Priceless office transformation

A quantitative research on the spillover effects of office transformation on Amsterdam house prices

Nick Witte
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Abstract

This thesis concerns an empirical research on the effect of office transformation on surrounding house prices in the city of Amsterdam. Many office buildings in The Netherlands became obsolete during the GFC. These empty offices are believed to affect their surroundings by being a disamenity. At the same time the housing market is experiencing a shortage, because too little homes were built during the crisis to be able to meet current demand. A solution to both problems could be the transformation of vacant office buildings into housing. This research aims to measure the effect of such transformations on the environment. Due to the lack of observable market prices of externalities, the value attached to them must be measured in an indirect way. For that purpose, house prices in the vicinity of transformed office buildings are used. The effects of office transformation on surrounding house prices are mearured by hedonic pricing models. In addition to office transformation into housing, other new functions are included in this research for comparison reasons. A distinction is made between transformations insinde and outside the Amsterdam ring road, to analyze whether different urban environments affect the spillover effects. The datafile used for this research was compiled from housing data provided by the Dutch realtor association NVM and office transformation data provided by the municipality of Amsterdam. The outcomes of the statistical analysis indicate that the transformation of office buildings has a significant effect on surrounding property prices within the target radius of 1000 meters. The effects occur before, during and after office transformation. Growth rates of property prices as a result of nearby office transformation range from -6,26% outside the Amsterdam ring road before transformation and +25,1% during transformation in case of the new function being a hotel. These rates apply to a target group in comparison to a control group of properties. The results confirm the existence of office transformation externalities and provide policy makers with useful information about the financial implications of inner city (re)development.

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Disclaimer: “Master theses are preliminary materials to stimulate discussion and critical comment. The analysis and conclusions set forth are those of the author and do not indicate concurrence by the supervisor or research staff.”

Preface

Before you lies my master thesis “Priceless office transformation, a quantitative research on the spillover effects of office transformation on Amsterdam house prices”. Over one year ago I started working on my thesis and it has been quite a journey. Since that time I have left my student life and the beautiful city of Groningen behind me to pursue a career in Real Estate elsewhere. From the summer of 2018 onwards I combined a full time job at RE/MAX Netherlands with writing my thesis. It has been a challenge, but a privilege nonetheless.

I would like to thank my supervisor Mark van Duijn for his feedback and support over the past year, my parents and employer for continuously providing me with the desks to work at and Maaike Dijkstra for her endless patience.

Lastly, I would like to thank the NVM and the municipality of Amsterdam for providing me with the data necessary to conduct this research.

I wish you pleasant reading,

Nick Witte

Content

1. Introduction

1.1 Motivation

“Empty offices are the dead spots in our neighborhoods, cities and business parks. No one walks there anymore, nothing happens anymore, they are no longer alive. This threatens livability and the local business climate. In any case, vacancy is a waste of space and capital.” (Agentschap NL, 2013) This was said by the former Dutch Minister of Housing, Stef Blok, when a new expert team for office transformation was installed in 2013. The transformation of vacant office space has become a hot topic in the Dutch real estate market since the beginning of the global financial crisis and the installment of the expert team was one of the ‘Government actions’ that were agreed in the ‘Approach on Vacant Office Space Covenant’, made between the national government and the property market sector in 2012. At that time, there were 7,5 million square meters of vacant office space, approximately 15% of the total Dutch office space (Agentschap NL, 2013).

Alongside the nationwide approach of the Expert team, local governments are developing additional policies to battle high office vacancy rates. In the city of Amsterdam for example, 288 office buildings were transformed in the period between 2015 and 2017, of which 175 into housing (Gemeente Amsterdam, 2018). Office transformation is encouraged by the Amsterdam municipality, which strives to find new and optimal functions for vacant buildings in the city (Gemeente Amsterdam, 2018). Over the past few years the municipality of Amsterdam has maintained an ‘office transformation policy’, which was initially put up because many inner city office buildings became obsolete during the global financial crisis. Due to the recent burst of economic activity take-up rates of inner city commercial real estate are increasing, but not enough to eliminate all vacancy. This means there are still plenty of opportunities for redevelopment. In 2017, the Dutch real estate news journal ‘Vastgoedjournaal’ reported that up to 250 vacant office buildings were to be transformed during the following 2 years, which would result in 5,000 new Amsterdam apartments (Camu, 2017).

In addition to the high office vacancy rates, the initiative for large-scale office transformation has its origins in the tight housing market. Because, even though the housing market is booming, the quickly recovering market also has its downsides. During the global financial crisis, the number of newly built houses decreased rapidly. Insufficient houses were built to meet the current demand, which causes increasing competition and rising house prices. The development and construction of new houses is lagging behind, because the building process can take up to two years. The situation requires new housing stock to be added to the market quickly, making optimal use of the space available. Together with the desire to improve the environment and inner city living, local policymakers focus on the transformation of vacant commercial real estate into housing as a possible solution to the problem (Vastgoed actueel, 2017).

Alongside the intended effects of office transformation come the unintended spillover effects on the surrounding area, also referred to as externalities. These externalities partially explain why urban renewal and infill development are not always well-received by local residents (Fischel, 2001). The so called NIMBY’s[1] fear that nearby development will impact their home or neighborhood in a negative way, depending on the type of construction being realized. Transformation however, does not add

[1] The term NIMBY (Not In My Back Yard) originated in the eighties and is used in special planning to refer to those who oppose urban development in fear of negative (side)effects on their property or wellbeing.

any new real estate to a location, thereby reducing the risk of consequential property depreciation for surrounding home-owners. Since this type of risk is a strong driver of NIMBYism, a low risk profile should result in less protest (Fischel, 2001). A transformation could even cause a value increase of surrounding properties. For instance by replacing a disamenity or by becoming a local landmark (Schwartz et al, 2007).

Previous studies show that inner city (re)development can affect nearby property values in both a positive and negative way (Thibodeau, 1990). Research also indicates that the existence of commercial real estate in a primarily residential area affects house prices significantly (Thibodeau, 1990). However, previous studies are mainly focused on new and infill development. They hardly take property transformation into consideration, whilst the effects of changing an existing building could be very different. Additionally, most of the existing literature on the subject analyzes the American urbanized areas, which are structured very differently from European cities (Brueckner et al, 1999).

It is apparent that transforming the abandoned and desolate office buildings described by Minister Blok, will have an effect on the surrounding area. By definition, these 'spillover effects' or 'externalities' do not have observable market prices. The value attached to them must therefore be measured in an indirect way (Duijn et al, 2016). For that purpose, house prices in the vicinity of transformed office buildings can be used. Hence, this paper focuses on the potential spillover effects of office transformation on surrounding house prices.

1.2 Research problem statement

This paper aims to explain the spillover effects of office transformation on surrounding house prices. Measuring the external effects of transformation on neighboring house prices can be used to further assess the financial extent of transformation policies and provide more insight in the value generation of urban development. This information is relevant in regards to future urban (re)development and local housing markets. Measuring the effects could also lead to a better understanding of the pros and cons of office transformation on the surrounding area in order to create essential support among the community. This research will contribute to the existing literature by investigating the price effects of a so far largely unexplored type of urban real estate development and the outcomes of the analysis will provide new insights into the housing market and urban planning decision-making.

Based on the aim of the analysis, the main research question is: **"What is the effect of office building transformation on surrounding house prices in the Amsterdam real estate market?"**

In order to measure the effects of office transformation on house prices across Amsterdam adequately, the analysis is split up into three sub-questions:

- To what extent does office building transformation affect nearby house prices according to literature?
- What is the magnitude of the effect of office building transformation on nearby house prices?
- To what extent does the effect on surrounding house prices differ between office transformation inside and outside the ring road?

The first sub-question is aimed to derive a set of hypotheses from literature. The data will be analyzed based on these hypotheses, using the effects found in previous studies as a guideline.

The second sub-question aims to empirically determine the magnitude of the effect of office transformation on surrounding house prices. In order to measure this effect properly, control variables such as 'house characteristics' and two subsample categories 'residential area' and 'new function' are added to the equation. Based on the outcomes of the analysis, city planners can make well informed decisions about which office buildings to designate for transformation.

The third sub-question is focused on potential differences between residential areas as a robustness check. It is important to know if the effect of office transformation is equal across these areas, or whether differences can be detected. It could be the case that the presence of an office building and its potential transformation into housing are perceived differently by local communities based on their location within the city. To answer this question the main sample is split into two subsamples: 'inside ring' and 'outside ring', referring to the ring road encircling the inner city of Amsterdam. The ring road separates the old historic city center from the Amsterdam 'suburbs', essentially dividing the city in two distinct real estate markets. It is tested whether the regression results of the subsamples are equal to each other. A different outcome would confirm that its location within the city affects office transformation externalities.

1.3 Research area

The Dutch expert team on office transformation has been actively involved in multiple projects throughout The Netherlands (figure 1). For this research the city of Amsterdam was selected to be analyzed in depth. The Amsterdam municipality is actively encouraging office transformation, generating a lot of data, enabling research on a larger scale compared to other Dutch areas. Additionally, focusing on the city of Amsterdam will provide the most suitable outcomes for future international comparison analysis.

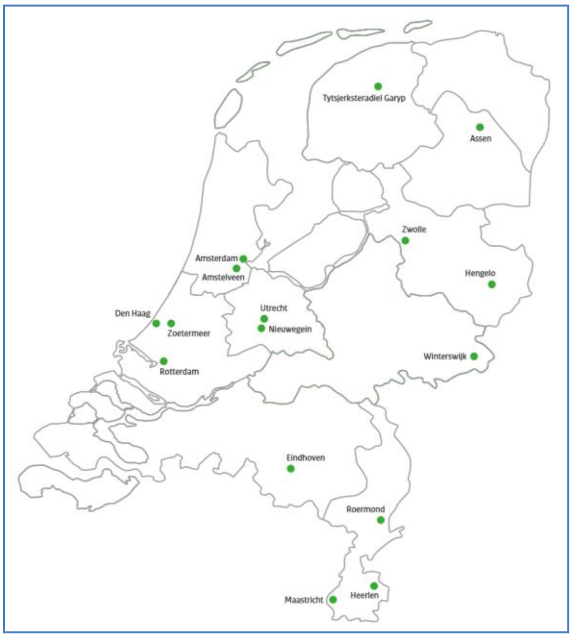


Figure 1 Cities in which the Expert team on Office Transformation was involved in one or multiple projects (Agentschap NL, 2013)

1.4 Conceptual model

The conceptual model (figure 2) includes a representation of the playing field in which the urban development takes place. It visualizes the effect of office building transformation on surrounding house prices of properties inside and outside the ring road. Control variables, such as house characteristics are included to accurately measure the sole effect of transformation on price. The effects will be determined using hedonic difference-in-difference modeling and are expected to differ depending on the distance to the city center.

House prices are defined as the dependent variable (Y) in the hedonic model, which is influenced by the 'main focus' independent variables (X). Besides these key independent variables, control variables (Z) are included in the regression. These variables, such as house characteristics, are likely to affect the dependent variable but do not count as key variables in this research. All independent variables are derived from or based on research literature.

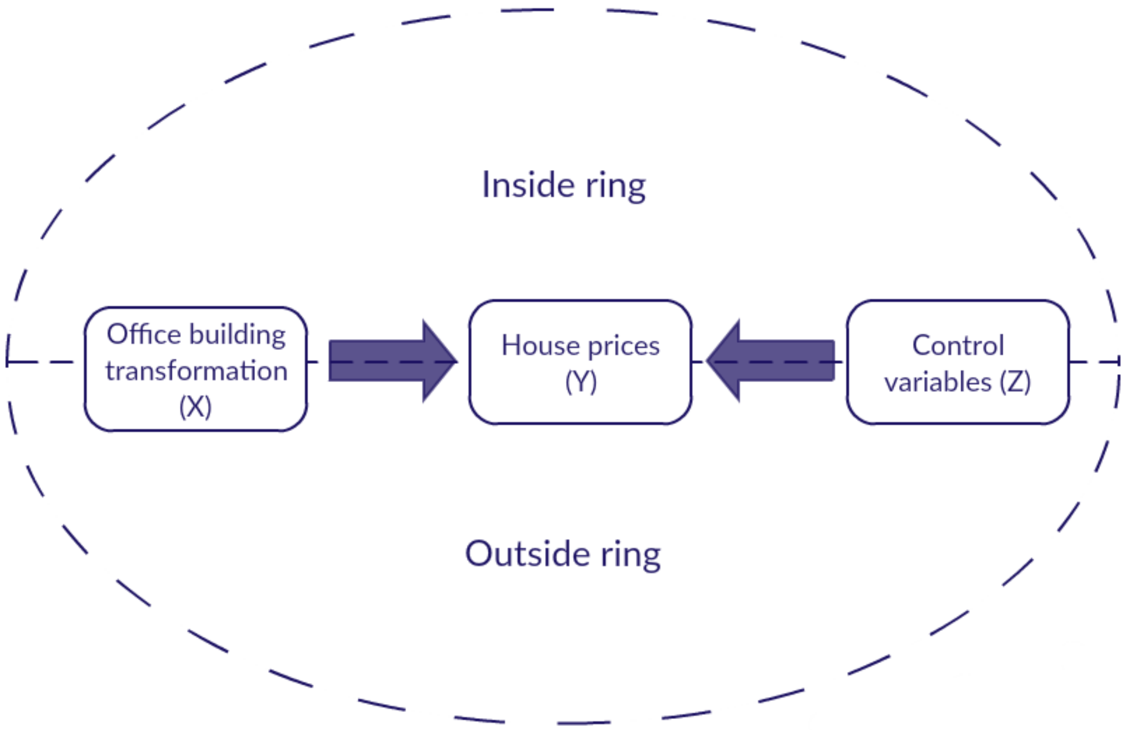


Figure 2 Conceptual model explaining the effect of office transformation on nearby house prices

1.5 Paper structure

The structure of the paper is as follows. Chapter 2 will discuss the theoretical framework and substantiate the conceptual model. The dependent and independent variables are derived from literature and the hypotheses are formulated. This provides the answer to the first sub-question. Chapter 3 includes a descriptive analysis of the data and outlines the methodology of this study. Furthermore, chapter 4 presents the results of the hedonic regression analysis and interprets these results. Finally, chapter 5 concludes this research with the main findings in light of the literature and addresses its limitations and future research propositions.

