a debated subject regarding the rental housing market. According to Glaeser (2002), the purpose of the rent controls on the rental housing market is to provide with housing for every agent in expensive cities and mix the rich with the poor, thus creating decreased segregation in the society. However, Glaeser (2002) found evidence that economic theories do not necessarily predict that rent control will reduce segregation. Resulting in a best-case scenario where the policy regime of rent controls works as an *"aid for integration"* because it creates "*pockets of low rent together with low quality*" (Glaeser, 2002).

The second strand of literature is about establishing housing bubbles on household indebtedness. Finocchiaro et al (2011) studied the household indebtedness, suggesting that the high degree of regulations on the housing market may potentially increase the indebted household exposure to tenancy-owned houses and interest rate fluctuation. Furthermore, Finocchiaro et al (2011) also suggests that the heavily regulated rental market in Sweden is contributing to shortage of supply. Indicating that that shortage of supply of rental apartments can have an important function in the development of house prices and indebtedness. Hull (2015) also studied the amortization requirements and household indebtedness in Sweden, focusing on the Swedish Financial Supervisory Authority (FSA) identification of the amortization as an instrument for controlling for household indebtedness. Hull (2015) suggests that increasing the rate for the amortization requirement is ineffective for reducing indebtedness.

Recent thesis's such as Mattson (2015) studied the stabilization policies impact on the housing market in Sweden with greater focus on the increasing household debt, concluding that neither amortization requirements or debt-to-income ratio limits answers the real purpose for the enlarged household indebtedness. Mattson (2015) suggests that an amortization requirement will not have any greater effect on lowering the indebtedness for agents on the housing market, which is supporting Hull's (2015) findings.

In addition, previous literature on the determinants of queuing time for rental apartments in Stockholm has been done using OLS regressions techniques. Zahir (2005) suggested that queuing time for apartments decreases when rents and the distance to the inner-city centre increases, which is also supported by Lindblad (2010) and Nabseth & Strömsten (2014), who also analysed the queuing time for rental apartments in Stockholm. However, Lindblad (2010) and Nabseth & Strömsten (2014) used the data to estimate market rents without the rent control regimes, contributing more to the benefits and cost theories surrounding rent controls, similar to Olsen (1979) and Turner & Malpezzi (2003). Recent studies about queuing time for rental apartments is also found in Johansson (2012), where he studied the preferences on the rental housing market in Gothenburg. Concluding that the geographical location of the rental apartment, determines the queuing time required for receiving an apartment.

Previous studies such as above has analysed different determinants of queuing time. However, this thesis analyses new unique data, new hand-gathered data and is studying another perspective with queuing time as the dependent variable. While previous literature has studied the market equilibrium rent without rent regulations, this thesis studies the effect of the amortization requirement, emphasized mainly on the positive effect of financial stabilization by using amortization. My thesis points out that financial stabilizing policy aimed at the tenancy-owned apartments can cause indirect effect on the rent controlled market.

3. Housing market in Sweden

The following historical background and description is based upon the late 19th century and is largely a consequence of the two world wars and the economic fluctuations from 1917 - today.

History of the Swedish housing market

There is a tradition of rent controls in Sweden, which holds back investments and construction of apartments because of the lack of profit that could be possibly generated from investing in rental apartments. Consequently, we today have large queues for rental apartments in Stockholm (see Appendix Figure 8). Rental Controls in Sweden goes back to the 1917, which are called the first generation rent controls. After the first world war, several nations introduced rent controls, and in Sweden it was introduced in 1917. The purpose was to protect the tenants from the price increase that could be expected from the lack of apartments after the war, lower salaries and the expected need for the landlords to increase the rents. The Swedish parliament abolished rent controls with one vote overweight for the "yes voters" in 1923. The consequence was that housing construction increased considerable (Sandberg, 2002).

The government introduced rent controls again in 1942 because of the same reasons as in 1917, but there was no reason to believe that these rent controls were supposed to last after war time. The rent regulations were an "war time effort" that would later be revised (Sandberg, 2002). Housing policy became a very own political area after the second world war. The problem was focused on the lack of apartments with good living standards (Boverket, 2007). During the last years of the 1940's, the government created "Allmännyttiga" (hereby named "Public Housing") housing companies which had a great growth in constructions during the 1940's, and helped agents with housing, which was updated to modern standards (Boverket, 2007). In the middle of the 1960's the demand for apartments was increasing. In Sweden, this demand for apartments created the term "Miljonprogrammet" (the million program), which was a ten-year plan of building real estates for the citizens in Sweden. Between 1961-1975 up to 1,4 million of real estates were built in Sweden, and up to 900 municipal housing companies were active (SOU, 2008). This would later build up a supply that exceeded the demand during the first half of the 1970's. First generations rent controls were discounted and substitute by the second generation rent controls in 1968 and with later additions in 1974, with the so called "Bruksvärdesregleringen" (Use Value principle), (Sandberg, 2002).

During the 1990's the market drastically changed for the residential companies because of the reduction of subventions from the government and tax reliefs, resulting in decreased production of new houses (Boverket, 2007).

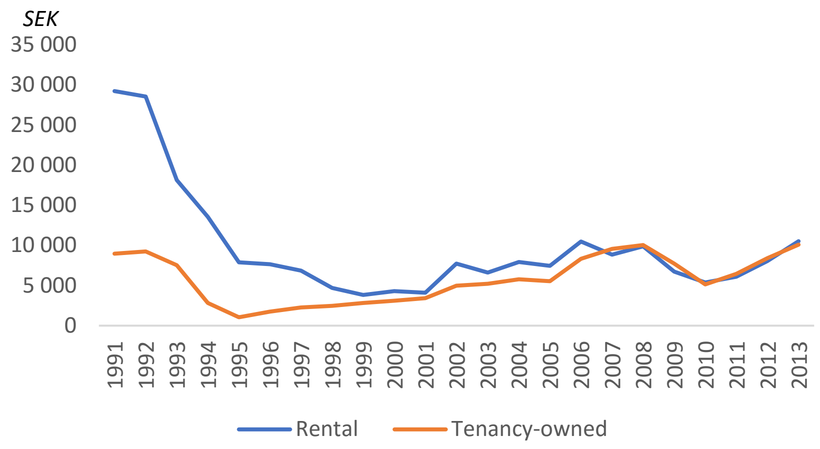

Figure 1: *Number of completed apartments divided in tenancy-owned- and rental apartments, during 1991-2013.* (SCB)

In Figure 1, we can see how the production of completed rental apartments and tenancy-owned apartments during 1991-2013 has developed. We can observe the dramatical downfall of the production in 1999 of only 6,651 completed rental apartments, to compare with the beginning in 1991 with 38,201 completed apartments (SCB). The public housing was supposed to run more like a business during the 1990s. One of the ground pillars for the policy of rent controlled housing previous years have been that people with low income, has social problems or financial problems, should not be assembled in the same places. The housing policy has in that sense, an important variable in the segregation that started to take more place during 1990's (SOU, 2008), contrary to the theories and conclusions of Glaeser (2002), earlier described.

The Swedish housing market today

In Sweden today, the tenure structure consists of public rental, private rental and tenancy owned apartments. At year end 2015, the share of rental and tenancy owned apartments consisted of 45-and 55 percent respectively (SCB). For rental apartments, the aim is to create equal conditions with fair rents for the tenants (Hyresgästföreningen, 2013). However, there are structural problems in the Swedish housing market, which causes long waiting queues for apartments in the inner city and creating vacancies in other areas (Hüfner & Lundsgaard, 2007). One of the reasons for the increasing queuing time is the Use Value principle. The Swedish rent system is not straight forward and is not like other countries system. The Swedish Tenant Union divides the price system for apartments in the below scale:

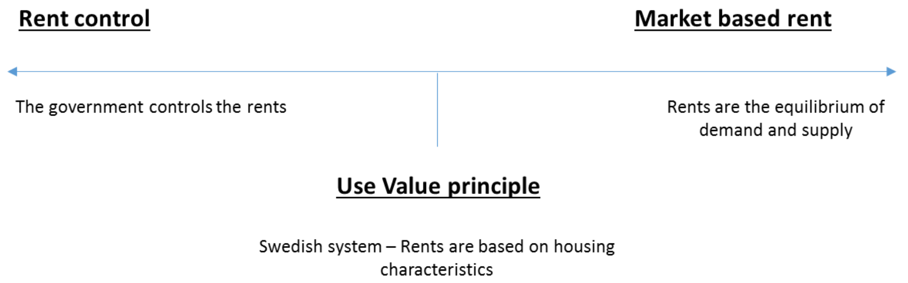

Figure 2: *Overview of the rent market.* Inspired from Hyresgästföreningen (2013)

The left side in Figure 2 represents a market where rents are based on rent controls, which means that the government is controlling the rents like in 1917 and 1942 in Sweden. The right side represents market based rents, where rents are the equilibrium of demand and supply. The Swedish Use Value principle is in the middle of rent controls and market based rents, resulting in a mix of them both. There is no system today that only has market based rents. However, there are countries with market based rent system together with a system with public housing directed for tenants that are outside of the system (Hyresgästföreningen 2013). The apartments rent is decided between a collaboration by the Rent Law and the Rent Negotiation Law (1978:394). Boverket (2014) describes that the Rents Law function is to judge if one apartments rent is fair, when a tenant and a landlord disagree. The purpose of the Rent Negotiation Law is to describe how rents can collectively be negotiated. The Use Value principle should also protect the tenant's tenancy rights, which includes an above limit that the landlord could increase the rent and the right to extend the apartment contract (Hyresgästföreningen, 2013).

The price of the rents, according to the Use Value principle, is basically dependent and decided in the following two directions according to Boverket (2014). First, the work is to find apartments that is similar to the apartment in were the rent should be valued. Second, when data from several apartments has been assembled, the apartments rent is decided. If the rent is substantially higher than the other apartments, the rent is seemed as unfair. A new law implemented in January 2011 included that the comparison of apartments should be to apartments that are close by in location and were the rents has been decided by collectively negotiated agreements. See Appendix Exhibit 4 to find a summary of the Swedish Housing policy.

Amortization requirement

In order to analyse the effect of the amortization requirement on the rental market, it is important to know the historic background as well as how the amortization requirement works today. This section present how the amortization requirement has developed from 2013-today.

History of Amortization requirement

The Swedish Financial Supervisory Authority (Finansinspektionen) (hereby "FI") was commissioned by the government to strengthen the foundation for a healthy amortization culture in 2013. The commission was assigned to investigate the conditions for a suitable regulation for the credit lenders to individually adjust amortization plans for their customers. The suggestion to the credit lending companies from FI, was to establish with their customers an individually adjusted amortization plan that ensured that the households encompass a "*good and thorough understanding what it means to amortize*". The amortization plans would also consider various of factors such as income, size of mortgage and rent (FI, 2013).

With the mission to stop an eventual economic recession, FI suggested the 11th of March 2015 to introduce the amortization requirement with support from the Swedish law 6 kap 4 § (2004:297) (Regeringen, 2016). The suggestion was aimed to counteract macro economical- and financial stabilization risks that are attached to the households' increasing net debt. (FI, 2015). The government submitted a bill on the 9th of February 2016 with the suggestion of introducing the amortization requirement, which the parliament voted on the 23rd of March 2016. The law was later implemented the 1st of June 2016 (Regeringen, 2016). These two dates are later used as dummy variables for the data analysis in section 4-6, in order to analyse the effect of the amortization requirement on queuing time for rental apartments in Stockholm.