2. Theory

Much scientific research has been done regarding urban development and the effects of inner city development and improvements on the surrounding area. A large portion of the research has been focusing on the effects of infill and re-development on surrounding house prices, whilst others aim to explain the drivers behind these price effects, such as economic processes and perceived neighborhood quality by residents.

The first thing considered in this literature review are house price determinants. Secondly, the origins of urban externalities are described. It is explained how and why urban development affects the surrounding area and finally, the problem of office vacancy, its effects on society and the potential solutions are discussed.

2.1 House price determinants

"A house is made up of many characteristics, all of which may affect its value. Hedonic regression analysis is typically used to estimate the marginal contribution of these individual characteristics (Sirmans et al, 2005)". The published real estate literature has already put forth a number of housing characteristics to explain house prices (Zietz et al, 2008). A simple explanation to this relation is the laws of demand and supply.

When a housing characteristic is in high demand, it is valued more and will thus cost more if supply is relatively low. Houses composed of such high valued characteristics therefore sell at a higher price. However, housing characteristics are not always priced the same across a given distribution of house prices. This is because different groups of buyers, e.g. low vs. high income, value certain housing characteristics differently (Zietz et al, 2008).

In any case, previous research shows that physical housing characteristics only partially explain selling prices when used in OLS regression. The remainder can be explained by including external factors such as the physical environment and nearby activities (Sirmans et al, 2005).

2.2 Mechanism of agglomeration externalities

According to previous studies by Rossi-Hansberg et al (2008) and Ooi & Le (2013), urban externalities are strongly related to agglomeration and decentralization processes. By studying these processes, the drivers and effects of externalities become clear.

Rossi-Hansberg et al (2008) explain that virtually all urban theories on agglomeration economies are producer-based. Meaning that companies locate in such a way that they reduce production and transportation costs to a minimum, this causes them to cluster in a specific location. Thus, according to these theories the existence of cities is a manifestation of the presence of agglomeration forces between economic agents. However, forementioned authors propose that agglomeration effects can also result from interactions between residents. Specifically, they can take the form of housing externalities whereby improvements made to a particular house can have an effect on the values of nearby houses. These effects would decline with distance, resulting in agglomeration of residents and potentially the formation of cities.

One of the opposite effects of agglomeration, called decentralization, is described by Ooi & Le (2013). The growth pattern or decentralization process of modern cities, often referred to as urban sprawl, is believed to be caused by rising household incomes, lower commuting costs and cheaper land costs in the suburbs. However, besides the positive drivers, urban sprawl is also associated with problems such as traffic congestion, increased infrastructure costs and loss of rural land. Because of this, municipalities can decide to encourage infill developments that involve developing on vacant parcels within existing urban areas. Additionally, infill development can be used to replace old buildings to improve the urban environment.

These studies show that agglomeration and decentralization can both lead to an increase in urban development, more specifically in high density areas. Either because of positive pull factors, or as a result of negative push factors. Rossi-Hansberg et al. (2008) aim to provide evidence that sites that do not directly benefit from capital improvements can nevertheless experience considerable increase in land value relative to sites in a control area. This could to some extent prove their theory of 'spillover-based agglomeration economies'. Ooi & Le (2013) aim to determine the spillover effects of infill developments on local housing prices. They point out that infill development may affect nearby property values for several reasons such as: visual pollution, increased traffic noise or loss of a neighborhood's character. However, the effects can also be positive, by creating a local amenity. According to the researchers, the net effect is likely to be positive because a new building adds to the overall appeal of a neighborhood. These positive spillovers could then counter the negative effects of urban sprawl.

2.3 Urban development spillover effects

A hedonic pricing model can be used to estimate the effect of property development on nearby house prices, which was done in both studies described above. Ooi & Le (2013) used a basic regression model: $P = \beta 1 + \beta 2 * D + e$. One of the independent variables (D) is a dummy that has the value of unity when a property is located near an infill development and is sold after this development was launched. The coefficient b1 provides a simple estimate of the effect of the development on the sales price. Using this method they found that infill developments have a positive and persistent impact on local housing prices. The effects were larger for developments that had been built on teardown sites. They also found that the spillover effects can be traced to the overpricing of the new homes by developers. Rossi-Hansberg et al. (2008) also compared prices across two points in time, namely before and after home improvements. The outcomes of their analysis show that land prices in the targeted area rose by 2 to 5 percent at an annual rate above those in the control area. As expected, the externalities decrease by half every 990 feet, which proves the existence of positive home improvement spillovers.

Even though several studies try to explain the effect of urban development on nearby house prices, none of them consider the price effects of building transformation on its surroundings. There are studies that focus on the negative externalities of inner city office buildings, which is interesting in regards to the potential effects of a functional change, which is yet to be studied.

2.4 Non-residential land use and NIMBYism

Thibodeau (1990) describes the relationship between residential property values and nonconforming land uses, as studied by many urban economists. He explains that they have tried to measure the negative externality costs and the amenity benefits associated with non-residential land uses. Urban planners and local governments have been concerned with this relationship for some time, because of its effects on society. In practice, the potential for negative externalities often results in public hearings and the establishment of strict zoning districts. However, such measures and initiatives are usually the result of emotion and misinformation and the so-called NIMBY sentiment, instead of statistical evidence. The existence of NIMBY's (Not In My Back Yard) is studied by Fischel (2001), he tries to explain why residents oppose development of land in their immediate area. Fischel argues that 'NIMBYism' is a rational response to the uninsured risks of home ownership. For many homeowners their house is the only sizable asset that they possess. The owner-occupied home is therefore an unusual asset, because it cannot be diversified among locations. Owners are confronted with a risk of devaluation by nearby changes in land use, for which their home cannot be insured. Planned land development is always meticulously weighted by the community, which is likely to be an important determinant of spillover effects (Fischel, 2001).

Thibodeau (1990) finds that homeowners' concerns regarding negative externalities can be justified for those with properties adjacent to a non-residential land use. He uses a hedonic estimation technique to estimate the effect that a high-rise commercial building has had on the value of nearby houses. The analysis focuses on a single office building in a small residential area of North Dallas. The building, called Lennox Center, was selected for the case study because it is a high-rise office building constructed in a primarily residential district. Properties situated between 1,000 and 2,500 meters from the building benefit from the high-rise. This means that many more homeowners benefit from the high-rise in this specific case. However, the costs for those living next to the building are much higher than the benefits of those further away. The study proves that high-rise office buildings can act as a disamenity for some and as a benefit to others. Further research could tell if the same applies for residential high-rise, or if a functional change could have an impact on the spillover effects.

2.5 Office building vacancy

According to Remøy (2010) *"Current office employees are not pleased with monofunctional office environments and the inner city and mixed use locations are (re)gaining popularity as office locations. Accordingly, office buildings in monofunctional locations become obsolete and structurally vacant"* These office building vacancies can cause problems for both owners and the community. The owners of vacant offices are often confronted with a negative cash flow, resulting in financial problems. Additionally, many of the properties are deteriorating and subjected to vandalism, which causes societal issues. Converting vacant office buildings into housing could be a potential solution to this problem (Remøy & Van der Voordt, 2007). In previous research forementioned authors discussed financial, functional, structural, technical and aesthetic issues in order to determine the risks, chances, brakes and triggers of transformation projects.

The outcomes of their research show that conversion is sensible from a sustainability point of view, both ecologically and from an urban regeneration point of view. However, these projects will only be interesting for developers if they are financially feasible. Social housing associations have additional social goals and can wait for property price increases through long-term externalities as a result of upgrading of the area. This implies that office transformation can have a positive effect on surrounding property values, which will eventually affect the value of the building itself.

2.6 Literature gap

The literature contains explanations on the mechanism of externalities in the built environment, which provides a solid basis for further research on real estate development spillover effects. The effects of urban (infill) development on surrounding house prices have been studied, as well as the effects of non-residential land uses on the surrounding property values. The effects of office vacancy on house prices are explained, and transformation is proposed as solution to negative office vacancy externalities. However, the spillover effects of building- or office transformation have not yet been studied. Real estate development externalities that have been studied mostly relate to the United States real estate market. This research will add to the existing literature by providing insight in the effects of office transformation in the Amsterdam real estate market.

2.7 Expectations and hypotheses

The hypotheses derived from previous research, which are used to answer the main and sub-questions of this research are as follows:

Previous research proves the existence of spillover effects of different types of urban real estate development on surrounding property values. Even though infill and re-development have a higher impact on the built environment, it is expected that the transformation and upgrade of an office building will also have a significant impact on surrounding house prices:

***H0**: There is no relation between office transformation and surrounding house prices;*
***H1**: There is a relation between office transformation and surrounding house prices.*
If hypothesis **H0** is rejected, the effect of office transformation on house prices will be explained.

Previous research also clearly shows that agglomeration effects and externalities are related. Hence, office transformation is expected to affect house prices differently based on distance from the city center. This research compares the effect of office transformation 'inside the ring road' and 'outside the ring road' on surrounding house prices:

***H0**: The effects of office transformation inside and outside the ring road on surrounding house prices are equal;*
***H1**: The effects of office transformation inside and outside the ring road on surrounding house prices are not equal.*
If hypothesis **H0** is rejected, the different effects of office transformation inside and outside the ring road will be explained.

3. Data description

In this chapter the origins of the data, the variables and the data transformation are discussed. Together these aspects form the foundation for the hedonic pricing model.

3.1 Origins

The panel data for this research originates from two main sources. The first portion of data was provided by the municipality of Amsterdam, specifically by the 'Transformationteam' which is tasked with executing the city's office transformation policy. The Transformationteam provided a dataset containing information on 181 commercial real estate transformations that had been realized within the municipality between 2014 and June 2018. The dataset contained 11 variables, among which were: floorspace, vacancy rates, old and new functions, type of transformation, number of houses added by transformation and the starting dates.

A selection of observations and variables was made to be able to use the information in the hedonic pricing model, in relation to the aim of this research. The observations were selected based on 'old function' being an office and 'new function' being housing, hotel or commercial. Another important selection criterion was 'date of completion', as this point in time is vital in order to perform before/after house price comparison. Without the date of completion it would be impossible to measure the effect of office transformation on surrounding house prices. The date of completion was not included in the data, therefore it had to be derived from other sources. The observations for which no verified completion date could be found, were not included in the final selection. The same applies for transformations that were completed in 2018, as house price comparison would require data of 2018, which were not available. The final selection consists of 20 office buildings spread across the Amsterdam municipality, visualized in figure 3.

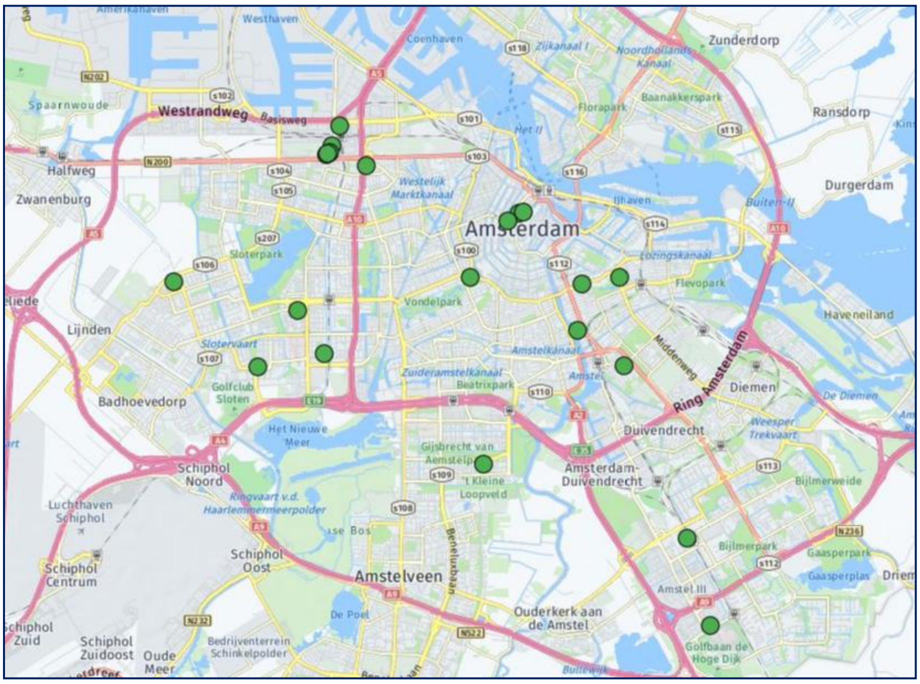


Figure 3 Selection of office building transformations

In addition to the office transformation data, a dataset containing housing information was provided by the ‘NVM’ (Dutch association for realtors). This dataset contains 81 variables with information about 174.899 sales of 64.149 unique properties in Amsterdam between 2005 and 2017. The dataset was entirely unlabeled, an explanation of the variables and coding was therefore provided in a separate document. Apart from transforming the property data, explained in chapter 3.3, the original variables and coding were completely renamed and relabeled before performing descriptive statistics and further alterations.

The dataset contained numerous variables that have been previously proven to affect house prices significantly. By including these variables in the hedonic pricing model as control variables, their effects on house prices are removed from the equation. This is essential in measuring the true effect of office transformation on the dependent variable.

Combining the two data sources was required to be able to perform the statistical analysis. The data was combined using the geo-data analysis program: ArcGIS. The first step was to identify the coordinates of all office buildings. The Dutch ‘Rijksdriehoekstelsel’ coordinate system was used to ensure compatibility with the property dataset. Secondly both office and property data were loaded into the program in order to calculate the distance between each property and every office building. These values were exported as a new dataset, containing all properties as observations and the distance to each office as a new variable. Finally a new variable was generated in Stata (statistical analysis program) showing the distance to the nearest office building. This variable is used to define target and control groups for the hedonic pricing model.

3.2 Variables

The hedonic pricing model is made up of the key variable ‘Transaction price’, the primary independent variables ‘target or control group’, ‘before, during or after transformation’ and ‘distance’ and the control variables as referred to previously. All employed variables are listed in table 1. The table includes the variable types, the base levels used in regression, the way variables have been transformed and a short description for each variable.

Variables	Type	*baselevel*	Transformation	Description
Dependent (Y)				
log_transprice	Ratio		Natural logarithm + removed outliers	Transaction price object
Independent (X)				
target	Dummy	Control		Target or control group
bf	Dummy	No		Sold before transformation
dr	Dummy	No		Sold during transformation
at	Dummy	No		Sold after transformation
D	Ratio			Distance to transformation
D2	Ratio			Distance to transformation squared
Control (Z)				
log_sqm	Ratio		Natural logarithm + removed outliers	Floorspace object
b5.bper	Ordinal	2001>	Several catagories were merged	Building period
b3.htype	Nominal	Apartment	Combined single family home and apartment housetypes, several catagories were merged	House type
log_rooms	Ratio		Natural logarithm + removed outliers	Number of rooms
b0.park	Nominal	No parking		Parking at object
b1.gardenq	Ordinal	No garden	Replaced 'missing' by 'no garden' for most apartment types, several catagories were merged	Garden quality
b2.inmain	Ordinal	Average	Several catagories were merged	Indoor maintenance level
b2.outmain	Ordinal	Average	Several catagories were merged	Outdoor maintenance level
b0.insu	Ordinal	No insulation		Insulation object
b0.leaseh	Nominal	Freehold		Leasehold/freehold
Fixed effects				
i.qdum	Ordinal		Created quarter trend from month and year	Quarters sold
i.pc4	Nominal			Postcode 4
Interactions				
target*dr/at*D*D2	Dummy*dummy*ratio	control & before		Interaction between 'target group', 'during or after transformation' and 'distance (squared)'
Sub-sample groups (Chow-test)				
oloc	Dummy	Outside ring		Office location inside or outside the ringroad highway
nfun	Nominal	Housing		New function of the transformed office building: housing, hotel or commercial

Table 1 Variable description

The control variables are mainly housing characteristics and time and location fixed effects. The time fixed effects are included as quarters in which a property has been sold, the location fixed effects are included as postcodes. Both fixed effects are expected to affect house prices significantly based on previous research (Ooi & Le, 2013). In their research about the external effects of industrial heritage redevelopment, Duijn et al. (2016) also included ‘size’ as a control variable. This development characteristic could not be included in this research, because the gathered data is not conclusive when it comes to transformation size. The office transformation data provided by the municipality of Amsterdam does not provide information about floorspace or the number of newly developed homes for each of the transformation sites. An attempt was made to gather the required information from other sources, but this information was inconsistent and therefore the dataset remains inconclusive regarding size. Based on the information available, it can be stated that the known floorspaces range from approximately 1.000 meters to 13.650 meters. In case of transformation into housing, the number of newly added homes ranges from 8 to 354.

Furthermore, an interaction variable has been used to measure the combined effect on the transaction price of a property in the target group which was sold during or after the nearest office transformation, compared to a property in the control group, sold before the nearest office transformation. The variables ‘D’ and ‘D2’ are included to measure whether and how the effect changes over distance, similar to the approach that was used by Duijn et. al (2016). The variable ‘distance squared’ ensures that an increase or decrease of the effect over distance can be measured.

Originally the variable ‘out’ was included in the models to control for the effect of a property-bound outside area on the house price. This variable was removed from the regression, because only 0,99% of the observations lack this feature. The variable ‘heating’ should have been included based on literature, but was excluded because over 90 percent of all observed houses feature central heating. Using all remaining variables listed in table 1, the total number of observations included in the model 1 regression is 92.025 of which 54.021 are unique properties.

3.3 Transformation

After combining the data and making a first selection of variables in relation to the aim of this research, the remaining data were analyzed and transformed to ensure normal distribution. Several steps were taken to check the variables for missing or 'wrong' values and outliers. These values were corrected if possible, or otherwise removed from the data to avoid distortion of the analysis outcomes. The first step was looking at the histograms of the continuous variables 'transaction price' and 'floorspace'. The histograms show signs of positive skew and leptokurtic distributions, see figure 4.

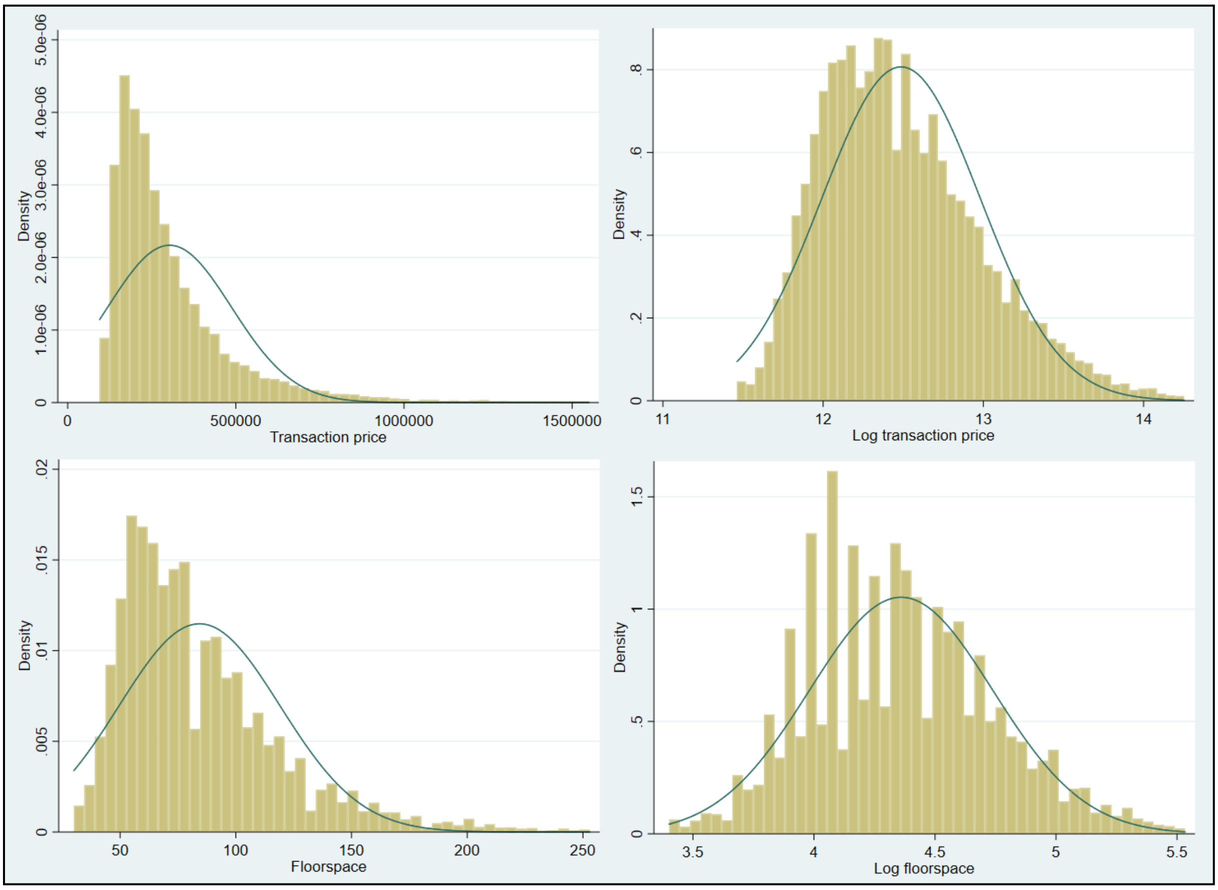


Figure 4 Histogram of transaction price (top) and floorspace (bottom), before (left) and after (right) data transformation

The findings above were verified by looking at the variable statistics, shown in table 2. The statistics show signs of asymmetrical distribution of the continuous variables. The distributions of both 'transaction price' and 'rooms' are strongly skewed to the right (positive skew). The same variables have an extreme leptokurtic distribution, which also applies to the 'floorspace'. This indicates that the tails are relatively heavy.

variable	N	mean	sd	max	min	skewness	kurtosis
transprice	106141	503644.8	1.31e+07	1.00e+09	1	75.81864	5775.555
target	173176	.4213863	.4937826	1	0		
bda	173176	1.273236	.5923773	3	1		
D	173176	1346.339	1023.369	10492	1	2.087977	7.903785
D2	173176	2859907	5216970	1.10e+08	1	3.764535	22.52025
sqm	173176	131.3135	1838.46	99999	1	53.89441	2921.744
bper	173176	2.695876	1.262836	5	0		
htype	173176	2.025968	.5261254	3	1		
rooms	173176	3.430631	1.953797	198	0	17.85981	1090.744
park	173176	.4310759	1.252481	8	0		
gardenq	173176	1.308524	.72175	3	1		
inmain	173176	2.9128	.3389212	3	1		
outmain	173176	2.975424	.1763136	3	1		
insu	173176	1.717732	1.839079	5	0		
leaseh	157977	.5896428	.4919001	1	0		
qdum	173176	26.95967	14.60051	52	1		
pc4	173176	1058.152	27.6891	1109	1011		

Table 2 Statistics before data transformation (target=1000)

In case of the transaction price, floorspace and rooms, the first and last percentile were dropped, removing a total of 2.903 observations from the dataset (including missing values). This limits the dataset to observations with a maximum of 7 rooms and 253 sqm. Furthermore, the natural logarithm was generated for each continuous variable to ensure a more normal distribution.

variable	N	mean	sd	max	min	skewness	kurtosis
transprice	98709	303085.3	184022.8	1550000	95000	2.272524	10.09776
log_transp~e	98709	12.48651	.4944758	14.25377	11.46163	.6496735	3.123143
target	98709	.3998116	.4898619	1	0		
bda	98709	1.328562	.6349885	3	1		
D	98709	1402.896	1060.37	10492	13	1.950779	7.021734
D2	98709	3092491	5432873	1.10e+08	169	3.462947	19.54835
sqm	98709	84.31815	34.75597	253	30	1.37755	5.366319
log_sqm	98709	4.360126	.3789286	5.53339	3.401197	.3197615	2.812406
bper	98709	2.777629	1.202806	5	0		
htype	98709	2.037626	.5071145	3	1		
rooms	98709	3.263117	1.094792	7	2	.9819559	3.927013
log_rooms	98709	1.130252	.3208681	1.94591	.6931472	.2182731	2.44621
park	98709	.35399	1.105815	8	0		
gardenq	98709	1.28194	.6953584	3	1		
inmain	98709	2.902359	.3567545	3	1		
outmain	98709	2.9775	.1677916	3	1		
insu	98709	1.712964	1.796294	5	0		
leaseh	92025	.6443792	.4787036	1	0		
qdum	98709	27.72929	15.45386	52	1		
pc4	98709	1059.634	26.93305	1109	1011		

Table 3 Statistics after data transformation (target=1000)

The variable statistics after data transformation are included in table 3. The number of observations was reduced for each variable. The maximum amount of observations was lowered from 173.176 to

98.709, the minimum amount was lowered from 106.141 to 92.025. This last amount is being used in the hedonic pricing model. The skweness and kurtosis improved significantly as a result of the transformation. By removing outliers, wrong- and missing values, the skweness of transaction price dropped from 75,80 to 2,27. Simultaneously the kurtosis dropped from 5775,56 to 10,10. By generating the natural logarithm these numbers are further lowered to 0,65 and 3,12 respectively. Similar changes can be seen for the skewness and kurtosis of floorspace and rooms, which were transformed in a similar manner. Overall the transformation improved skewness and kurtosis values of the continuous variables significantly, bringing them closer to the preferred levels between -0,5 and 0,5 and between -2 and 2 respectively (George & Mallery, 2010).