Theory of Amortization requirement

With the amortization requirement implemented, the requirement is considered as a first step to lower the risks attached to the household's net debt as earlier described. The amortization requirement contains essentially according to Regeringen, (2016):

- The amortization requirement is directed towards mortgages which exceeds 50 percent of the value of a dwelling
- When mortgages exceed 70 percent of the value of the property, the mortgage should be amortized by at least 2 percent per year. When mortgages are between 50 and 70

percent of the value of the property, the mortgage should be amortized with 1 percent per year.

- The valuation of the property should be based on the market value. Also, a revaluation should take place at the earliest every five years, or when significant changes in value of the property that are not due to the general price trend in the housing market appears (Regeringen, 2016).

Amortization requirement effect on housing market

The amortization requirement is focused and directed towards tenancy-owned apartments and houses. Regeringen (2017) concluded that the amortization requirement, since its implementation has had an effect towards tenancy-owned houses. The conclusion was based on that agents with new mortgages are lending less and are buying cheaper houses.

Regeringen (2017) also concluded that the average loan ratio for new homeowners decreased to 64 percent in 2016, which is a one percent decrease compared to 2015. The average debt-income ratio, meaning the total debt in relationship to income for households with new mortgages, decreased from 406 percent during 2015 to 402 percent for 2016 (FI, 2017). FI (2017) concluded that the implementation of the amortization requirement was the reason for the decrease in average debt-income ratio during 2016, because of the share of substantially high average debt ratios over 750 percent had decreased. This ratio has previous increased steadily since 2011, which then recorded a 325 percent debt ratio level.

The amortisation requirement tightens the ability for agents to borrow money for new houses and instead force agents to buy cheaper houses (FI, 2017). This makes sense, since the prices for apartments in Stockholm inner cities has increased substantially over the last three years.

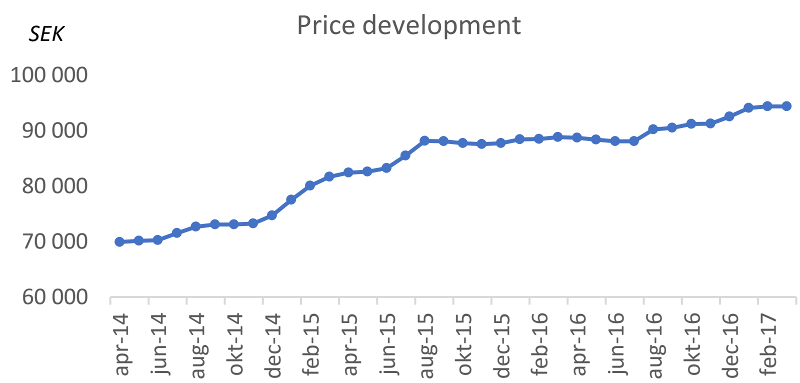

Figure 3: *Price development for tenancy-owned apartments in Stockholm per sqm,* (Mäklarstatistik, 2017)

The prices per square meter for apartments have increased with 34.9 percent according to Mäklarstatistik (2017), illustrated in Figure 3. The amortization requirement is one of the financial stabilization measure implemented by the government. One of the purpose is to have a negative effect on the price increases for tenancy-owned houses. We can see from Figure 3, that during the time for the amortization requirement policy to be implemented into the system, 23rd of March 2016 to the 1st of June 2016, the prices for apartments in Stockholm did stabilize. However, the prices still increase slightly after the practice of the amortization requirement.

The amortization requirement also indirect effects the rental market. When it is harder to buy apartments, agents instead turn to the rental market. This would increase the queuing time for rental apartments after the passing of the amortization requirement. The theory for this thesis is that agents who are on the Stockholm Housing Agency attendance list (who supplies rental apartment) but also looking to buy an apartment, now instead turns to the rental market when it is harder to borrow money, as an effect of the amortization requirement.

Stockholm Housing Agency

The Stockholm Housing Agency is the company who has provided most of the data for this paper, involving 6,288 unique observations of rental apartments in Stockholm, provided from their database to this thesis. An observation from the Stockholm Housing Agency is a registration of the specific agent's choice of apartment, meaning the address, the rent for the apartment, size, number of rooms, the time the agent has been on the queuing list until he or she got the apartment and the date when the agent is registered as the tenant of the apartment.

Stockholm Housing Agency allocate 10,000 apartments each year and has brokerage rental apartments in the Stockholm region since 1947. Since the start in 1947, the agency has brokerage over 600 000 apartments (SHS, 2017). Everyone who has turned 18 years of age, pay a yearly fee of 200 SEK and has a Swedish personal identity number, can be registered as a housing applicant and start queuing. Both public and private housing companies can let the Stockholm Housing Agency rent out their apartments.

On the webpage, bostad.stockholm.se, applicants can search and submit notices of interest for apartments of their choices. According to Stockholm Housing Agency, the queue is a result formed of the agents who have submitted notices of interest for an advertised apartment. The person that has queued the longest is primarily offered the apartment. When the agent has chosen apartment, his or hers queuing time is set to zero. This information is used in the next section.

4. Theoretical framework

In this section, I present the classical rent control model that offers theoretical predictions for my empirical analysis. The model is illustrated in Figure 4, implemented with a positive demand shock for rental apartments, causing the demand curve to shift upwards.

First, consider the rental market clearing prices at P^* and clearing quantity of rental apartments at Q^*, developing an equilibrium of demand and supply. Now, consider the market with rent control, were the government introduce a price ceiling for rental apartments at P^C, while Q^{**}units of apartments are demanded, but only Q^C units of apartments are supplied to the market, resulting in an under-supply of apartments. This raises questions on who should get which apartments when the price of rent is capped. As in the case of Sweden, queuing time determines the priority in applying for apartments. Stockholm Housing Agency uses queuing time as a separator for choosing which agent should get which apartment. The agent with longest time of queuing time, has the opportunity to pick the available rental apartment, as earlier described. The general practice for receiving a rental apartment in an attractive area, is to register at the Stockholm Housing Agency and be on the waiting list for more than 10 years (SHS[2] 2017). This queuing time can influence buying rental contracts on the black markets, which is illegal, or to buy cheaper apartments because of the newly introduced amortization requirement.

Second, consider that there is a positive demand shock, resulting the demand curve D shifting towards D^*. Now at P^C, there are Q^{***} agents demanding apartments, rising from Q^{**}. If the new interested applicants for a rental apartment have long queuing time, then they will increase the queuing time for each apartment. However, if the interested applicants on average have shorter queuing time compared to other applicants, then the increase in demand will not translate into an increase in queuing time. Since, the theoretical results suggest that a positive shock on demand may or may not increase queuing time, this is implying that it remains an empirical question whether queuing time will increase.

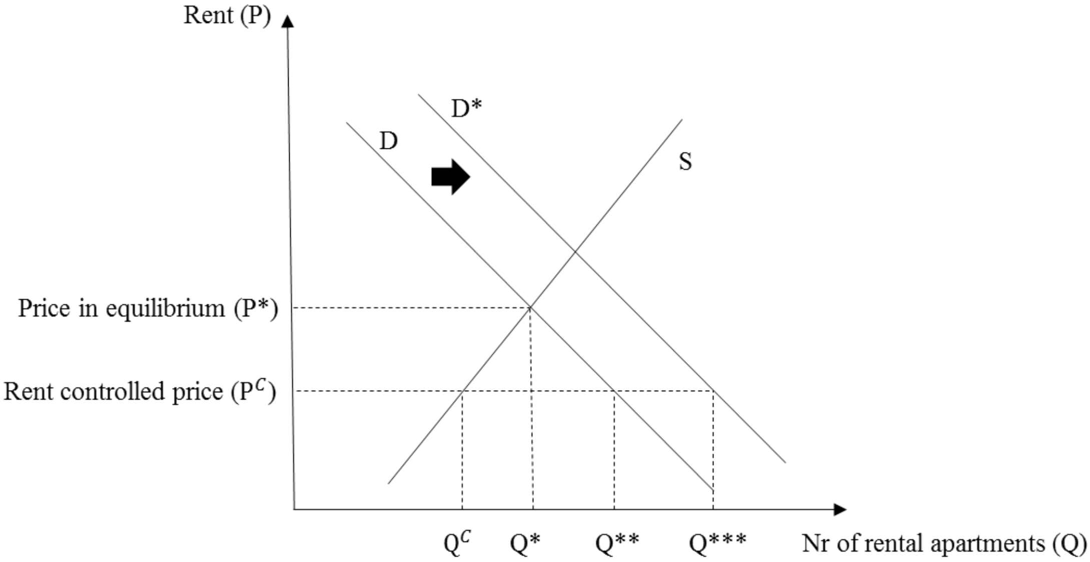

Figure 4: *Effect of rent regulation and positive demand policy chock. (Own source)*

With the amortization requirement implemented towards the tenancy-owned housing market, which is decreasing the amounts of mortgages in Stockholm and contributing to tightening the lending policy, agents instead turn to the rental market for housing. This presented theory suggests that the queuing time for rental apartments in Stockholm should increase. In the next section, I investigate a policy change on amortization requirement during 2016, which can be considered as a positive shock on demand. The following hypothesis can be obtained based on previous theoretical analysis.

H_0: *The amortization requirement does not increase queuing time for rental apartments in Stockholm*

H_1*: The amortization requirement increases queuing time for rental apartments in Stockholm*

5. Data and methodology

To analyse the effect of amortization requirement on queuing time for rental apartments in Stockholm, it is essential to have data and a methodology procedure. This section provides information of where the data is sampled from, information regarding the variables obtained from the data and what methodology is used. This section also discusses limitations- and provide a summary of the dataset.

5.1 Data

The selection of data to evaluate the effect from the amortization requirement on the rental market is critical. The largest part of the dataset, used in this thesis, is collected and received from the Stockholm Housing Agency. The panel-data provides information regarding rental apartment observations between the 1st of January 2015 to the 21st of April 2017. The dates for the observations are chosen to obtain and study the effect of the amortization requirement implemented the 1st of June 2016. The dataset consists of 6,288 unique observations of rental apartments in Stockholm, provided for this thesis, which should show statistical evidence supporting the thesis hypothesis.

The variables *Rent, No. of rooms, Size, Queuing time* and *Yearly rent/sqm* are obtained from the Stockholm Housing Agency dataset. Previous thesis's have been done using data from the Stockholm Housing Agency, to analyse different hypothesis and time periods with queuing time as dependent variable, such as Zahir (2005), Lindblad (2010) and Nabseth & Strömsten (2014). Johansson (2012) also used similar data from another housing agency called boplats.se, to analyse the Gothenburg rental market.

The webpage scb.se, were the Swedish official statistics is gathered and presented, is used to obtain the variable *Average income.* Also, the personal information webpage hitta.se is used for the variable *Average income,* as a supplement when scb.se could not provide with statistics for the observed district.

The commuting travel webpage sl.se is used to manually gathering information for the variable *Travel time.* In addition, the app Google maps, is used to manually gathered and receive information for the variable *Travel distance.* The data is obtained from drawing and measuring the distance from Drottninggatan in Stockholm to the observed apartments district. Drottninggatan is considered as the centre of Stockholm for this thesis.

The webpage mäklarstatistik.se and hemnet.se is used for gathering each district average tenancy-owned prices per square meter during 2016. This information is later used for the district variables *District (1-10),* where *District 1* is the most attractive district to live in Stockholm and *District 10* is the least attractive district to live in.

Description of data

Rent

The *Rent* variable is straight forward and is the mediated monthly rent for the tenant who live in the observed apartments. This variable is important for every tenant who chooses an apartment to live in. The *Rent* variable is the direct negotiation between the tenant and the landlord according to the earlier described Utility Value principle. A high *Rent* variable could decrease the queuing time for an apartment, thus showing a negative relationship. The *Rent* variable is measured in SEK.