3.4 Methodology

In order to determine whether the transformation of office buildings has an effect on surrounding house prices, a statistical analysis is performed by using a difference-in-difference (DID) hedonic regression. This multiple linear regression measures the effect of office transformation on a treatment group versus a control group. The approach is visualized in figure 5, which shows all property sales in Amsterdam between 2005 and 2017 (red dots) and the 20 selected office transformations (green dots). The treatment group is indicated by the green areas around the transformed office buildings. All other properties represent the control group.

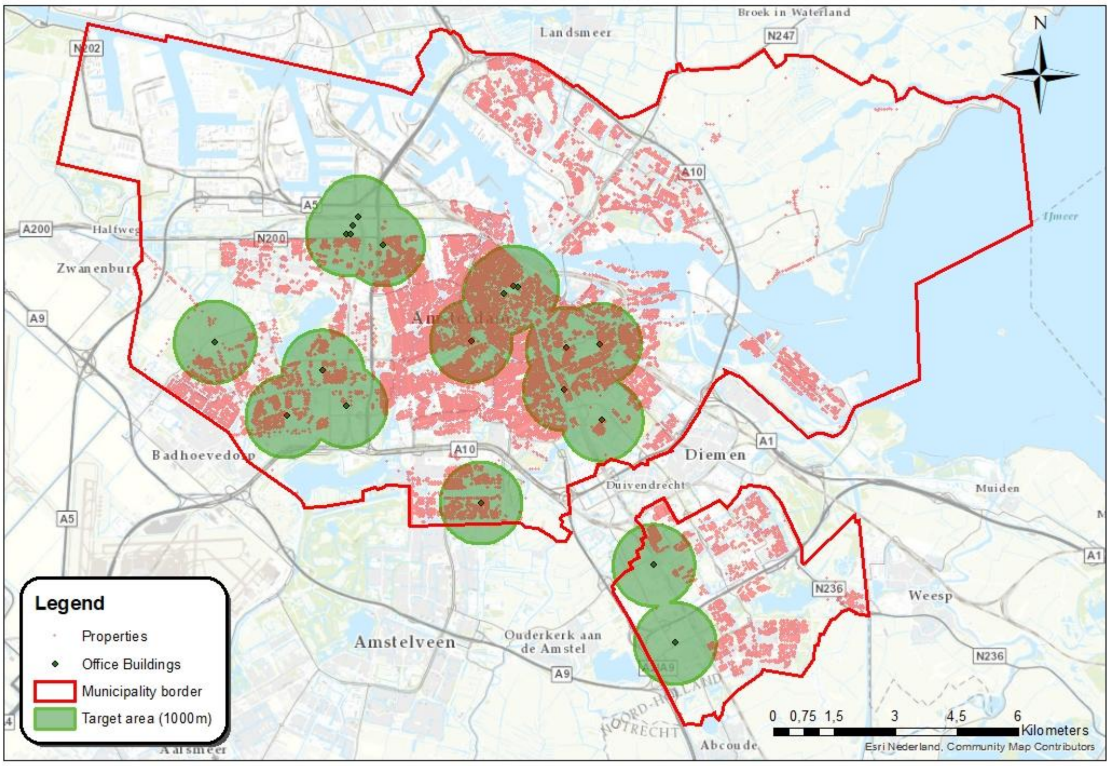


Figure 5 Visual representation of difference-in-difference approach, treatment radius 1000m

DID analysis will indicate whether office transformation is a significant predictor of house prices and to what extent prices are being affected. The regression coefficients will provide insight in the magnitude and direction of the effect. The DID method uses panel data to measure differences between two groups, of changes in the dependent variable that occur over time. This approach is different from a time-series approach, which analyzes differences over time on a single group or subject, or a cross-section estimate measuring the difference between treatment and control groups.

The first requirements for this type of multiple linear regression are a continuous dependent variable and at least two independent variables. This specification is met by using the key variable 'house price' as dependent variable in the hedonic regression, which results in the following functional form:

$$ln(p) = \beta0 + \beta1tc + \beta2tc*D + \beta3tc*D2 + \beta4tc*dr + \beta5tc*dr*D + \beta6tc*dr*D2 + \beta7tc*at + \beta8tc*at*D + \beta9tc*at*D2 + \beta10ht + \beta11bp + \beta12f + \beta13r + \beta14pa + \beta15g + \beta16im + \beta17om + \beta18i + \beta19lf + \beta20t + \beta21l + \varepsilon$$

p=house price; tc=target/control; bf=before; dr=during; at=after; D=distance; D2=distance squared; ht=house type; bp=building period; f=floorspace; r=rooms; pa=parking; g=garden; im=indoor maintenance; om=outdoor maintenance; i=insulation; lf=leasehold/freehold; t=time fixed effect (quarters); l =location fixed effect (postcode 4); ε=error term.

There are five principal assumptions which justify the use of linear regression models (Brooks & Tsolacos, 2010). These assumptions of the OLS model apply equally to a difference-in-difference approach. The assumptions are:

1. $E(it) = 0$ *(There is a linear relation between the dependent and independent variables, the error term is equal to 0);*
2. $var(it) = \sigma^2 < \infty$ *(Homoscedasticity, the variance of error terms is constant);*
3. $cov(ii,ij) = 0$ *(No autocorrelation, the error terms are independent);*
4. $cov(it,xt) = 0$ *(No multicollinearity, the x variables are endogeneous);*
5. I$t \sim N(0,\sigma 2)$ *(The residuals are normally distributed).*

The linearity assumption is met by including an error term in the regression models, this ensures the assumption cannot be violated (Brooks & Tsolacos, 2010). Linearity is checked by looking at twoway scatterplots of the dependent and independent variables. The scatterplot of 'ln transactionprice (y)' and 'ln floorspace (x)' (figure 6) shows evidence of their linear relation.

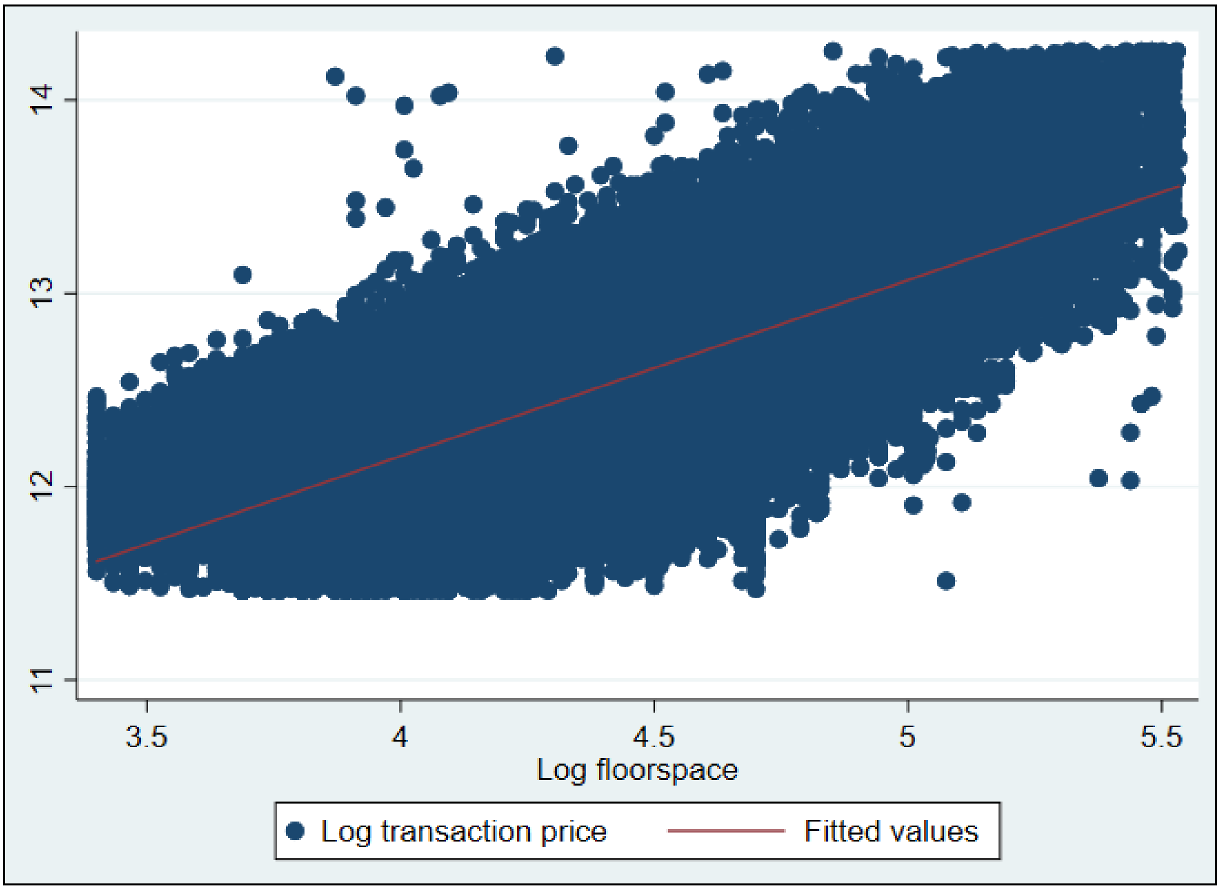


Figure 6 Scatterplot of ln transaction price and ln floorspace

The assumption of homoscedasticity can be checked by looking at a scatterplot of the residuals (appendix II). There should be no clear pattern in the distribution. A cone-shaped pattern indicates a heteroscedasctic distribution. The scatterplot shows no such pattern. Additionally, tests are performed to check for homoscedasticity statistically. The outcome of the Breusch-Pagan/Cook-Weisberg test shows a Chi2-test p-value of 0.0000 (appendix I). This indicates that the second assumption is violated. This issue can be overcome by the use of robust errors in the linear regressions. This ensures more accurate p-values, but doesn't alter the estimators.

The assumption of independence of the error terms can be explained as a lack of autocorrelation. Autocorrelation is a similarity between observations as a function of delay. This type of correlation can occur in datasets that include multiple observations of a single subject over time, known as time-series data. The data used in this research can be qualified as panel data and are therefore not prone to autocorrelation. The assumption is therefore met.

The assumption of no multicollinearity can be checked by computing a Pearson's Bivariate Correlation matrix. This matrix (appendix II) shows no sign of multicollinearity as all values are smaller than 0.8. Some variables show relatively high correlations, as can be expected between variables such as 'rooms' and 'floorspace'. Additionally, the variance inflation factor (VIF) is checked to confirm that the assumption is met. The VIF outcomes (appendix II) verify that no multicollinearity exists in the regression, as all values are below 5.

The last assumption that the residuals are normally distributed is checked by looking at the histogram of the residuals and the residuals vs. fits plot. The histogram of the residuals (appendix III) shows that their distribution is approximately normal. The residuals vs. fits plot shows that the pattern of dots is densest near the center line, which indicates that the distribution is not skewed. The Jarque-Bera normality test was performed to verify this finding, but the test outcome indicates that the assumption is violated (appendix III). However, large sample sizes almost always 'fail' the normality tests and violate the assumption of normality. This is because the normal distribution has an assumed range of negative to positive infinity. Given a large sample size, this would indicate extreme and impossible values, such as negative floorspace. Therefore visual analysis of the residuals is decisive and the distribution considered to be approximately normal. Additionally, the large sample size justifies the assumption of a normal distribution based on the central limit theorem.

4. Results

This chapter reports the results of the hedonic pricing models performed to measure the effect of office building transformation on surrounding house prices. A total of 6 models are used to regress house prices in the Amsterdam municipality, in order to analyze how different transformation characteristics add to the equation. In this chapter, outcomes are considered significant at a 5% level, unless stated differently. Additionally the following assumptions are used to interpret the models: Firstly, if the coefficient of 'target (during/after)' is not significant, then its 'distance coefficients' are considered not to be significant either. Secondly, if the coefficients for 'target (during/after)' and 'Distance squared' are significant, then 'Distance' is considered to be significant as well.