No. of rooms

The *No. of rooms* variable is also straight forward, involving information of the number of rooms for the observed rental apartment. The demand for apartment can increase or decrease with the number of rooms in the apartment depending on the agent's preferences. The average number of rooms for the dataset is 2.38, which can be interpreted that a two-and a half room apartment is the most demanded apartment in our observed dataset for the Stockholm region or is the most supplied. A two-and a half room apartment can be a home for a single agent or couples in different stages in their life's, thus increasing the demand for the characteristics.

Size

The data from Stockholm Housing Agency contains the size for every apartment, measured in square meters. An increase in apartment size can increase the living standard for the agent living in the apartment, thus be an important variable for estimating the *Queuing time*. A larger apartment in *Size* will have a higher *Rent* according to the Utility Value principle and thus decrease the demand for the apartments. However, large families are demanding larger apartments, and thus show a higher demand for apartments with larger *Size* variable.

Queuing time

Queuing time is measured in years. The variable contains information about how long time the specific tenant has been waiting for the apartment. This variable is the most significant for my hypothesis and is regarded as the demand variable for the observed apartments by the agents.

If *Queuing time* for a rental apartment is long, this can be translated as that the demand for the apartment is high. See Appendix Figure 5 and 7 for average queuing times for all observed apartments and for each district. *Queuing time* is the dependent variable in the five different OLS regressions, later described in the Empirical identification section. Also, see Appendix Figure 11 for a Histogram of *Queuing time.*

Yearly rent/sqm

Yearly rent/sqm, measured in SEK, is the yearly rent divided by square meter for the agent's apartment. This variable, provided by Stockholm Housing Agency, gives important information about the demand for the apartment. It is an important ratio for the tenant to maximize the apartments size relative to its rent.

Travel time

The variable *Travel time* is calculated using the search engine on sl.se. From the search engine, it is easy to search information about the time it takes for agents, living in the observed apartments district and travel to the central station in Stockholm. This is an important factor that can be considered as an attractiveness variable for choosing apartments. This, because of the need for getting to work in the inner city of Stockholm and the possibly improved living standard to be near the central of the nation's capital. The longer distance to the central station, the lower demand for the apartment is assumed. However, this is not always the case, to catch the limitation of the data that one Stockholm district may be more attractive, although it is not near the inner city, ten district attractiveness variables are also taken into consideration, later described in the variable information section for *District (1-10).*

Travel distance

Google maps is used to maintain data for the variable *Travel distance*, were the data is manually gathered from drawing lines in the Google maps system, from the observed apartments district centre to Drottninggatan in Stockholms inner centre. The distance is measured in meters (See Appendix Figure 7). *Travel distance* is an important variable that can affect *Queuing time*, and hence the demand for the observed apartment. Below is an illustration on how the data is manually gathered from measuring the distance. We can see from Figure 5 that the distance from Drottninggatan to Gamla stan is approximately 840 meters.

Figure 5: *Example of Travel distance from Drottninggatan to the district Gamla stan* (Google maps)

Avg. income

Average income for the district is also used in this thesis as an attractiveness variable. The data is obtained from SCB for every Stockholm district. For districts where average income data could not be found from SCB, or when districts have many observations, the search engine on hitta.se was used to provide supplementary data of average income for specific streets. The variable is important because agents with higher income, may want to live with other agents with high income. The variable is also considered as an attractiveness variable because of where agents with high income live, districts may tend to be popular.

District (1-10)

The fixed effect dummy variables *District (1-10)* is complementing the variable *Travel time, Travel distance* and *Avg. income*. There can be many ways to determine attractiveness of a district. This thesis presents a model were data from mäklarstatistik.se and hemnet.se first has been manually gathered for 87 different district and second divided into 10 different other districts, were *District (1)* is the most demanded district to live in, and *District (10)* the least demanded. See Appendix Exhibit 7 for the division of districts. The data gathered from mäklarstatistik.se and hemnet.se is information regarding the average prices for every district tenancy-owned apartments sold during 2016 in November. High prices for apartments in the district can be regarded as the most attractive district to live in and low prices for apartments can be regarded as the least attractive districts to live in. The fixed effect dummy variables for *Districts (1-10)* is used to observe the effect of the different districts on *Queuing time*. Below is a self-made map showing every different district and their attractiveness number. From

Figure 6 it is easy to see that the district closes to Drottninggatan is the districts which are the most demanded. We can also see that district near Kista, *District 10*, is the least attractive district to live in.

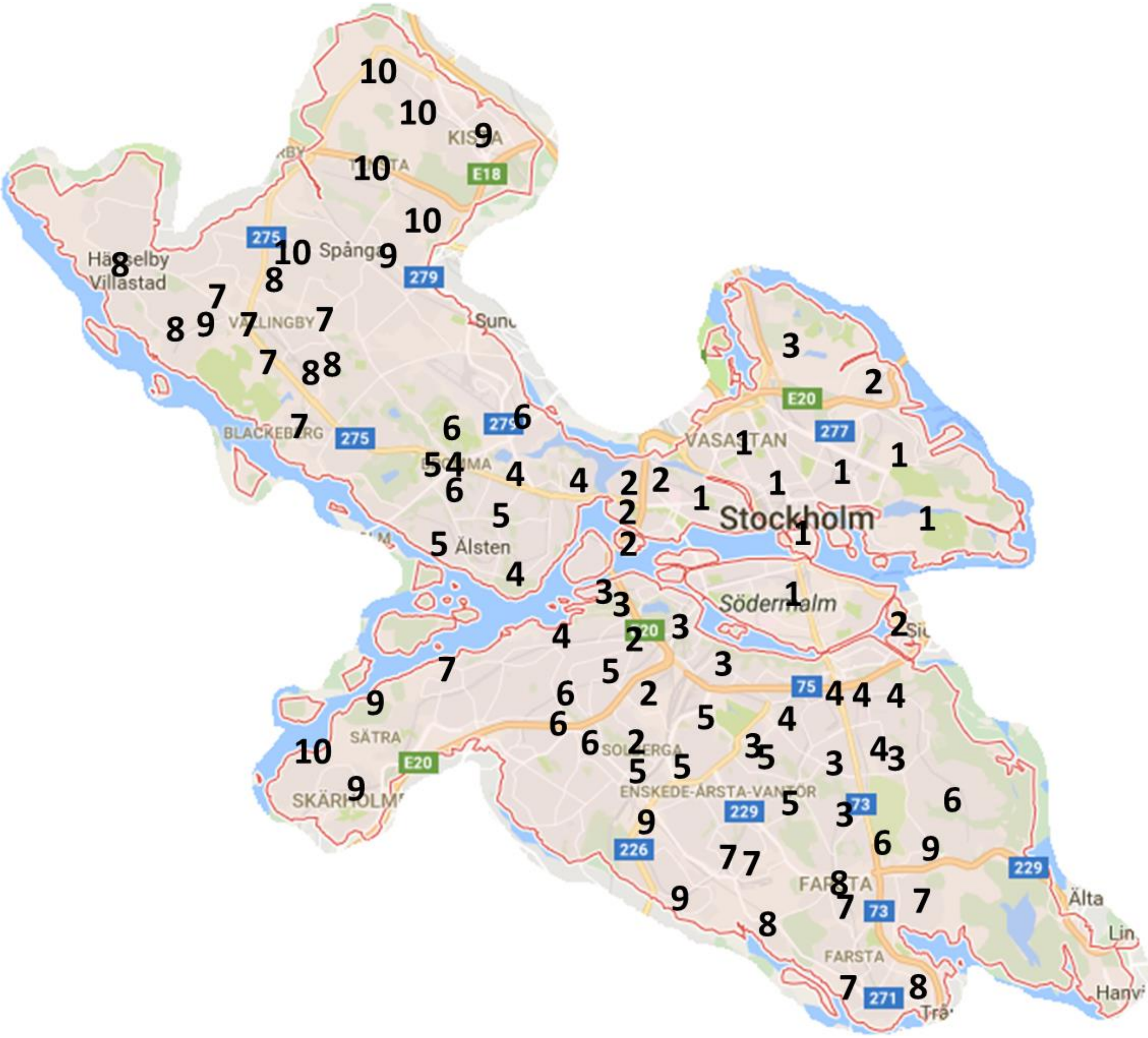

Figure 6: *Map over Stockholm with the District 1-10* (Google maps and own estimations)

Amortization dummy variables

Dummy variables are included in the data to capture the amortization requirement effect on rental apartments. *Amortization (March)* is equal to 1 if the observed data is registered before 23th of March 2016, and 0 otherwise. This dummy variable is of importance due to the public announcement on the 23rd of March by the government, that the implementation of the amortization requirement would take effect from the 1st of June 2016. Hence, the 23rd of March is the first date our agents behaviour can be observed. Some individuals may have already in

March demanded a rental apartment, because of this, two different amortization dummy variables are used in the OLS regressions to capture the effect.

The other amortization dummy is the *Amortization (June)* variable. *Amortization (June)* is equal to 1 if the observed data is registered before the 1st of June 2016 when the amortization requirement passed, and 0 otherwise.

Yearly dummy variables

This thesis uses fixed effect yearly dummy variables for 2015, 2016 and 2017 to account for seasonal effects. The variations of the demand for apartments can depend on how many agents moved to Stockholm during the years or increased demand for rental apartments due to increased prices of tenancy-owned apartments. Hence, the fixed effect yearly dummy variables are implemented to control for overestimations of our amortization requirement dummy variables. *Year 2015* is equal to 1 if apartments are registered during 2015 and 0 otherwise. *Year 2016* is equal to 1 if apartments are registered during 2016 and 0 otherwise. *Year 2017* is equal to 1 if apartments are registered during 2017 and 0 otherwise.

Limitations of the data

Because the data consists of 6,288 observations a few simplifications have been made. The average income variable, *Avg. income,* is the average income for every district. In districts with many observations as in *District (2)*, *District (7)* and *District (8)*, data for the variable *Avg. income* has been covered for more addresses than only at district level, this to increase the credibility for the variable.

The variable *Travel time* is based on the commuting time it takes from the observed district to the central station in Stockholm. There are however other measurements that could have been used instead. Suggestions of other measurements are; The time it takes to walk, the time of cycle to the central station or the time it takes to travel by car to the central station in Stockholm. Not every agent use train or bus for travel to work.

The dataset from Stockholm Housing Agency is large, but there are some data that could have been implemented in a best-case scenario for this thesis. Stockholm Housing Agency could not include data for housing characteristics as number of floors, how old the buildings are, or due to integrity reasons income of tenant living in the observed apartment. Stockholm Housing agency could also not provide information regarding the quality standard of the apartment. In this thesis, I use the rent level instead for compensate for this. The rent level should be an approximation in level with the Utility Value principle, which is earlier described, and should be a measurement for different house characteristics for our observed rental apartments.

Furthermore, the fixed effect dummy variables *District (1-10),* are calculated using average price statistics for tenancy-owned apartments for every district. In a best-case-scenario, this thesis should have more price statistics observations for individually streets and thus providing better estimated coefficients. Because of the time constraints of thesis work, this could not be implemented.

To analyse the amortization requirement effect on *Queuing time* for rental apartment, some assumptions must be made. The amortization requirement makes it harder to borrow money for an apartment and agents instead turns to the rental market. However, there could be several other macro factors increasing *Queuing time* for rental apartments in Stockholm, which are limitations of this thesis. Suggestions of other macro factors are; Increased prices for tenancy-owned apartments, implicating a higher *Queuing time* for rental apartment or increased population moving into Stockholm, which also could increase *Queuing time.*

Summary statistics

Table 1 below summarizes the statistics for all independent variables, as well as our dependent variable. The number of observations that Stockholm Housing Agency provided for this thesis is 6,288. For the social status dummy variables *District (1-10),* the variables *District (7)* and *District (8),* have the most number observations of data with 23.28 percent and 12.26 percent respectively. Our fixed effect yearly dummy variables *Year (2015), Year (*2016) and *Year (2017)* have 46.99, 39.34 and 13.66 percent number of observations respectively. The amortization requirement dummy variable observed number of data equal to 1 was 2,339 for *Amortization (June),* and 2,702 for *Amortization (March).* The variables *Yearly rent/sqm*, *Rent* and *Avg. income* is measured in SEK. *Travel time* are measured in minutes, *Travel distance* in meters, *Size* in square meters and *Queuing time* in years.

The average *Queuing time* is 10.58 years, minimum is 0.14 and the maximum value for the variable *Queuing time*, meaning the maximum years for queuing for an apartment in Stockholm, is found in Östermalm with 34.09 years. The average number of *Rooms* and *Size* for an apartment is 0.86 and 63.10 respectively. The average *Yearly rent/sqm* and *Avg. income* for the dataset are 1,536.73 and 23,761.54 SEK respectively. The average of *Travel time* from the observed apartments address to the central stations in Stockholm city is 21,73 minutes and the average of *Travel distance* is 3,561.51 meters in the dataset.

Variable	Observations	Mean	Std. dev	Min	Max
Queuing time	6,288	10.58	4.32	0.14	34.09
Rooms	6,288	2.31	0.86	1	4
Size	6,288	63.10	18.94	16	189
Yearly rent/sqm	6,288	1,536.73	402.80	855.73	3,578.93
Travel time	6,288	21.73	8.29	1	51
Travel distance	6,288	7,949	3,561.51	380	14.900
Avg. income	6,288	23,761.54	4,515.68	15,650	38,036
Amortization(June)	6,288	36.94%	-	0	1
Amortization(March)	6,288	43.62%	-	0	1
Year (2015)	6,288	46.99%	-	0	1
Year (2016)	6,288	39.34%	-	0	1
Year (2017)	6,288	13.66%	-	0	1
District (1)	6,288	7.82%	-	0	1
District (2)	6,288	11.91%	-	0	1
District (3)	6,288	5.50%	-	0	1
District (4)	6,288	4.48%	-	0	1
District (5)	6,288	3.64%	-	0	1
District (6)	6,288	8.41%	-	0	1
District (7)	6,288	23.28%	-	0	1
District (8)	6,288	12.26%	-	0	1
District (9)	6,288	1.38%	-	0	1
District (10)	6,288	8.81%	-	0	1

Table 1: *Summarized statistics*, (own estimates)

5.2 Empirical identification

OLS regression

The methodology in this thesis is primarily processed with help from the program STATA and with the assumption that the variable *Queuing time* is a function of multiple independent variables. Five different regressions are made to control and analyse the robustness of the model. This can be achieved due to the large dataset Stockholm Housing Agency has provided for this thesis, together with the great public data sources available at SCB, hitta.se, sl.se, mäklarstatistik.se and hemnet.se.

In the first regression, Regression (1), which is the baseline model, all the basic explanatory variables provided from Stockholm Housing Agency together with *Travel time* gathered from hitta.se and the dummy variable *Amortization (June)* is implemented. This, to form a base regression and thereafter controlling for the changes of coefficients when adding more explanatory variables in Regression (2-5).

$$Queuing\ time_i = \beta_0 + \beta_1 * No.of\ rooms_i + \beta_2 * Size_i + \beta_3 * Yearl\ rent\ per\ sqm_i + \beta_4 * Rent_i + \beta_5 * Travel\ time_i + \beta_6 * Travel\ distance_i + \beta_7 * Amortization\ (June)_i + \epsilon_i$$

Equation 1: *OLS regression model 1*

In the second regression, Regression (2), the variable *Avg. income* is added into the model to control for the factor that the districts average income could be important for agents when choosing rental apartments.

$$Queuing\ time_i = \beta_0 + \beta_1 * No.of\ rooms_i + \beta_2 * Size_i + \beta_3 * Yearl\ rent\ per\ sqm_i + \beta_4 * Rent_i + \beta_5 * Travel\ time_i + \beta_6 * Travel\ distance_i + \beta_7 * Amortization\ (June)_i + \beta_8 * Avg.Income_i + \epsilon_i$$

Equation 2: *OLS regression model 2*

In the third regression, Regression (3), the district attractiveness fixed effect dummy variables *District (1-10)* are added into the model to analyse the attractiveness factors effect on *Queuing time* of each district.

$$Queuing\ time_i = \beta_0 + \beta_1 * No.of\ rooms_i + \beta_2 * Size_i + \beta_3 * Yearl\ rent\ per\ sqm_i + \beta_4 * Rent_i + \beta_5 * Travel\ time_i + \beta_6 * Travel\ distance_i + \beta_7 * Amortization\ (June)_i + \beta_8 * Avg.Income_i + \sum_{10}^{20} \beta_j * District_{ij} + \epsilon_i$$

Equation 3: *OLS regression model 3*

In Regression (4), the fixed effect yearly dummy variables *Year (2015)* and *Year (2016)* are added into the model to control for seasonal effects.

$$Queuing\ time_i = \beta_0 + \beta_1 * No.of\ rooms_i + \beta_2 * Size_i + \beta_3 * Yearl\ rent\ per\ sqm_i + \beta_4 * Rent_i + \beta_5 * Travel\ time_i + \beta_6 * Travel\ distance_i + \beta_7 * Amortization\ (June)_i + \beta_8 * Avg.Income_i + \sum_{10}^{20} \beta_j * District_{ij} + \beta_9 * Year\ 2015_i + \beta_9 * Year\ 2016_i + \in_i$$

Equation 4: *OLS regression model 4*

In the last regression, Regression (5), the amortization dummy variable *Amortization (March)* is added into the model to test and control if the results from the dummy variable for June is robust. This, because the June dummy variable might have incorrectly identified some agents who already anticipated in March that the policy will occur in June, and adjust their housing behaviour accordingly. Under the June dummy, these agents are assumed to be not affected by the amortization requirement, and in fact, they might be affected.

$$Queuing\ time_i = \beta_0 + \beta_1 * No.of\ rooms_i + \beta_2 * Size_i + \beta_3 * Yearl\ rent\ per\ sqm_i + \beta_4 * Rent_i + \beta_5 * Travel\ time_i + \beta_6 * Travel\ distance_i + \beta_7 * Amortization\ (March)_i + \beta_8 * Avg.Income_i + \sum_{10}^{20} \beta_j * District_{ij} + \beta_9 * Year\ 2015_i + \beta_9 * Year\ 2016_i + \in_i$$

Equation 5: *OLS regression model 5*

In the next section, each model and explanatory variable is presented, analysed, discussed and tested with several significant tests.

6. Empirical results

Five different regressions are conducted to test the robustness of the OLS regressions as described in the earlier section, and are thus presented and analysed in this section. After the results from Table 2 below are analysed and discussed, the statistical significance tests results are studied for robustness of the model. Table 2 summarize the relationship between the dependent variable *Queuing time* and the independent variables. The t-statistics are presented in brackets and R-squared, adjusted R-squared and number of observations are presented in the bottom of Table 2.

Every estimated coefficient is highly significant in the regression models. The fixed effect dummy variable *District (10)* is dropped in Regressions (4) and (5), because it is the base variable in our regressions. The fixed effect dummy variable *Year (2017)* is also dropped, because of the same reason as *District (10)*, in Regressions (4) and (5). The variables *Size* and *Travel distance* were dropped in all the regression models because of collinearity, which are later described and studied in the statistical significance test section.

The results from Regressions (1-5) supports the thesis´s hypothesis H_1, and that we can reject the null hypothesis H_0.

H_0: *The amortization requirement does not increase queuing time for rental apartments in Stockholm*

H_1*: The amortization requirement increases queuing time for rental apartments in Stockholm*

The dependent variable *Queuing time* has increased after the implementation of the amortization requirement. However, the result is not unbiased, other macro factors could have affected *Queuing time* to increase during the observed period, which in this section are analysed and discussed.

Table 2

	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5
No. of rooms	0.530***	0.558***	1.011***	1.003***	1.007***
	(3.97)	(4.57)	(9.17)	(9.11)	(9.15)
Yearly rent/sqm	-0.00201***	-0.00416***	-0.00429***	-0.00437***	-0.00435***
	(-8.36)	(-17.11)	(-19.49)	(-19.90)	(-19.82)
Rent	-0.000194***	-0.000235***	-0.000334***	-0.000328***	-0.000327***
	(-4.00)	(-5.14)	(-7.90)	(-7.76)	(-7.76)
Travel time	-0.246***	-0.184***	-0.0816***	-0.0809***	-0.0819***
	(-33.94)	(-31.15)	(-12.24)	(-12.27)	(-12.42)
Amortization(June)	1.235***	1.169***	1.314***	0.383**	
	(12.49)	(13.17)	(16.94)	(3.12)	
Avg. income		0.000439***	0.000132***	0.000127***	0.000126***
		(33.53)	(8.34)	(8.04)	(8.03)
District(1)			9.655***	9.805***	9.802***
			(29.20)	(29.73)	(29.74)
District(2)			4.712***	4.867***	4.874***
			(20.93)	(21.62)	(21.71)
District(3)			4.877***	5.063***	5.079***
			(18.90)	(19.55)	(19.64)
District(4)			4.098***	4.274***	4.278***
			(14.49)	(15.12)	(15.13)
District(5)			3.070***	3.221***	3.232***
			(12.01)	(12.60)	(12.69)
District(6)			2.299***	2.376***	2.387***
			(12.12)	(12.55)	(12.61)
District(7)			1.079***	1.164***	1.178***
			(7.31)	(7.88)	(8.00)
District(8)			1.420***	1.508***	1.531***
			(8.46)	(8.99)	(9.14)
District(9)			0.788***	0.812***	0.830***
			(6.56)	(6.79)	(6.93)
Year(2015)				-1.435***	-1.311***
				(-8.75)	(-7.35)
Year(2016)				-0.366**	-0.401***
				(-3.04)	(-3.46)
Amortization(March)					0.506***
					(3.61)
Constant	18.88***	10.70***	13.03***	14.31***	14.17***
	(47.34)	(30.40)	(35.34)	(35.57)	(34.55)
R-squared	0.254	0.392	0.526	0.534	0.535
Adj.R-Squared	0.253	0.391	0.525	0.533	0.533
No.of.observations	6288	6288	6288	6288	6288

t statistics in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Table 2: *OLS regression result table*

Regression (1)

All the independent variables are highly significant in Regression (1). The variables *Rooms, Yearly rent/sqm, Rent, Travel time* and *Amortization (June)* are all highly significant at 99 percent confidence level, which indicates robustness for the model. R-squared for the model is 0.254.

The variable *Amortization (June)* coefficient is at 1.235, meaning that *Queuing time* is increasing with 1.235 years if apartments are registered after the amortization requirement was implemented 1st of June 2016. The results from only this coefficient, indicates support for our hypothesis H_1, that the agents are demanding more apartments after the amortization requirement then before.

The interpretation of the estimated coefficient from the variable *No. of rooms* is that if we increase *No. of rooms* by one room, our dependent variable *Queuing time* will increase by 0.530 years. The *No. of rooms* variable is an important factor when selecting apartments. In general, an apartment with more rooms is more demanded than one-room apartments. However, cities with many students or agents with single civil status may demand more one-room apartments. In Stockholm, according to SSCO (2017), 85,000 students are registered, indicating a high demand for one-room apartments.