4.1 Sample transaction prices

The transaction prices (Y) of the entire sample are analyzed first. Table 4 shows property prices from 2005 to 2017 in the target and control areas. Column T/C shows the target prices as a percentage of control prices per year, with an overall average at the bottom of the table.

Year	Target	Control	T/C
2005	€ 254.213,50	€ 245.010,60	104%
2006	€ 275.565,50	€ 260.427,70	106%
2007	€ 310.045,80	€ 283.112,40	110%
2008	€ 306.664,90	€ 302.845,30	101%
2009	€ 289.194,20	€ 274.882,90	105%
2010	€ 291.898,80	€ 287.304,80	102%
2011	€ 303.827,00	€ 274.771,50	111%
2012	€ 271.931,20	€ 255.948,90	106%
2013	€ 278.053,70	€ 254.656,60	109%
2014	€ 297.310,40	€ 274.883,70	108%
2015	€ 339.324,00	€ 302.884,40	112%
2016	€ 392.218,60	€ 355.666,30	110%
2017	€ 440.211,70	€ 412.485,90	107%
		Average:	106,95%

Table 4 Sample mean transaction prices

This does not present an immediate problem to the model, as long as price development is approximately equal in both areas. Prices are assumed to behave in a similar pattern, which is confirmed by the parallel trend lines in figure 7. It shows a nearly identical directional pattern of price development in both areas throughout the years 2005 to 2017.

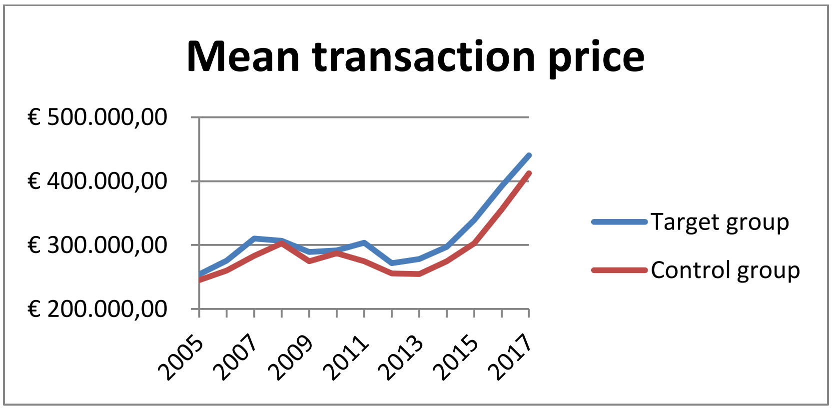


Figure 7 Transaction price development target vs. control group 2005 to 2017

4.2 Base model

As transaction prices are proven to be valid, they are included as dependent variable in the pooled model of the hedonic regression. The outcomes of this base model, or restricted model, are included in table 5. The R-squared of model 1 shows that the included independent variables explain 90,4% of the variance. As expected based on previous research on house price determinants, the hedonic pricing model shows a very high goodness of fit when housing characteristics and time- and location fixed effects are included.

Model 1 (Restricted): Target=1000m							
Log Transaction price	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Target or control							
Target	0.026	0.006	4.36	0.000	0.014	0.038	***
Target*Distance	6.34E-05	0.000	3.19	0.001	0.000	0.000	***
Target*Distance squared	-1.01E-07	0.000	-6.21	0.000	0.000	0.000	***
Target*During	0.033	0.012	2.72	0.007	0.009	0.058	***
Target*During*Distance	-1.6E-05	0.000	-0.36	0.722	0.000	0.000	
Target*During*Distance squared	1.21E-08	0.000	0.33	0.745	0.000	0.000	
Target*After	0.011	0.014	0.80	0.425	-0.016	0.038	
Target*After*Distance	1.16E-04	0.000	2.22	0.026	0.000	0.000	**
Target*After*Distance squared	-8.80E-08	0.000	-1.95	0.051	0.000	0.000	*
Log floorspace	YES						
Building period	YES						
House type	YES						
Log rooms	YES						
Parking	YES						
Garden	YES						
Indoor maintenance	YES						
Outdoor maintenance	YES						
Insulation	YES						
Leasehold/freehold	YES						
Postcode 4	YES						
Quarter	YES						
Constant	YES						
Mean dependent var		12.489		SD dependent var		0.492	
R-squared		0.904		Number of obs		92025.000	
F-test		.		Prob > F		.	
Akaike crit. (AIC)		-84734.375		Bayesian crit. (BIC)		-83253.894	

**** p<0.01, ** p<0.05, * p<0.1*

Note: the coefficients and significance of the control variables can be obtained from Appendix IV, model 1.

Table 5 Model 1 outcomes

In addition to the effect of housing characteristics on house prices, the model shows that the transformation of nearby office buildings has a significant effect as well. The outcomes indicate that all transformation variables associated with the target group before transformation (Target, Target*Distance, Target*Distance squared) are significant at a 1 percent level. The same applies for

Target*During. It's coefficient shows that house prices in the target group are significantly higher during transformation compared to prices in the control group, given the effects of the target group before transformation. However, no change over distance can be detected for the effect of Target*During. Changes over distance can be seen for the effect Target*After, but the effect itself is not significant at any level. The changes over distance are therefore meaningless and not included in the interpretation of the outcomes.

In Log-linear interpretation, the regression coefficients represent growth rates. These growth rates are calculated by taking exp(β). The model 1 growth rates and its changes over distance at a 5 percent significance level are shown in figure 8. The figure shows that growth rates before and during an office transformation within a 1000 meter radius, are significantly different from those in the control area. After office transformation, house prices are equal to those before transformation in the target area.

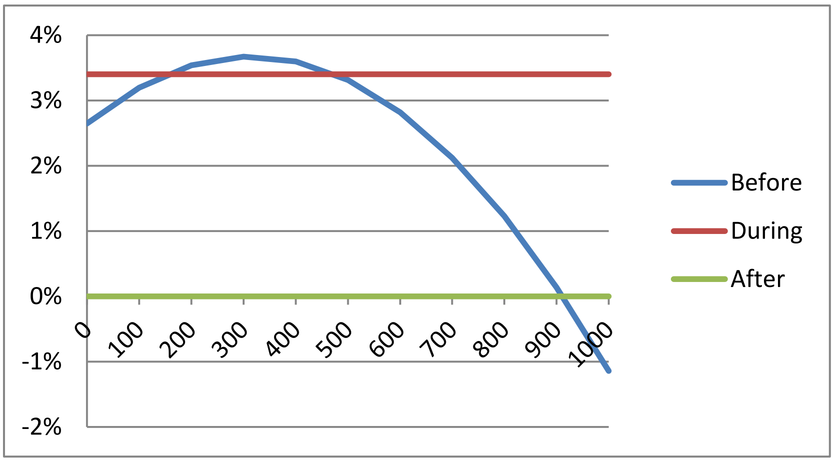


Figure 8 House price growth rates target group model 1

	Before	During	After
0	2,6462%	3,4007%	0,0000%
100	3,1947%	3,4007%	0,0000%
200	3,5369%	3,4007%	0,0000%
300	3,6705%	3,4007%	0,0000%
400	3,5949%	3,4007%	0,0000%
500	3,3104%	3,4007%	0,0000%
600	2,8187%	3,4007%	0,0000%
700	2,1230%	3,4007%	0,0000%
800	1,2272%	3,4007%	0,0000%
900	0,1368%	3,4007%	0,0000%
1000	-1,1417%	3,4007%	0,0000%

Table 6 Growth rates by distance model 1

At 0 meters from the office transformation site, house prices before treatment are 2,65% higher compared to prices in the control group. This number can be calculated by taking the exponent of all significant coefficients associated with the target group before transformation:

$$(\exp{(Target + (TargetDistance * D) + (TargetDistance2 * D^2))} - 1) * 100 =$$

$$(\exp{(0{,}026 + (0{,}000 * 0) + (-0{,}000 * 0^2))} - 1) * 100 = 2{,}65\%$$

At that same distance, house prices during office transformation are an additional 3,4% higher, adding up to a total of 6,05% higher compared to prices in the control area.

When increasing the distance from the office transformation site, the house price growth rate for 'target group before transformation' changes, due to the significant *Target*Distance* and *Target*Distance squared* coefficients. Eventually, at a little over 900 meters from the transformation site, the growth rate drops below zero. The model 1 growth rates used to draw figure 8 are presented in table 6. As a result of these findings the null hypothesis of hypothesis 1 is rejected:

~~***H0**: There is no relation between office transformation and surrounding house prices;*~~
***H1**: There is a relation between office transformation and surrounding house prices.*

4.3 Outside vs. inside ring road

Model 2 and 3 contain unrestricted samples of the outside and inside ring road office transformations respectively. In model 2, only the properties considered ‘outside ring office transformation target group’ and the control group properties are included in the regression. Model 3 only contains the ‘inside ring office transformation target group’ and control group properties.

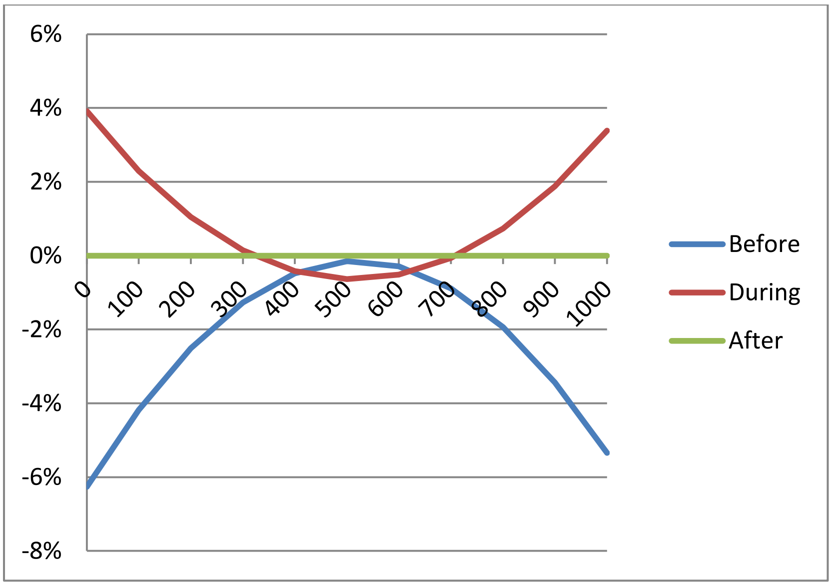
A clear difference in significant outcomes can be observed between the two models. Table 7 shows that in model 2, property prices in the target area are affected before and during office transformation, with a changing effect over distance. This changing effect over distance is less present in model 3. Model 3 does not show a significant change over distance of the effect on house prices during transformation and the changing effect over distance before transformation is only significant for *target*distance squared.* Due to the fact that the change over distance is significant for *target*distance squared*, the coefficient for *target*distance* is included in the calculations as well.

Model 2 & 3 (Unrestricted): Outside & Inside ring road				
Log Transaction price	Model 2	Sig.	Model 3	Sig.
Target or control				
Target	-0.065	***	0.061	***
Target*Distance	2.427E-04	***	6.44E-06	
Target*Distance squared	-2.33E-07	***	-6.01E-08	***
Target*During	0.038	**	0.048	***
Target*During*Distance	-1.741E-04	**	-6.21E-05	
Target*During*Distance squared	1.69E-07	***	4.13E-08	
Target*After	0.034	*	0.022	
Target*After*Distance	1.46E-05		9.45E-05	
Target*After*Distance squared	3.13E-08		-8.28E-08	
Log floorspace	YES		YES	
Building period	YES		YES	
House type	YES		YES	
Log rooms	YES		YES	
Parking	YES		YES	
Garden	YES		YES	
Indoor maintenance	YES		YES	
Outdoor maintenance	YES		YES	
Insulation	YES		YES	
Leasehold/freehold	YES		YES	
Postcode 4	YES		YES	
Quarter	YES		YES	
Constant	YES		YES	
Number of obs	25558		66467	
R-squared	0.890		0.911	

**** p<0.01, ** p<0.05, * p<0.1*
Note: the coefficients and significance of the control variables can be obtained from Appendix IV, model 2 & 3.