The variable *Yearly rent/sqm* is showing a negative coefficient, which is also what we expect, because of the interpretation that a more expensive apartment per square meter, should be less demanded by agents. *Yearly rent/sqm* is decreasing *Queuing time* with 0.00201 years if we increase *Yearly rent/sqm* with one SEK. Interpretation of the result is that agents do not demand apartments if the apartments are more expensive to rent per square meter,

The coefficient for the variable *Rent* is supporting the coefficient for the variable *Yearly rent/sqm*, meaning that increasing *Rent* will decrease *Queuing time* for apartments, which is an expected result because of that a more expensive apartment should be less demanded by our average agent. The result is indicating that a high *Rent* variable is not as demanded as a low *Rent* variable.

Travel time is decreasing *Queuing time* with 0.246 years, a result also expected because of the lower prices for tenancy-owned apartments further away from the city centre. If we increase *Travel time* with one minute, *Queuing* time will increase by 0.246 years. The consequence of a longer commuting time to the central station is that apartments will not be as demanded.

Interpretation of the results are that apartments near the city are more demanded, than apartments located further away.

Regression (2)

In Regression (2) the variable *Avg.income* is added. All the explanatory variables are highly significant at 99 percent confidence level. R-squared for Regression (2) is 0.392, indicating that the model explains 39.2 percent of the variability of the response data around its mean. This is an increase from Regression (1), which is expected when adding new variables to OLS regressions. The adjusted R-squared adjusts for adding explanatory variable. However, the adjusted R-squared is almost at the same level at 0.391.

The new variable *Avg. income* is also highly significant at 99 percent confidence level. The coefficient for *Avg. income* is 0.000439, indicating a positive relationship towards *Queuing time.* If we increase *Avg. income* with one SEK, *Queuing time* will increase by 0.000349 years, indicating that a district with high average income, is more demanded to live in than a district with low average income. A district with a higher income is often a district of high standard, better location and higher social status, and thus more demanded for our agents. The variable *Avg. income* can therefore be interpreted as an attractiveness variable for apartments.

The dummy variable *Amortization (June)* is still showing the same sign. The coefficient has decreased to 1.169, indicating that adding the variable *Avg. income* decreased the coefficient power for *Amortization (June).* However, the difference is insignificant and almost negligible.

Furthermore, the explanatory variables are still showing the same signs as in Regression (1), which is indicating robustness for our model. When we increased our model with the variable *Avg. income,* the variable *No. of rooms* increased its coefficient to 0.558, which can also be neglected because of the minimal difference. However, the variable *Yearly rent/sqm* decreased its coefficient to -0.00416, which is almost a 100 percent decrease from Regression (1), indicating that *Yearly rent/sqm* in Regression (2) is affecting *Queuing time* more when increasing *Yearly rent/sqm* for the apartment. The correlation between the two variables are 0.5281, which could be the reason for the decrease of the estimated coefficient.

The variables *Rent* and *Travel time* changed its coefficients to -0.000235 and -0.184 respectively, which is a small decrease for the variable *Rent*- and a small increase for the variable *Travel time* compared to Regression (1). Indicating robustness for the model.

Regression (3)

In Regression (3), the fixed effect dummy variables *District (1-10)* are added to the model, which are contributing with attractiveness factors for each district for where the apartments are located. Every explanatory variable is highly statistical significant at 99 percent confidence level. The R-squared is 0.526, indicating that the model explains 52.6 percent of the variability of the response data around its mean, which is a high R-squared level.

Furthermore, *Amortization (June)* increased the coefficient slightly from 1.169 in Regression (2) to 1.314 in Regression (3), indicating a stronger relationship between *Queuing time* and *Amortization (June)* in Regression (3). However, the difference is minimal compared to the previous regression, also indicating for a robust model.

The variable *No. of rooms* increased its coefficient to 1.011, which is almost a 100 percent increase compared to Regression (1) and (2), indicating a stronger relationship between *Queuing time* and *No. of rooms,* when we implement the fixed effect variables *District (1-10).*

In addition, small and negligible decreases were in the variables *Yearly rent/sqm* and *Rent,* indicating for robustness of the model. However, the variables *Travel time* and *Avg. income* increased to -0.0816 and decreased to 0.000132 respectively. These are large substantial differences compared to Regression (1) and (2).

The added fixed effect dummy variables *District (1-10)* are all highly significant at 99 percent confidence level. Not surprisingly and expected, *District (1)*, which is the most attractive district to live in Stockholm, is showing the strongest positive relationship towards *Queuing time.* The coefficient of 9.655 is indicating that *Queuing time* is 9.655 larger than for our base level *District (10).* More surprisingly, *District (3)* is showing a stronger relationship towards *Queuing time* than *District (2).* However, the difference between the two districts is negligible. Moreover, the variables *District (1-10)* are decreasing in descending order of both statistical significant and relationship to *Queuing time*.

The inclusion of the fixed effect dummy variables *District (1-10),* increased the R-squared level to 0.526 compared to 0.394 in Regression (2). This increase is positive for the model, but can also be explained by the added variables into the regression. To increase the number of explanatory variables will often increase R-squared. However, the added variables *District (1-10)* are highly significant and are showing the expected signs of increased *Queuing time* near the city centre, which is increasing the credibility for the model in Regression (3). The adjusted R-squared is also supporting the model with an increase to 0.525.

Regression (4)

In Regression (4) the fixed effect yearly dummy variables *Year (2015)* and *Year (2016)* are added into the model, meaning that all the explanatory variables are implemented in the model. Each explanatory variable is highly significant at 99 percent confidence level. The R-squared level is increased slightly compared to Regression (3), to 0.534, indicating that the final model is explaining 53.4 percent of the variability of the response data around its mean, which is a high R-squared level for our thesis. The adjusted R-squared is at the same level as in Regression (4), the difference is negligible.

The fixed effect dummy variables *Year (2015)* and *Year (2016)* was implemented to control for the seasonal effects and controlling for macro factors. The results from *Year (2015)* and *Year (2016)* is demonstrating that *Queuing time* has increased from 2015 to 2016 compared to our base dummy variable, *Year (2017)*. This provides meaning for more analysis in how or if, just the amortization requirement implemented in June is the reason for the increased *Queuing time* for rental apartments in Stockholm. The increased *Queuing time* can be an effect of either increased population (See Appendix Figure 1, for Stockholm population), higher prices for tenancy-owned apartments (see Appendix Figure 2) or a direct effect of more demand in general for rental apartments in Stockholm. The reason for more demand for rental apartments can be explained of the implied attractiveness for easy living with low rents, a consequence from the earlier described Swedish Utility Values principle.

Amortization (June) decreased its coefficient from 1.314 to 0.383. The reason for the estimated coefficient decrease is that the dummy variables *Year (2015)* and *Year (2016)* are added into Regression (4). In general, if variables are uncorrelated, the coefficients will not change. *Year (2015)* and *Year (2016)* are most correlated with *Amortization (June)*, see Appendix Figure 10 for correlation table. However, *Amortization (June)* is still describing a positive relationship towards *Queuing time, m*eaning that *Queuing time* is increasing with 138 days if apartments are registered after the amortization requirement was implemented.

The other explanatory variables in the model, *No. of rooms, Yearly rent/sqm, Rent*, *Travel time, Avg. income* and the fixed effect district variables *District (1-10)* are not changing either signs or estimated coefficients significantly, when adding the fixed effect yearly dummy variables. This is indicating that our model is robust. The modest increase in R-squared when adding the fixed effect yearly dummy variables can be explained by collinearity between *Amortization (June)*, *Year (2015)* and *Year (2016).* However, the importance of adding variables that are controlling for the seasonal effect, is of significance for the model.

Regression (5)

In Regression (5) the dummy variable *Amortization (March)* is added into Regression (4), instead of the dummy variable *Amortization (June)*. All the explanatory variables are highly statistical significant at 99 percent level in Regression (5). The variables *No. of rooms, Size, Rent* and *Avg. income* are showing almost the same results as in regression (4), indicating for robustness of the model. R-squared of Regression (5) is also almost the same as in Regression (4), meaning that the variations of our dependent variable *Queuing time* can be explained by 53.5 percent of the variations of our explanatory variables.

The variable *Amortization (March)* is added to control if the agents already in March decided to queue for apartments in the Stockholm region. The result of the estimated coefficient from *Amortization (March)* is 0.506, which is 182 days, indicating that *Queuing time* is increasing for agents after the 23rd of March. In comparison to Regression (4), where the *Amortization (June)* variable was indicating 138 days increase of *Queuing time.*

The result from the variable *Amortization (June)* in Regression (4) in comparison to the results of *Amortization (March)* in Regression (5), is indicating that the usage of either one of the two amortization dummy variables is suggesting more or less the same results. This is of high interest for the thesis´s hypothesis, and can be interpreted that our agents already in March decided to queue for a rental apartment, due to the public announcement by the government.

Furthermore, the difference between the amortization requirement dummy variables for March and June in Regression (4) and Regression (5) can be explained by several factors. One important factor when adding more observations into the regression model, is that in general the estimated coefficient will increase, showing a stronger relationship towards the dependent variable. The variable *Amortization (March)* has 2,702 observations distributed as values equal to 1, compared to *Amortization (June)* with 2,339 observations distributed as values equal to 1, accounting for a difference of 363 observations. The difference of 15.5 percent more observations for the *Amortization (March)* variable can impact the result positive. However, it is important for the robustness of the model to also include an amortization dummy for March and controlling for agent's possible earlier decisions on queuing for rental apartments.

The fixed effect yearly dummy variables *Year (2015)* and *Year (2016)* are highly significant at 99 percent confidence level in Regression (5). The difference from their coefficients in Regression (4) is minimal. The interpretation is that *Queuing time* is still increasing from 2015 to 2016, indicating that *Queuing time* was shorter during 2015 compared to 2016 with the base year of 2017.

The variable *Travel time* in the Regressions (1-5) is indicating the same results, that the variable is highly statistical significant and that it has a negative relationship to *Queuing time*. If *Travel time* is increasing, *Queuing time* will decrease by 0.0819 years in Regression (5). However, this is not the whole picture, apartments that are further located from the city inner centre can still be attractive for the agents. *District (2-4)* is showing almost the same coefficients towards *Queuing* time in Regressions (3-5). Interpretations of these results is that *District (2-4)* is affecting *Queuing time* with the same explanatory power. Furthermore, *District (1)* is the area where agents are queuing the longest time, at an average of 17.7 years (see Appendix Figure 8), indicating that rental apartments nearest to the inner centre is most demanded by agents.

The results from Regression (4) and (5) can also be explained by increased population in Stockholm, with an increase of 1.7 percent, accounting for 37,621 more agents in Stockholm during 2016 compared to 2015 (see Appendix Figure 1). The prices for tenancy-owned apartments in Stockholm has also increased from 84,387 SEK per square meter during 2015, to 89,447 SEK per square meter during 2016, indicating a 6.0 percent increase. The financial stress for agents during 2016 is high when debt to income ratios are at a 402 percent level, even if the amortization requirement is decreasing the ratio. In comparison, the rent for rental apartments has only increased with 0.7 percent during 2015-2016. All the above is resulting in higher demand for rental apartments, due to the lowered living costs and lowered financial stress implied by living in a rental apartment compared to tenancy-owned apartments. This is initiating agents for demanding rental apartments in Stockholm, instead of buying apartments. However, it is difficult to find an apartment in Stockholm, when the average *Queuing time* is 10.58 years.

Significance tests results

The t-statistics from the OLS regressions conclude that the models are statistical significant, which can be observed from Table 2. The R-squared of 0.534 and 0.535 from Regressions (4) and (5), highlights that the model is highly explained by the explanatory variables. Figure 12 in Appendix, shows how the observed values are fitted against the predicted values in a residual plot. The difference between the observed values and the fitted values is the residual. We can see that the observations are generally near the fitted line. However, some outliers are disturbing the results. The model suffers from heteroskedasticity, which was found and studied with help from a Bruesch-Pagan test. The chi-square value 1021.35 indicates that heteroskedasticity is present, and thus violating the Gauss-Markov theorem of no heteroscedasticity, meaning that the estimators are not best linear unbiased estimators. To control for the heteroskedasticity, the regressions in Table 2 are made with the robust function in STATA, resulting in robust standard errors. The regression table before correcting for heteroskedasticity is presented in Appendix Exhibit 13, showing in general higher t-statistic values for all the explanatory variables. The coefficients are not affected.

Furthermore, the R-square measurement provides an estimation of the power of the relationship between the model and the explanatory variables. Thus, the R-square measurement does not deliver a hypothesis to test the relationship between the dependent variable and the explanatory variables. To evaluate the overall significance of the model, an F-test was conducted. The concept is to test the minimum level at which the null hypothesis can be rejected. The result shows an F-value of 458.91, indicating that the explanatory variables are statistical significant and higher than the critical value.

Collinearity is not unusual when working with OLS regressions. To control for collinearity an VIF-test and a correlation matrix was performed in STATA to test the significant of the results (See Appendix Exhibit 7 and 8 respectively). The VIF-test, tests if the variances of the estimated coefficients are inflated when multicollinearity exists. The correlation analysis is made to identify if multicollinearity exists between the explanatory variables. Not surprisingly, the correlation matrix indicated a strong relationship between the *No. of rooms* variable and the *Size* variable. The correlation value was 0.906, also, the variables *Travel time* and *Travel distance* are highly correlated at a value of 0.670. In the VIF-test, the variable *Size* resulted in a 24.13 value, high above the generally accepted critical value of 10. The mean value from the VIF-test was 7.09. The conclusion was to drop *Size* and run new regressions (See Appendix Exhibit 14). The variable *No. of rooms* in Table 3 is statistical significant at 99 percent confidence level, and is also indicating a stronger relationship towards *Queuing time.* This result is not surprising with the previous conclusion of a strong correlation between *Size* and *No. of rooms.*

When controlling for a new VIF-test after dropping *Size*, the values were significantly lower, with the mean value of 4.25 (see Appendix 7). However, the variable *Travel distance* still indicated a high VIF-test value at 8.22 and was highly correlated with *Travel time*. The decision was to drop the variable *Travel Distance* and run a third OLS regression, ending up in our best table 2. Third and final VIF-test is showing a mean value of 3.31, which is accepted.

7. Conclusion

The data gathered from Stockholm Housing Agency, hitta.se, SCB, sl.se, mäklarstatistik.se and hemnet.se have provided the opportunity to perform five different OLS regressions and analyse the effect of the implemented amortization requirement, towards the queuing time for rental apartments.

The regressions performed in Regression (4) and (5), with all the explanatory variables implemented, are supporting my hypothesis H_1, that the amortization requirement has increased queuing time for rental apartments in Stockholm. However, as discussed in the Results section above, this is not describing the whole picture. With increasing demand for rental apartments from macro factors such as increasing population during 2015-2016, and with increasing prices for tenancy-owned apartments. Resulting in a 6.0 percent increase during 2015-2016, and only a 0.7 percent increase for rent per square meter for rental apartments during the same years, rental apartments are increasing in demand.

Moreover, the implied risk correlated with borrowing money to a tenancy-owned apartment is increasing the demand for rental apartments in Stockholm. The average income to debt ratio has increased from 325 percent in 2011 to 402 percent in 2016, which might indicate stress to agent's financial situations if the interest rate goes up. These suggested macro factors together with a Utility Value principle system, that is preventing and sustaining landlords from investing in rental apartments, and indirectly causing limited supply (See theoretical framework section), is initiating the demand for rental apartments to increase further in the future and thus increasing queuing time for rental apartments in Stockholm.

Furthermore, the OLS regression results indicate that we can reject the null hypothesis that the amortization requirement has not affected the queuing time for rental apartments in Stockholm. The implementation of credit lending policies is turning agents to the rental market, suggesting that the tightening lending policy put strains on the rental market.

In addition, more studies can be done in this field using the thesis´s results and data to calculate and analyse how credit lending policies directed towards the tenancy-owned market, indirectly affect the rental housing market. Especially, as the population according to SCB is forecasted to increase substantially in the near future, creating more demand for rental apartments in Stockholm.

Limitations to my approach is that there may be other statistical models that could explain the introduced amortization requirement effect towards the rental housing market in Stockholm. The OLS regression technique may or may not be the best statistical method for the thesis hypothesis. Other limitations of my analysis are that there could be other variables that are not used in this thesis that could describe the effect of the amortization requirement towards the rental market in Stockholm. Furthermore, my methodology can have measurement errors, which could impact the results negative or positive.

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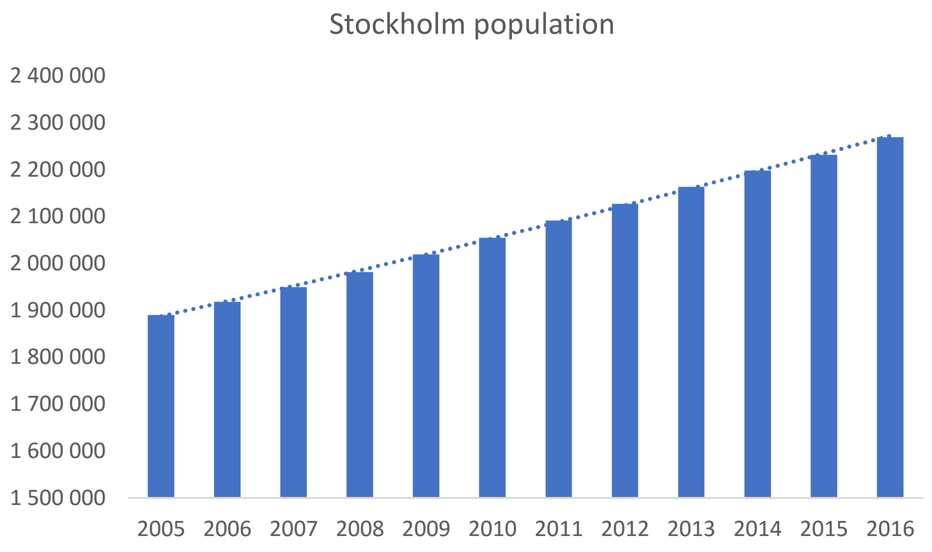
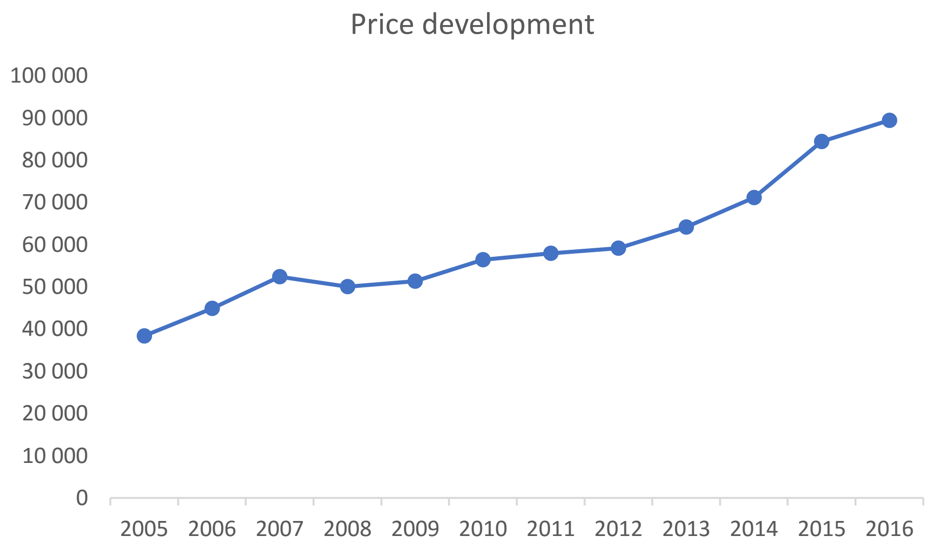
B. Appendix

Figure 1: Stockholm´s population has increased with 20.0 percent since 2005.



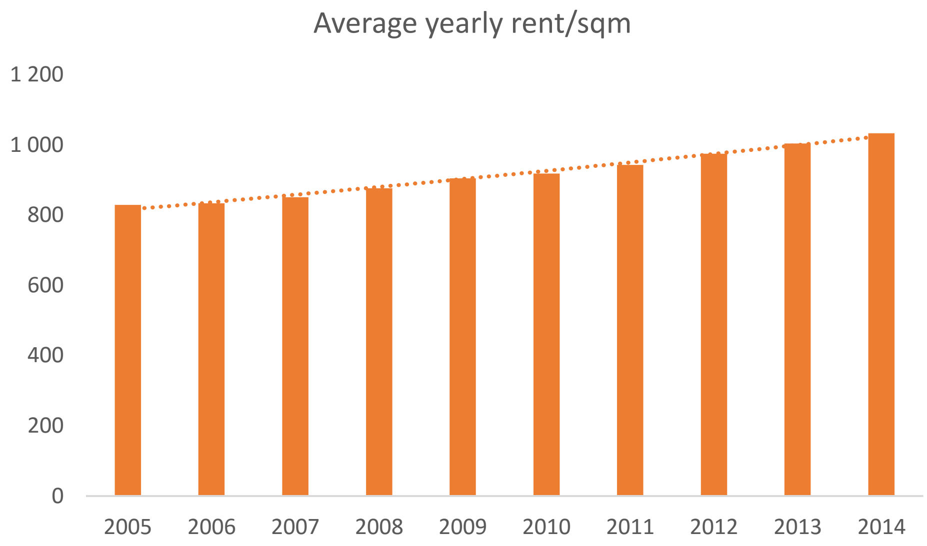
Source: *SCB*

Figure 2: Price development in Stockholm for tenancy-owned apartments in price per square meters during 2005-2016, accounting for a 133 percent increase. Price per square meter in SEK on y-axis and dates on x-axis.



Source: *Mäklarstatistik*. https://www.maklarstatistik.se/omrade/riket/stockholms-lan/stockholm/centrala-stockholm/ [2017-05-05].

Figure 3: The diagram shows the average yearly rent/sqm for rental apartments in Stockholm from 2005-2014, accounting for a 26.1 percent price increase.



Source: *SCB*

Exhibit 4: To summarize the Swedish housing policy and what it has today developed into, SOU (2008) presented four corner stones that characterizes the market.

- A general direction – The procedures are targeted to all citizens and not only particular groups
- Municipal companies are the most important tools for public housing
- Integrated Rent Control market where municipal- and private tenancy companies competes in the same market
- The Rent Control is controlled by a collective negotiation system, where the rents of the public housing companies are the standard norm for the complete rent market (SOU, 2008)

Figure 5: In Figure 5, the average *Queuing time* is plotted for every observed apartment in the dataset. The average *Queuing time* before the implementation of the amortization requirement is 10.53031 years, and after 10.53325 years. Meaning a 0.028 percent increase of *Queuing time* after the implementation of the amortization requirement.