Table 7 Model 2 & 3 outcomes

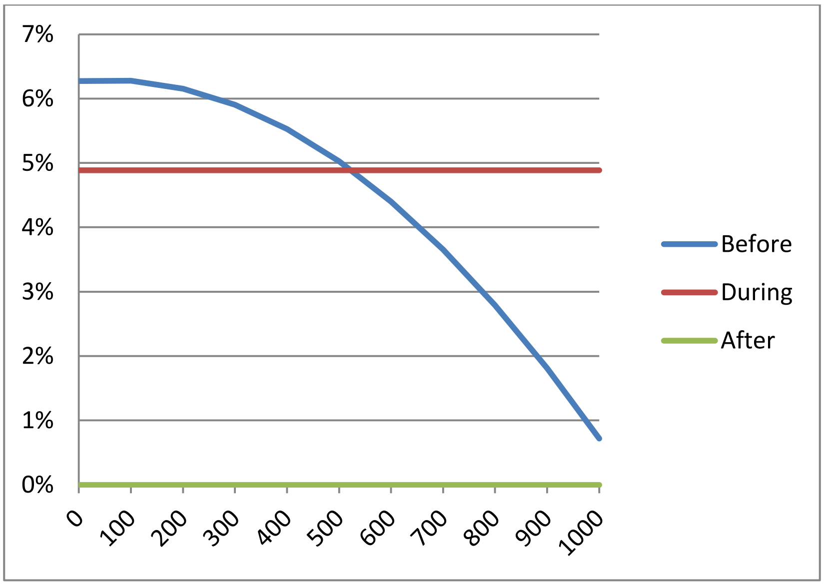
Besides significance of the coefficients, another difference between models can be found in the direction of the effects. Model 2 shows a negative effect on house prices in the target area before transformation, whilst model 3 presents a positive effect for the same variable. These opposite patterns are shown by the blue lines in figures 9 and 10. The growth rates derived from the model 2 and 3 coefficients and used to draw the graphs below are included in table 8 and 9.



	Before	During	After
0	-6,2580%	3,9178%	0,0000%
100	-4,1786%	2,2970%	0,0000%
200	-2,5084%	1,0424%	0,0000%
300	-1,2703%	0,1411%	0,0000%
400	-0,4812%	-0,4161%	0,0000%
500	-0,1523%	-0,6350%	0,0000%
600	-0,2880%	-0,5177%	0,0000%
700	-0,8864%	-0,0630%	0,0000%
800	-1,9393%	0,7337%	0,0000%
900	-3,4321%	1,8805%	0,0000%
1000	-5,3443%	3,3892%	0,0000%

Table 8 Growth rates by distance model 2

Figure 9 House price growth rates target group model 2 (outside ring road)



	Before	During	After
0	6,2723%	4,8868%	0,0000%
100	6,2769%	4,8868%	0,0000%
200	6,1538%	4,8868%	0,0000%
300	5,9034%	4,8868%	0,0000%
400	5,5268%	4,8868%	0,0000%
500	5,0251%	4,8868%	0,0000%
600	4,4003%	4,8868%	0,0000%
700	3,6546%	4,8868%	0,0000%
800	2,7905%	4,8868%	0,0000%
900	1,8112%	4,8868%	0,0000%
1000	0,7200%	4,8868%	0,0000%

Table 9 Growth rates by distance model 3

Figure 10 House price growth rates target group model 3 (inside ring road)

The model 2 coefficients show that before office transformation outside the ring road, house prices at 0 meters distance from treatment are 6,26% lower than in the control area. During transformation, prices rise with 3,91% compared to before transformation in the target group. This implies that house prices in the target area during office transformation are $-6{,}26\% + 3{,}91\% = -2{,}34\%$ compared to prices in the control group. As observations are located further away from the transformation site, the growth rates in the target group before transformation rise towards zero and those during transformation drop towards zero, both at a similar but opposite slope. This shows that the upcoming transformation has a significant negative effect on nearby house prices, but this effect is reduced during transformation. After completion of the office transformation, prices are equal to those in the target area before transformation.

The coefficients of model 3 show a different pattern. As stated previously, the house prices of the target group inside the ring road before transformation are higher compared to those in the control area: 6,27% at 0 meters from the transformation site. The positive effect decreases with distance, reaching 0% just over 1000 meters. During transformation, prices in the target group increase even further with 4,89% at 0 meters. The total growth rate during office transformation is thus 11,16% at 0 meters from treatment compared to prices in the control group. Similar to model 2, no differences between prices in the target group after and before transformation can be detected inside the ring road.

The statistics show that office transformation is better received inside than outside the ring road. Presumably because an obsolete office building inside the ring road has a higher negative impact on its environment, due to the inner city's historic and vibrant character. However, this does not explain why an upcoming office transformation would have a negative effect on surrounding house prices outside the ring road. Perhaps because the environmental improvements do not outweigh the local shift in demand and supply, resulting in lower house prices. The true reason for the opposite effects of model 2 and 3 cannot be obtained from these regression results, this would require further research. The outcomes do imply that the inside and outside ring road real estate markets behave differently when it comes to the impact of urban development.

4.4 New function models

Model 4, 5 and 6 contain unrestricted samples based on the new function that is realized by office transformation. These functions are housing, hotel and commercial real estate respectively. In light of the literature, different new functions may have other effects on surrounding house prices. Hypothetically this could either be the result of different degrees of function related NIMBY'ism, or by affecting the local demand and supply ratio of housing.

Model 4, 5 & 6 (Unrestricted): New function = housing, hotel or commercial						
Log Transaction price	Model 4	Sig.	Model 5	Sig.	Model 6	Sig.
Target or control						
Target	0.011	*	0.125	***	0.044	
Target*Distance	4.19E-05	*	1.07E-05		3.27E-04	***
Target*Distance squared	-6.71E-08	***	-1.37E-07	***	-3.79E-07	***
Target*During	0.012		0.112	***	0.060	
Target*During*Distance	-1.99E-05		-1.928E-04		3.611E-04	*
Target*During*Distance squared	2.97E-08		1.20E-07		-3.93E-07	**
Target*After	-0.013		0.063		0.103	**
Target*After*Distance	1.56E-04	***	-8.99E-05		-3.27E-05	
Target*After*Distance squared	-1.04E-07	**	6.58E-08		-3.36E-08	
Log floorspace	YES		YES		YES	
Building period	YES		YES		YES	
House type	YES		YES		YES	
Log rooms	YES		YES		YES	
Parking	YES		YES		YES	
Garden	YES		YES		YES	
Indoor maintenance	YES		YES		YES	
Outdoor maintenance	YES		YES		YES	
Insulation	YES		YES		YES	
Leasehold/freehold	YES		YES		YES	
Postcode 4	YES		YES		YES	
Quarter	YES		YES		YES	
Constant	YES		YES		YES	
Number of obs	65230		14340		12455	
R-squared	0.905		0.915		0.902	

**** p<0.01, ** p<0.05, * p<0.1*
Note: the coefficients and significance of the control variables can be obtained from Appendix IV, model 4, 5 & 6.

Table 10 Model 4,5 & 6 outcomes

Firstly, table 10 shows no significant outcomes for model 4: new function housing. The coefficients for *Target*Distance squared, Target*After*Distance* and *Target*After*Distance squared* are significant at a 5% level, but because the main effects are not significant, the change over distance is left out of the equation.

Secondly, table 10 does show significant outcomes for model 5: new function hotel. The model indicates that before office transformation, prices in the target area are 13,3% higher than in the control group at 0 meters from the transformation site. During transformation, prices are an additional 11,8% higher, thus a total of 25,1% higher compared to the control group. As was the case in the previous models, after transformation house prices are equal to those before transformation in the target area. Model 5 shows the highest growth rates in the target group of both before and during office transformation. This implies that the transformation development of a hotel in the vicinity has a relatively high positive effect on surrounding house prices, compared to other potential functions.

Lastly, the outcomes of model 6 show that office transformation into commercial real estate has no significant effect on house prices before and during transformation. However, after transformation prices are 10,9% higher than before transformation in the target area. This could imply that the local community is not expecting environmental changes as a result of the transformation, due to the similarity of 'office' and 'commercial' functions. Afterwards, transformation does seem to bring improvements or an economic boost to the neighborhood, resulting in a substantial positive effect on surrounding house prices.

Due to the lack of significant outcomes, no growth rates are presented for model 4. Figure 11 and table 11 present the growth rates over distance of model 5. Model 6 only shows significant coefficients after transformations, representing a growth rate of 10,9%, which remains equal over distance.

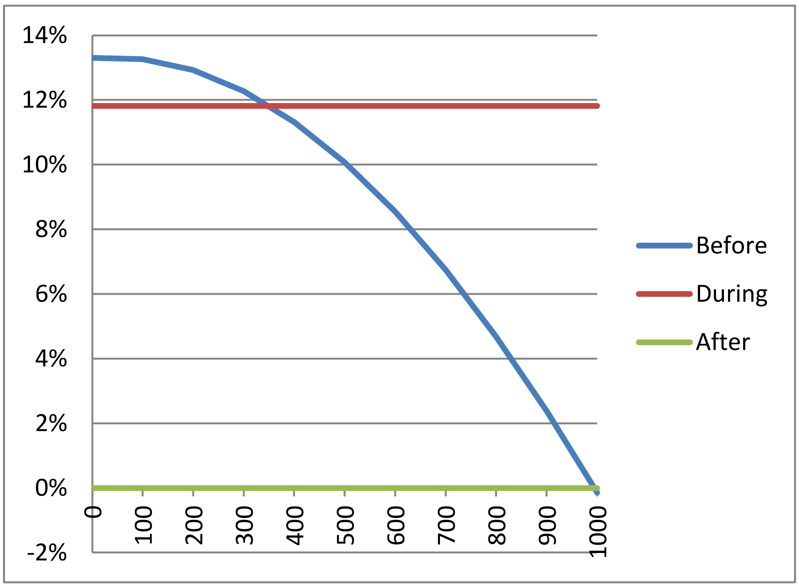


Figure 11 House price growth rates target group model 5 (hotel)

	Before	During	After
0	13,3003%	11,8200%	0,0000%
100	13,2663%	11,8200%	0,0000%
200	12,9225%	11,8200%	0,0000%
300	12,2717%	11,8200%	0,0000%
400	11,3192%	11,8200%	0,0000%
500	10,0728%	11,8200%	0,0000%
600	8,5425%	11,8200%	0,0000%
700	6,7406%	11,8200%	0,0000%
800	4,6815%	11,8200%	0,0000%
900	2,3811%	11,8200%	0,0000%
1000	-0,1427%	11,8200%	0,0000%

Table 11 Growth rates by distance model 5

4.5 Robustness

In order to explore the stability of the main estimates, the unrestricted models discussed in paragraphs 4.3 and 4.4 are used to perform two robustness tests. Due to the linear form of the hedonic pricing model, Chow tests are used to test for robustness. The first Chow test contains the unrestricted samples ‘outside and inside the ring road’. For the second Chow test, the unrestricted samples ‘new functions: housing, hotel and commercial’ are tested against the restricted model 1.[2]

The Chow test is calculated as follows:

$$F = (RSSr - (\sum RSSu))/(g * k - k)/(\sum RSSu)/(n - g * k)$$

RSS = residual sum of squares
r = restricted sample
u = unrestricted sample
g = no. of groups
k = independent vars + constant
n = observations

The null hypothesis of the Chow F test states that there is no structural break point, so that the data set can be represented with a single regression line. It tests whether one regression line or multiple separate regression lines fit the data best. If the null hypothesis is rejected, then the restricted models perform better than the pooled model.

The first Chow test is performed on the ring road subsets:

F=(5611,591 - (4410,996))/(2*87-87)/(4410,996)/(92025-2*87) = 3,41E-08

It computes an F-value of 3,41E-08, which is smaller than the critical F-value of 1,26. This means the null hypothesis cannot be rejected, meaning that the coefficients of subsets are equal and that the data can be presented with a single regression line. As a result of these findings the null hypothesis of hypothesis 2 can also not be rejected:

H0*: The effects of office transformation inside and outside the ring road on surrounding house prices are equal;*
~~***H1****: The effects of office transformation inside and outside the ring road on surrounding house prices are not equal.*~~

The second Chow test is performed on the new function subsets:

F=(5611,591 - (4778,66))/(3*87-87)/(4778,66)/(92025-3*87) = 1,09E-08

It computes an F-value of 1,09E-08, which is smaller than the critical F-value of 1,26. Again, this implies that the coefficients of subsets are equal. The null hypothesis cannot be rejected.

The Chow tests show that none of the subsets outperform the pooled model, confirming that the main estimates are robust.

[2] The fixed effects are not included in the Chow tests, due to a varying number of FE variables between subsets.

5. Conclusion

This chapter summarizes the main findings of this research and provides an answer to the main and subquestions stated in chapter 1 and the hypotheses in paragraph 2.7. The results will be discussed in light of the literature, to see how they relate to previous findings. Furthermore, the contribution to literature will be explained, revisiting the literature gap discussed in paragraph 2.6.

5.1 Main findings summary

Table 12 represents a summary of model 1 to 6 outcomes. The characters B,D,A represent the variables *Before (Target)*, *During* and *After* respectively. A plus sign in the column 'Effect' indicates a positive significant effect was found, a minus sign indicates the presence of a negative significant effect. A '0' shows that no significant effect on house prices was found before, during or after transformation. The column 'Dist.' contains information about the change of the effects over distance (squared). A '0' indicates that the measures effect does not change over distance within the target area, a minus sign shows that the effect is decreasing over distance towards 0.