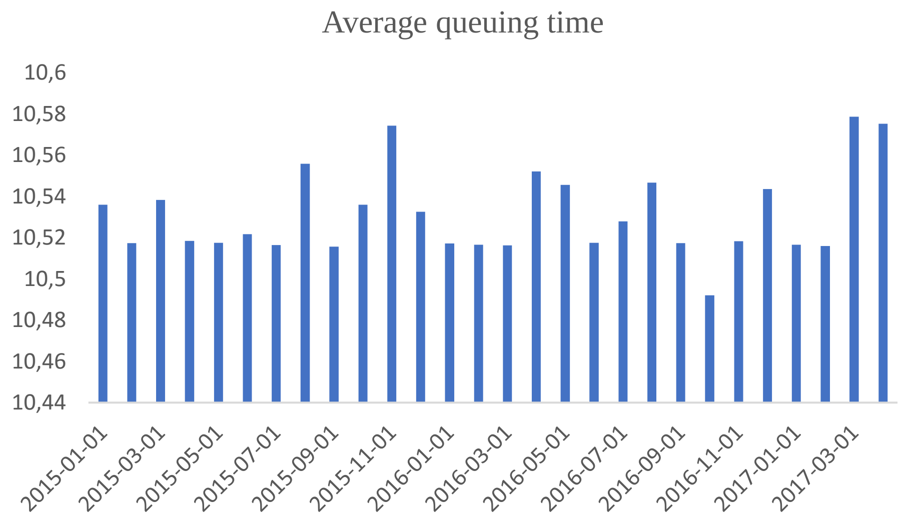


Figure 5: *Average Queuing time for every observed apartment* (Own source)

Figure 6: In Figure 6 below we can see the average queuing time for each district before and after the implementation of the amortization requirement. On average, queuing time for each district has increased by 8,7 percent after the implementation of the amortization requirement.

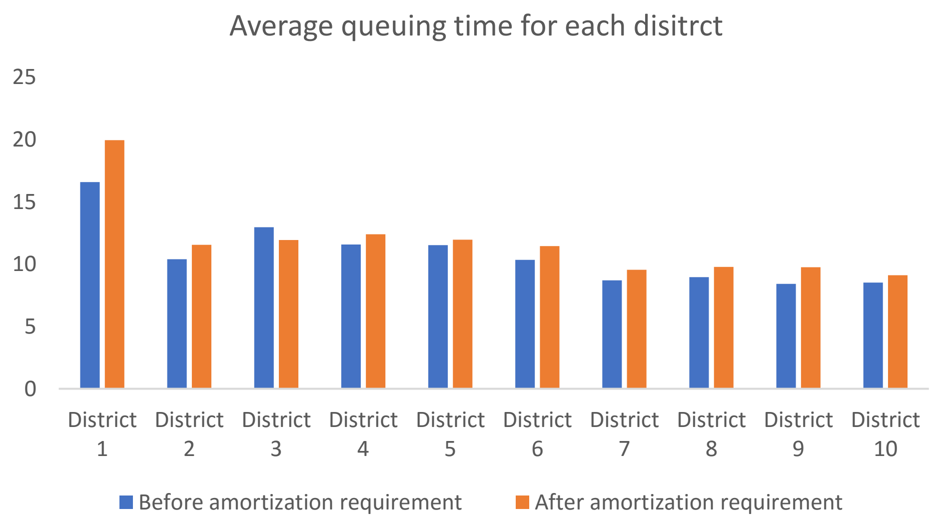


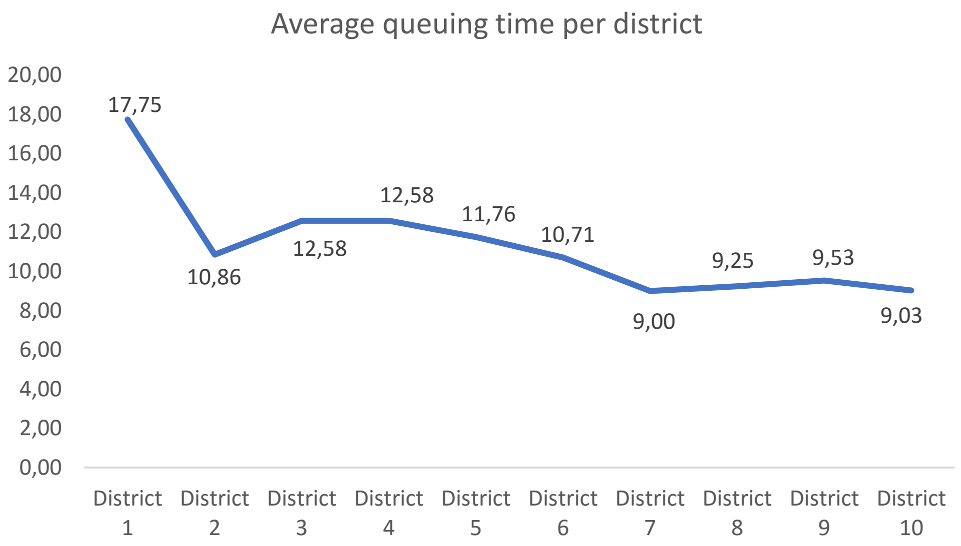
Figure 6: *Queuing time before-and after the amortization requirement for each district* (Own source)

Exhibit 7: Division for every district. 87 districts have been divided into 10 districts. The data is manually gathered from mäklarstatistik.se

Name	Price/sqm	District	Distance to Drottninggatan
Djurgården	86 400	1	2 900
Gamla Stan	94 000	1	839
Kungsholmen	85 800	1	1 066
Ladugårdsgärdet	86 400	1	2 098
Norrmalm	103 400	1	380
Skeppsholmen	94 000	1	1 300
Södermalm	87 418	1	2 035
Vasastaden	89 958	1	1 042
Östermalm	103 400	1	1 400
Fredhäll	77 700	2	3 054
Hjorthagen	75 100	2	3 000
Kristineberg	77 700	2	3 042
Lilla Essingen	78 334	2	3 074
Midsommarkransen	69 000	2	4 700
Solberga	69 000	2	6 035
Stadshagen	75 600	2	2 088
Södra Hammarbyhamnen	69 700	2	3 055
Västberga	69 000	2	5 200
Aspudden	67 700	3	5 000
Enskededalen	62 700	3	6 200
Enskedefältet	62 700	3	5 200
Gamla Enskede	62 700	3	6 000
Gröndal	64 700	3	3 820
Liljeholmen	64 700	3	3 037
Norra Djurgården	63 600	3	3 540
Tallkrogen	62 700	3	6 700
Årsta	64 700	3	3 900
Björkhagen	58 700	4	5 330
Enskede Gård	58 800	4	4 700
Hammarbyhöjden	62 100	4	4 590
Hägersten	60 200	4	6 200
Johanneshov	62 100	4	5 100
Kärrtorp	58 700	4	5 640
Mariehäll	59 400	4	7 400
Smedslätten	60 900	4	5 640
Traneberg	60 000	4	4 460
Ulvsunda	60 900	4	5 600
Abrahamsberg	55 000	5	6 330
Hägerstensåsen	57 900	5	5 820
Nockebyhov	58 600	5	8 840
Stureby	53 600	5	5 700

Svedmyra	56 100	5	6 630
Åkeshov	58 600	5	7 380
Älvsjö	53 600	5	7 000
Örby Slott	53 600	5	6 270
Östberga	53 600	5	5 100
Bagarmossen	52 500	6	7 440
Fruängen	52 200	6	7 430
Gubbängen	49 200	6	7 900
Långbro	52 200	6	6 600
Riksby	50 100	6	7 100
Ulvsunda Industriområde	46 500	6	5 730
Västertorp	51 400	6	7 000
Åkeslund	50 100	6	6 900
Bandhagen	45 300	7	7 000
Blackeberg	46 100	7	10 700
Bredäng	43 800	7	8 400
Farsta Strand	42 900	7	11 200
Flysta	41 400	7	10 000
Grimsta	46 100	7	11 800
Högdalen	45 200	7	6 800
Hökarängen	42 500	7	8 500
Sköndal	42 900	7	9 800
Vinsta	41 400	7	12 900
Vällingby	41 400	7	11 900
Beckomberga	39 000	8	9 500
Fagersjö	40 600	8	9 200
Farsta	40 600	8	9 400
Hässelby Strand	39 000	8	13 200
Hässelby Villastad	39 000	8	14 900
Larsboda	40 600	8	10 200
Nälsta	39 000	8	11 250
Råcksta	39 000	8	10 300
Bromsten	38 500	9	10 100
Hagsätra	35 400	9	8 600
Hässelby Gård	32 000	9	13 800
Kista	38 500	9	11 200
Rågsved	35 300	9	8 700
Skarpnäcks Gård	37 300	9	8 400
Skärholmen	38 000	9	11 000
Sätra	38 700	9	10 300
Akalla	27 637	10	13 100
Husby	29 200	10	11 600
Rinkeby	23 400	10	10 000
Solhem	23 400	10	11 800
Tensta	23 400	10	11 300
Vårberg	30 200	10	12 200

Figure 8: Average *Queuing time* in years over Districts (1-10) in Stockholm.



Source: *Own estimates.*

Exhibit 9: The VIF-test below, tests if there are multicollinearity issues. In general, VIF results above 4 requires further investigation, and results over 10 indicates high multicollinearity. From left to right, the first and last VIF-tests are presented. First test was conducted with all variables, second with variable *Size* dropped- and third with variable *Travel distance* dropped in the OLS regressions.

Variable	VIF	1/VIF
Sqm	24.13	0.041436
Rent	23.41	0.042723
YRS	12.46	0.080269
District2	8.45	0.118338
Distance	8.22	0.121648
District1	7.12	0.140385
Rooms	6.03	0.165713
District7	4.84	0.206751
District3	4.17	0.240021
District6	3.42	0.292222
District8	3.37	0.296537
AvgIncome	3.19	0.313819
District4	3.02	0.330832
Traveltime	2.86	0.349908
District9	2.58	0.386903
District5	2.29	0.437322
AmoJune	1.02	0.975868
Mean VIF	7.09	

Variable	VIF	1/VIF
District2	8.29	0.120592
Distance	8.22	0.121659
District1	7.08	0.141175
Rent	6.05	0.165423
District7	4.70	0.212880
Rooms	4.43	0.225526
District3	4.09	0.244257
YRS	3.66	0.273261
District6	3.30	0.302988
District8	3.28	0.305036
AvgIncome	3.16	0.315971
District4	2.98	0.335537
Traveltime	2.86	0.349965
District9	2.55	0.391390
District5	2.24	0.445862
AmoJune	1.02	0.975900
Mean VIF	4.25	

Variable	VIF	1/VIF
Rent	6.05	0.165283
Year2015	5.04	0.198284
Rooms	4.44	0.225470
District7	4.21	0.237270
District2	4.07	0.245897
District1	3.99	0.250881
YRS	3.67	0.272830
AvgIncome	3.17	0.315098
District8	2.98	0.335362
Year2016	2.81	0.355534
District6	2.50	0.399783
AmoJune	2.49	0.402386
District9	2.45	0.408348
District3	2.42	0.413127
District4	2.16	0.463547
Traveltime	2.00	0.499388
District5	1.78	0.562151
Mean VIF	3.31	

Figure 10: Correlation matrix table over all variables

	Queing~e	Rooms	Sqm	YRS	Rent	Distance	Travel~e	AvgInc~e	AmoJune	AmoMarch	Distri~1	Distri~2	Distri~3	Distri~4	Distri~5	Distri~6	Distri~7	Distri~8	Distri~9	Distr~10	Year2015	Year2016	Year2017
Queingtime	1.0000																						
Rooms	0.0384	1.0000																					
Sqm	0.0543	0.9066	1.0000																				
YRS	-0.1607	-0.1355	-0.2048	1.0000																			
Rent	-0.0817	0.6676	0.7016	0.5220	1.0000																		
Distance	-0.4547	0.0649	0.0642	-0.4518	-0.2725	1.0000																	
Traveltime	-0.4093	0.0200	-0.0024	-0.2148	-0.1427	0.6708	1.0000																
AvgIncome	0.3322	-0.0346	-0.0634	0.5281	0.3204	-0.6664	-0.3608	1.0000															
AmoJune	0.1132	0.0493	0.0489	0.0730	0.0955	-0.0341	0.0074	0.0514	1.0000														
AmoMarch	0.1260	0.0264	0.0274	0.0479	0.0586	-0.0134	0.0231	0.0307	0.8702	1.0000													
District1	0.4833	-0.1091	-0.0711	0.2124	0.0721	-0.5145	-0.4873	0.4233	-0.0218	-0.0199	1.0000												
District2	0.0232	-0.0105	-0.0080	0.3761	0.2803	-0.4611	-0.1023	0.3077	0.0227	0.0121	-0.1071	1.0000											
District3	0.1116	0.0266	0.0128	0.1020	0.0897	-0.2555	-0.0856	0.1943	0.0060	-0.0083	-0.0703	-0.0887	1.0000										
District4	0.0669	-0.0024	-0.0046	0.0868	0.0573	-0.1375	-0.0917	0.1705	0.0188	0.0124	-0.0631	-0.0797	-0.0523	1.0000									
District5	0.0529	0.0067	-0.0198	0.0220	-0.0012	-0.0905	-0.1245	0.0787	0.0605	0.0550	-0.0566	-0.0715	-0.0469	-0.0421	1.0000								
District6	0.0090	-0.0226	-0.0705	0.0034	-0.0474	-0.0775	-0.1410	0.0540	-0.0266	-0.0298	-0.0883	-0.1114	-0.0731	-0.0657	-0.0589	1.0000							
District7	-0.2019	0.0661	0.0406	-0.0495	0.0010	0.3135	0.2301	-0.0226	-0.0038	-0.0028	-0.1605	-0.2026	-0.1329	-0.1194	-0.1071	-0.1670	1.0000						
District8	-0.1158	-0.0673	-0.0913	-0.1333	-0.1649	0.2926	0.4258	-0.1543	-0.0199	-0.0199	-0.1089	-0.1375	-0.0902	-0.0810	-0.0727	-0.1133	-0.2059	1.0000					
District9	-0.0982	0.0521	0.0816	-0.2622	-0.1242	0.3063	0.1421	-0.3701	0.0008	0.0043	-0.1169	-0.1476	-0.0968	-0.0869	-0.0780	-0.1216	-0.2210	-0.1500	1.0000				
District10	-0.1121	0.0291	0.0973	-0.2467	-0.1148	0.2764	-0.0742	-0.4749	-0.0101	0.0173	-0.0906	-0.1143	-0.0750	-0.0674	-0.0604	-0.0942	-0.1712	-0.1162	-0.1247	1.0000			
Year2015	-0.1197	-0.0220	-0.0184	-0.0674	-0.0597	0.0033	-0.0033	-0.0219	-0.7207	-0.8283	0.0140	-0.0049	0.0159	0.0084	-0.0402	0.0165	0.0030	0.0230	-0.0201	-0.0229	1.0000		
Year2016	0.0645	0.0021	-0.0055	0.0443	0.0229	0.0123	0.0053	-0.0188	0.3710	0.5283	-0.0104	0.0033	0.0055	-0.0188	0.0520	-0.0459	-0.0146	-0.0113	0.0093	0.0494	-0.7584	1.0000	
Year2017	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.

Figure 11: Histogram over the variable *Queuing time* in years.

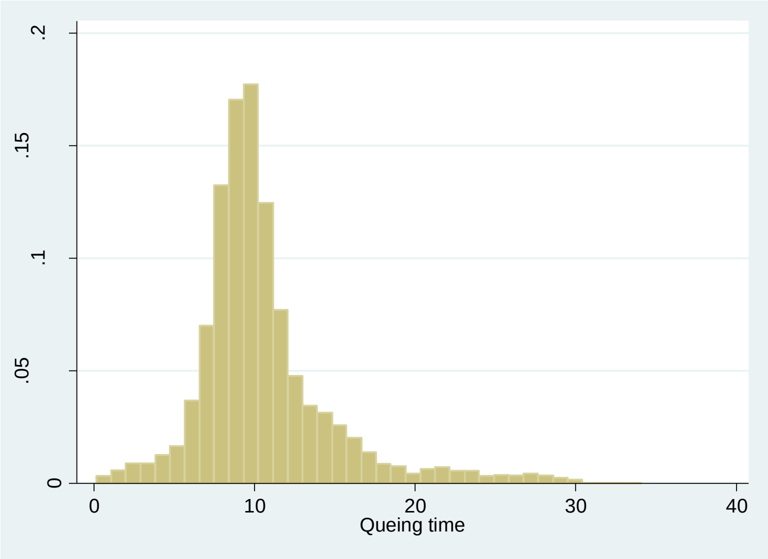


Figure 12: Residual plot output from STATA from Regression (4). Indicating that the models standard error might suffer from heteroskedasticity. The function robust standard errors were used to account for this in STATA.

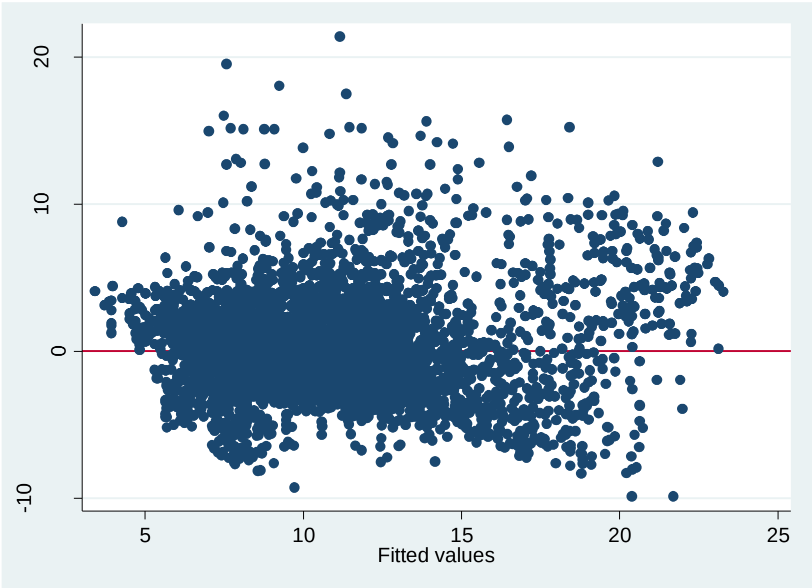


Exhibit 13: Regression table suffering from heteroscedasticity.

Table 2 without standard robust error

	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5
No. of rooms	0.530***	0.558***	1.011***	1.003***	1.007***
	(4.68)	(5.46)	(11.05)	(11.05)	(11.09)
Yearly rent/sqm	-0.00201***	-0.00416***	-0.00429***	-0.00437***	-0.00435***
	(-9.46)	(-20.82)	(-24.12)	(-24.72)	(-24.61)
Rent	-0.000194***	-0.000235***	-0.000334***	-0.000328***	-0.000327***
	(-5.13)	(-6.88)	(-10.88)	(-10.76)	(-10.75)
Travel time	-0.246***	-0.184***	-0.0816***	-0.0809***	-0.0819***
	(-42.21)	(-33.44)	(-12.74)	(-12.74)	(-12.87)
Amortization(June)	1.235***	1.169***	1.314***	0.383**	
	(12.60)	(13.21)	(16.74)	(3.15)	
Avg. income		0.000439***	0.000132***	0.000127***	0.000126***
		(37.76)	(8.97)	(8.64)	(8.61)
District(1)			9.655***	9.805***	9.802***
			(34.67)	(35.45)	(35.44)
District(2)			4.712***	4.867***	4.874***
			(20.22)	(21.01)	(21.05)
District(3)			4.877***	5.063***	5.079***
			(19.10)	(19.94)	(20.02)
District(4)			4.098***	4.274***	4.278***
			(15.43)	(16.18)	(16.21)
District(5)			3.070***	3.221***	3.232***
			(11.52)	(12.16)	(12.21)
District(6)			2.299***	2.376***	2.387***
			(10.77)	(11.21)	(11.26)
District(7)			1.079***	1.164***	1.178***
			(5.93)	(6.44)	(6.52)
District(8)			1.420***	1.508***	1.531***
			(7.20)	(7.70)	(7.81)
District(9)			0.788***	0.812***	0.830***
			(4.64)	(4.82)	(4.93)
Year(2015)				-1.435***	-1.311***
				(-8.57)	(-7.22)
Year(2016)				-0.366**	-0.401**
				(-2.86)	(-3.28)
Amortization(March)					0.506***
					(3.61)
Constant	18.88***	10.70***	13.03***	14.31***	14.17***
	(54.20)	(28.02)	(35.44)	(35.70)	(34.64)
R-squared	0.254	0.392	0.526	0.534	0.535
Adj.R-Squared	0.253	0.391	0.525	0.533	0.533
No.of.observations	6288	6288	6288	6288	6288

t statistics in parentheses
* p<0.05, ** p<0.01, *** p<0.001

Exhibit 14: Table 3, presenting results from OLS regressions when variable *Size* is dropped.

Table 3

	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5
No. of rooms	0.881***	0.792***	1.013***	1.005***	1.008***
	(7.14)	(6.63)	(9.19)	(9.12)	(9.16)
Yearly rent/sqm	-0.00345***	-0.00436***	-0.00428***	-0.00436***	-0.00434***
	(-14.70)	(-18.29)	(-19.45)	(-19.86)	(-19.78)
Rent	-0.000317***	-0.000305***	-0.000334***	-0.000328***	-0.000328***
	(-6.84)	(-6.77)	(-7.91)	(-7.77)	(-7.77)
Travel time	-0.0633***	-0.0802***	-0.0739***	-0.0738***	-0.0748***
	(-9.46)	(-12.38)	(-9.04)	(-9.08)	(-9.20)
Travel distance	-0.000710***	-0.000495***	-0.0000554*	-0.0000516	-0.0000507
	(-37.60)	(-26.01)	(-2.03)	(-1.91)	(-1.87)
Amortization(June)	1.163***	1.144***	1.303***	0.376**	
	(13.26)	(13.54)	(16.82)	(3.06)	
Avg. income		0.000274***	0.000133***	0.000128***	0.000127***
		(20.46)	(8.39)	(8.09)	(8.08)
District(1)			9.203***	9.383***	9.388***
			(22.75)	(23.32)	(23.34)
District(2)			4.275***	4.459***	4.473***
			(13.12)	(13.72)	(13.76)
District(3)			4.485***	4.697***	4.720***
			(13.21)	(13.86)	(13.93)
District(4)			3.795***	3.991***	4.000***
			(11.72)	(12.37)	(12.40)
District(5)			2.818***	2.985***	3.000***
			(9.82)	(10.43)	(10.51)
District(6)			2.077***	2.168***	2.183***
			(9.26)	(9.73)	(9.79)
District(7)			0.965***	1.058***	1.074***
			(5.84)	(6.42)	(6.53)
District(8)			1.305***	1.401***	1.425***
			(7.10)	(7.65)	(7.78)
District(9)			0.722***	0.751***	0.770***
			(5.71)	(5.96)	(6.10)
Year(2015)				-1.428***	-1.305***
				(-8.71)	(-7.33)
Year(2016)				-0.359**	-0.393***
				(-2.98)	(-3.39)
Amortization(March)					0.497***
					(3.54)
Constant	22.96***	16.63***	13.47***	14.71***	14.56***
	(56.77)	(39.44)	(33.78)	(34.25)	(33.24)
R-squared	0.407	0.447	0.527	0.535	0.535
Adj.R-Squared	0.407	0.446	0.526	0.533	0.533
No.of.observations	6288	6288	6288	6288	6288

t statistics in parentheses
* p<0.05, ** p<0.01, *** p<0.001