Model 1: Pooled			Model 2: Outside ring			Model 3: Inside ring		
	Effect	Dist.		Effect	Dist.		Effect	Dist.
B	+	-	B	-	-	B	+	-
D	+	0	D	+	-	D	+	0
A	0	0	A	0	0	A	0	0
Model 4: Housing			**Model 5: Hotel**			**Model 6: Commercial**		
	Effect	Dist.		Effect	Dist.		Effect	Dist.
B	0	0	B	+	-	B	0	0
D	0	0	D	+	0	D	0	0
A	0	0	A	0	0	A	-	0

Table 12 Model 1 to 6 outcomes summary

Table 12 shows that significant effects are mostly found *Before* and *During* office transformation. This applies to models 1, 2, 3 and 5. These effects of office transformation on surrounding house prices are positive with the exception of *Before* transformation outside the Amsterdam ring road, where a negative effect is found. In all these cases, the price effect *Before* transformation decreases over distance towards 0.

Two exceptions in the findings are that the effect *During* transformation in model 2 does decrease over distance, whilst this is not the case for the other models. Secondly, model 6 shows the only significant effect found for *After* transformation. The effect is negative and does not decrease over distance.

The magnitudes of the effects vary across models. In Log-linear interpretation, the regression coefficients represent growth rates. The most extreme growth rates per model are included in table 13, referring to the moment and distance at which the growth rate occurs.

Model	Growth rate	Moment	Distance
1 Pooled	7,07%	During	300 meters
2 Outside ring	-6,26%	Before	0 meters
3 Inside ring	11,16%	During	100 meters
5 Hotel	25,1%	During	0 meters
6 Commercial	10,9%	After	Equal over distance

Table 13 Model growth rates: extremes

5.2 In light of the literature

The literature review of this research discusses house price determinants, mechanism of agglomeration externalities, urban development spillovers, NIMBYism and office building vacancy.

The regression results seem to confirm theory on house price determinants. With an R-squared of 90,4%, model 1 shows a very high goodness of fit when housing characteristics and time- and location fixed effects are included. R2 increases when including environmental factors.

Theory on externality mechanism, mainly the decline of 'agglomeration effects' over distance by Rossi-Hansberg et al. (2008), is supported by the findings in this research. The model outcomes show that growth rates of house prices as a result of office transformation tend to decrease over distance towards zero. Thus, when distance from an office transformation increases its externalities are less likely to cause agglomeration effects.

As described by Thibodeau (1990) inner city (re)development can affect nearby property values in both a positive and negative way. The existence of urban development spillovers is also supported by the regression results of this research. The findings show that urban development, in the form of office transformation, has a significant effect on nearby house prices before, during and after construction. These findings add to literature by filling the gap referred to in paragraph 2.6, as prior to this research most literature was focused on the effects of infill and re-development on surrounding house prices

NIMBYism as described by Fishel (2001) may be a factor that influences office transformation growth rates, but the research outcomes do not always seem to coincide with the patterns expected in relation to NIMBYism. The mainly positive effect found *Before* transformation in models 1,2,3 and 5 support the hypothesis that home owners welcome improvements in the immediate vicinity of their properties. On the contrary, positive growth rates as a result of transforming office space into hotels are not expected in relation to NIMBYism. When sentiment is left out of consideration, it could be argued that development of a hotel or commercial real estate sparks economic development of the area, increasing local property prices. This would not explain the positive anticipation measured in model 5.

Finally, the results show that office transformation generally results in positive effects on surrounding house prices. Correlation between these effects and the reduction of office vacancy cannot be proven by this research, but is considered plausible based on the main results.

5.3 Questions answered

Finally, the main and sub questions of this research are answered. The main research question, as stated in chapter 1 is: **"What is the effect of office building transformation on surrounding house prices in the Amsterdam real estate market?"**

The main question is answered by providing an answer to the following sub questions that were used to structure this research:

- To what extent does office building transformation affect nearby house prices according to literature?

This question is answered in chapter 2 Theory. Literature study revealed that the effects of office transformation on nearby house prices represent a gap in literature, which is partially filled by the results of this research.

- What is the magnitude of the effect of office building transformation on nearby house prices?

This question is answered by looking at the outcomes of model 1 to 6 in chapter 4 Results. The magnitude of the effect cannot be captured in a single growth rate. The growth rates differ per model, per moment and sometimes change over distance. It can be said that the growth rates varies between -6,26% outside the Amsterdam ring road *Before* transformation and 25,1% higher *During* transformation compared to the control group in case of 'new function: hotel'.

- To what extent does the effect on surrounding house prices differ between office transformation inside and outside the ring road?

Models 2 and 3 show several differences between effects inside and outside the ring road of Amsterdam. The most remarkable difference is the direction of the effect. Inside the ring road, office transformation has a positive effect *Before* and *During* development. Whilst outside the ring road, the model shows a negative effect *Before* transformation*,* which is reduced to some extent *During* transformation. The reason for this difference remains uncertain and it should be noted that the Chow F-test indicates that none of the subsamples outperforms the pooled model. The main estimates are robust and the data is best presented with a single regression line. The regression line of the restricted model shows an overall positive growth rate of house prices in a 1000 meter radius as a result of office transformation.

5.4 Limitations and recommendations

As with any study, there are some limitations to this research. Firstly, the office transformation dataset provided by the municipality of Amsterdam lacked some vital information that had to be obtained from other sources. Missing information included the completion dates of transformed office buildings and often times the size of the transformation in floorspace or the number of newly added homes. As other sources of information were scarce and not all off the information was deemed reliable, most of the original 181 transformations were dropped from the dataset and 'size' could not be included as a control variable. This resulted in a relatively small dataset of 20 office transformations, limiting the explanatory power of the regression models and providing only generic findings in relation to the office transformation sample.

Secondly, the control group for each of the target groups consists of all properties outside the 1.000 meter radius from any of the office transformations. This means that the control group is equal for every target group associated with an office transformation. This limits the regression results, as a specific control group adjacent to each target group would have provided more valid results.

Based on the limitations of this research, further recommendations for future research include repeating this study with more office transformation data, obtained from reliable data sources. Additionally a case study could be performed on a single office transformation, to analyze its implications in depth, providing a better understanding of the regression results of this quantitative research. A case study could for instance explain why the inside and outside ring road target groups show opposite results.

Finally, population density and building density could be included in future research, because this research seems to indicate that hyper local real estate markets behave differently when it comes to the effects of office transformation, based on their location within the city. This may be connected to the mechanism of agglomeration externalities.

References

Agentschap NL (2013) “Kantoortransformatie, wonen als alternatief voor leegstand” [PDF] Available at:
https://www.rvo.nl/sites/default/files/KantoorTransformatie%20Informatiekrant%20jan%2713.pdf [Accessed 29-8-2018]

Brooks, C. and Tsolacos, S. (2010) Real estate modelling and forecasting. Cambridge: Cambridge University Press.

Brueckner, J.K., Thisse, J. and Zenou, Y. (1999) “Why is central Paris rich and downtown Detroit poor? An amenity-based theory” *European Economic Review,* 43, pp. 91-107

Camu, K. (2017) “Kantorentransformatie zorgt voor duizenden extra woningen in Amsterdam.” *Vastgoedjournaal* [online]. Available at: https://vastgoedjournaal.nl/news/30787/kantoortransformatie-zorgt-voor-duizenden-extra-woningen-in-amsterdam [Accessed 24-5-2018].

Fischel, W. A. (2001) “Why Are There Nimbys?,” *Journal of Planning Literature*, 16(1), pp. 80–163.

Gemeente Amsterdam (2018) “Kantorenleegstand en transformatie 2015-2018.”[PDF] Available at: https://www.amsterdam.nl/ondernemen/investeren/kantoren/transformatie/ [Accessed 5-6-2018].

George, D., & Mallery, M. (2010). SPSS for Windows Step by Step: A Simple Guide and Reference, 17.0 update (10a ed.) Boston: Pearson.

Ooi, J. T. L. and Le, T. T. T. (2013) “The Spillover Effects of Infill Developments on Local Housing Prices,” *Regional Science and Urban Economics*, 43(6), pp. 850–861. doi: 10.1016/j.regsciurbeco.2013.08.002.

Remøy, H. T. (2010). “Out of Office: a study on the cause of office vacancy and transformation as a means to cope and prevent.” Amsterdam: IOS Press.

Remøy, H. T. and van der Voordt, T. J. M. (2007) “A New Life: Conversion of Vacant Office Buildings into Housing,” *Facilities*, 25(3-4), pp. 88–103. doi: 10.1108/02632770710729683.

Rossi-Hansberg, E., Sarte, P.-D., Owens, R. and National Bureau of Economic Research (2008) *Housing externalities*. Cambridge, Mass.: National Bureau of Economic Research (NBER working paper series, no. 14369). Available at: http://www.nber.org.proxy-ub.rug.nl/papers/w14369

Schwartz, A., Ellen, I. and Voicu, I. (2007) “The External Effects of Place-Based Subsidized Housing,” *Sage Urban Studies Abstracts*, 35(3).

Sirmans, G. S., Macpherson, D. A. and Zietz, E. N. (2005) “The Composition of Hedonic Pricing Models,” *Journal of Real Estate Literature*, 13(1), pp. 3–43.

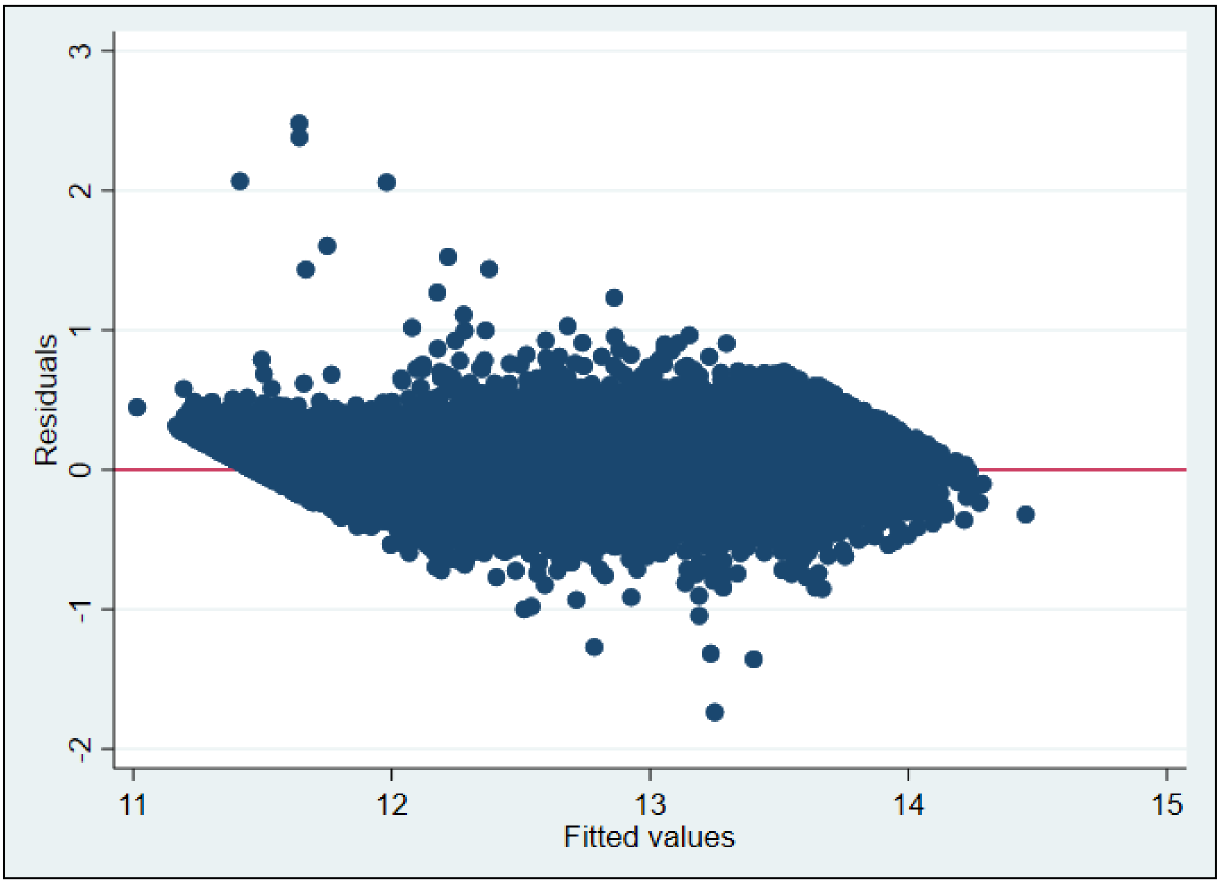
Thibodeau, T. G. (1990) “Estimating the Effect of High-Rise Office Buildings on Residential Property Values,” *Land Economics*, 66(4), pp. 402–402. doi: 10.2307/3146622.

van Duijn, M., Rouwendal, J. and Boersema, R. (2016) “Redevelopment of Industrial Heritage: Insights into External Effects on House Prices,” *Regional Science and Urban Economics*, 57, pp. 91–107. doi: 10.1016/j.regsciurbeco.2016.02.001.

Vastgoed actueel (2017) “Florerende woningmarkt kent ook knelpunten”, Available at: https://www.vastgoedactueel.nl/nieuws/florerende-woningmarkt-kent-ook-knelpunten [Accessed 29-8-2018]

Zietz, J., Zietz, E. N. and Sirmans, G. S. (2008) “Determinants of House Prices: A Quantile Regression Approach,” *The Journal of Real Estate Finance and Economics*, 37(4), pp. 317–333. doi: 10.1007/s11146-007-9053-7.

Appendix I: Results of Homoskedasticity tests



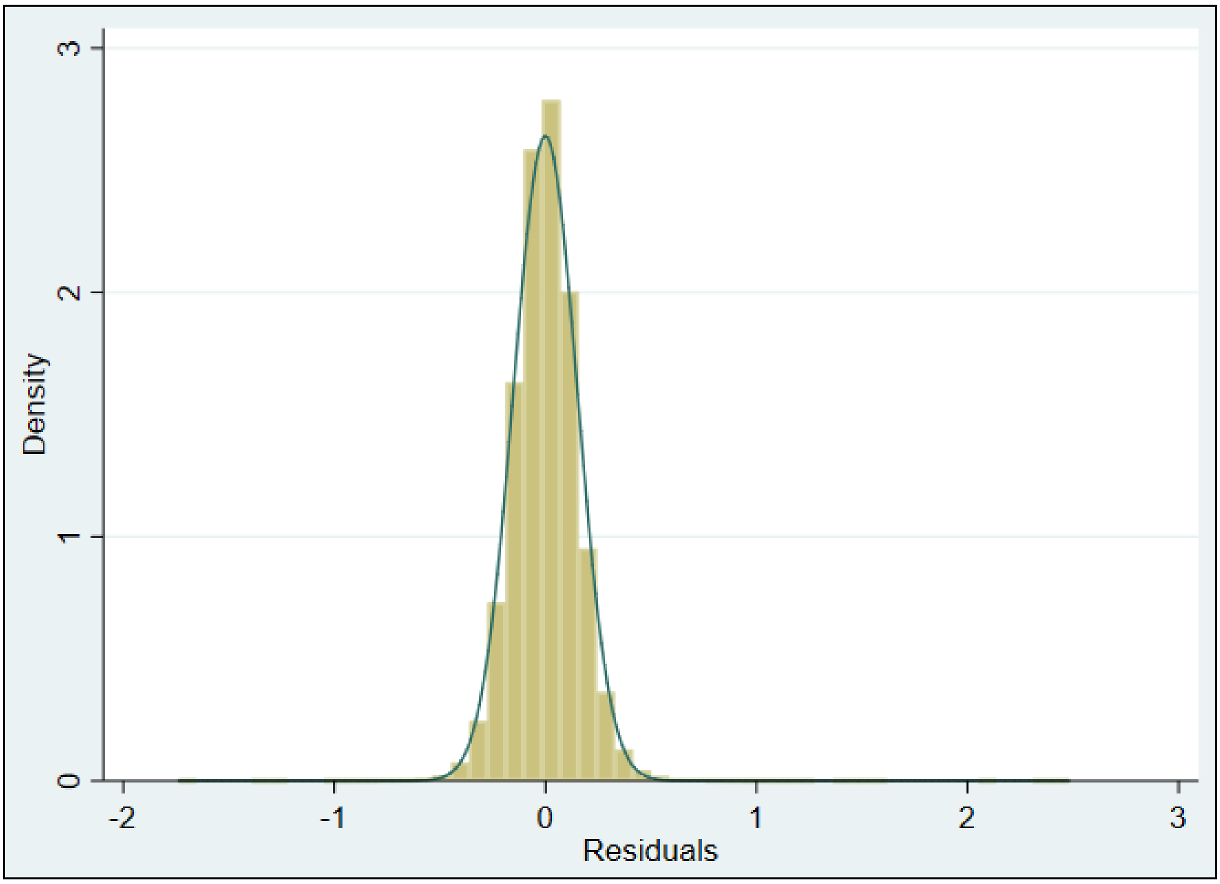

```
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
         Ho: Constant variance
         Variables: fitted values of log_transprice

         chi2(1)      =   2459.66
         Prob > chi2  =    0.0000
```

Appendix II: Results of a multicollinearity test

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1) log_transprice	1.000																
(2) target	0.051	1.000															
(3) bda	0.212	0.002	1.000														
(4) D	-0.118	-0.592	0.064	1.000													
(5) D2	-0.100	-0.396	0.081	0.952	1.000												
(6) log_sqm	0.695	-0.053	-0.012	0.133	0.143	1.000											
(7) bper	-0.180	-0.138	0.042	0.267	0.257	0.163	1.000										
(8) htype	0.007	0.064	-0.014	-0.239	-0.252	-0.208	-0.186	1.000									
(9) log_rooms	0.501	-0.077	0.032	0.152	0.151	0.756	0.093	-0.269	1.000								
(10) park	0.200	-0.097	0.039	0.168	0.163	0.310	0.359	-0.184	0.174	1.000							
(11) gardenq	0.127	-0.095	0.010	0.273	0.280	0.357	0.191	-0.639	0.379	0.209	1.000						
(12) inmain	0.067	-0.000	-0.006	-0.006	-0.005	-0.006	0.064	0.032	-0.071	0.040	-0.031	1.000					
(13) outmain	0.004	-0.010	-0.000	-0.009	-0.017	-0.029	0.061	0.061	-0.043	0.003	-0.055	0.392	1.000				
(14) insu	0.078	-0.057	-0.014	0.122	0.131	0.154	0.396	-0.128	0.059	0.274	0.150	0.156	0.086	1.000			
(15) leaseh	-0.260	-0.184	0.065	0.239	0.202	0.043	0.469	-0.125	0.094	0.130	0.139	-0.009	0.041	0.143	1.000		
(16) qdum	0.204	-0.012	0.648	0.027	0.034	-0.047	0.027	0.026	0.039	0.038	-0.031	0.006	0.005	0.018	0.054	1.000	
(17) pc4	-0.152	0.025	-0.027	-0.125	-0.125	-0.003	0.124	0.015	0.064	-0.031	-0.026	-0.016	0.010	-0.012	0.186	0.011	1.000

Variable	VIF	1/VIF
target	6.72	0.148891
target_D	6.68	0.149740
target_dr	8.52	0.117406
target_dr_D	8.55	0.116941
target_at	7.89	0.126819
target_at_D	7.86	0.127228
log_sqm	2.81	0.356373
bper		
0	1.00	0.995048
1	3.85	0.259813
2	5.04	0.198538
3	4.37	0.228740
4	3.58	0.279698
htype		
1	4.32	0.231381
2	1.63	0.615309
log_rooms	2.67	0.374590
park		
2	1.12	0.891332
3	1.24	0.807067
4	1.11	0.899465
6	1.03	0.974773
8	1.03	0.972059
gardenq		
2	1.05	0.953274
3	3.50	0.285417
inmain		
1	1.43	0.700103
3	1.49	0.671490
outmain		
1	1.29	0.773780
3	1.35	0.740751
insu		
1	1.66	0.601791
2	1.21	0.824072
3	1.12	0.895713
4	1.08	0.928806
5	1.92	0.520635
1.leaseh	1.41	0.706818
Mean VIF	3.11	

Appendix III: Results of residuals normality tests



Skewness/Kurtosis tests for Normality

Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	joint adj chi2(2)	joint Prob>chi2
residuals	92,025	0.0000	0.0000	.	.

Appendix IV: Regression models

Model 1: Restricted, Target=1000m							
Log Transaction price	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Target or control							
Target	0.026	0.006	4.36	0.000	0.014	0.038	***
Target*Distance	6.34E-05	0.000	3.19	0.001	0.000	0.000	***
Target*Distance squared	-1.01E-07	0.000	-6.21	0.000	0.000	0.000	***
Target*During	0.033	0.012	2.72	0.007	0.009	0.058	***
Target*During*Distance	-1.6E-05	0.000	-0.36	0.722	0.000	0.000	
Target*During*Distance squared	1.21E-08	0.000	0.33	0.745	0.000	0.000	
Target*After	0.011	0.014	0.80	0.425	-0.016	0.038	
Target*After*Distance	1.16E-04	0.000	2.22	0.026	0.000	0.000	**
Target*After*Distance squared	-8.80E-08	0.000	-1.95	0.051	0.000	0.000	*
Log floorspace	0.852	0.003	304.41	0.000	0.847	0.858	***
Building period							
Unknown	-0.040	0.037	-1.07	0.286	-0.113	0.033	
1500-1905	0.033	0.003	10.52	0.000	0.026	0.039	***
1906-1930	-0.005	0.003	-1.86	0.063	-0.011	0.000	*
1931-1970	-0.066	0.003	-21.20	0.000	-0.072	-0.060	***
1971-2000	-0.050	0.003	-18.72	0.000	-0.055	-0.045	***
(b)≥2001	0.000	.	.	.	.	.	
House type							
Row-house or(Semi-)detached	0.134	0.003	39.62	0.000	0.128	0.141	***
(b)Apartment	0.000	.	.	.	.	.	
2-level apartment	0.072	0.002	47.28	0.000	0.069	0.075	***
Log rooms	0.033	0.003	11.48	0.000	0.027	0.038	***
Parking							
(b)No parking space	0.000	.	.	.	.	.	
Parking space	0.056	0.004	15.11	0.000	0.049	0.064	***
Carport	0.055	0.003	17.03	0.000	0.049	0.062	***
Garage	0.090	0.004	20.71	0.000	0.081	0.098	***
Garage and Carport	0.103	0.009	11.67	0.000	0.085	0.120	***
Multi-car garage	0.181	0.012	14.91	0.000	0.157	0.205	***
Garden							
(b)No garden	0.000	.	.	.	.	.	
Soil or neglected	0.000	0.025	0.01	0.994	-0.049	0.050	
Normal to beautiful	-0.000	0.003	-0.03	0.974	-0.006	0.005	
Indoor maintenance							
Below average	-0.020	0.005	-3.93	0.000	-0.030	-0.010	***

(b)Average	0.000	.	.	.	.	.	
Above average	0.107	0.002	45.25	0.000	0.103	0.112	***
Outdoor maintenance							
Below average	-0.007	0.017	-0.40	0.686	-0.040	0.027	
(b)Average	0.000	.	.	.	.	.	
Above average	0.052	0.005	10.40	0.000	0.042	0.062	***
Insulation							
(b)No insulation	0.000	.	.	.	.	.	
1 type of insulation	-0.005	0.001	-3.39	0.001	-0.007	-0.002	***
2 types of insulation	0.035	0.002	16.02	0.000	0.031	0.039	***
3 types of insulation	0.046	0.003	15.95	0.000	0.040	0.051	***
4types of insulation	0.065	0.004	15.93	0.000	0.057	0.073	***
Fully insulated	0.049	0.002	26.49	0.000	0.045	0.052	***
Leasehold/freehold							
(b)Freehold	0.000	.	.	.	.	.	
Fixed leasehold	-0.056	0.002	-36.86	0.000	-0.058	-0.053	***
Postcode 4							
(b)1011	0.000	.	.	.	.	.	
1012	-0.082	0.007	-10.98	0.000	-0.097	-0.067	***
1013	-0.052	0.006	-8.29	0.000	-0.064	-0.039	***
1014	-0.300	0.033	-9.13	0.000	-0.364	-0.236	***
1015	0.062	0.006	9.94	0.000	0.050	0.074	***
1016	0.090	0.007	13.14	0.000	0.076	0.103	***
1017	0.096	0.006	14.90	0.000	0.084	0.109	***
1018	-0.079	0.006	-13.48	0.000	-0.091	-0.068	***
1019	-0.146	0.006	-24.42	0.000	-0.158	-0.135	***
1021	-0.387	0.008	-50.65	0.000	-0.402	-0.372	***
1022	-0.407	0.015	-26.60	0.000	-0.437	-0.377	***
1023	-0.277	0.011	-25.19	0.000	-0.298	-0.255	***
1024	-0.595	0.007	-89.86	0.000	-0.608	-0.582	***
1025	-0.587	0.007	-79.86	0.000	-0.601	-0.572	***
1026	-0.047	0.025	-1.92	0.055	-0.096	0.001	*
1027	-0.234	0.029	-8.16	0.000	-0.290	-0.178	***
1028	-0.166	0.037	-4.55	0.000	-0.238	-0.095	***
1031	-0.321	0.015	-21.13	0.000	-0.351	-0.291	***
1032	-0.499	0.008	-63.56	0.000	-0.514	-0.484	***
1033	-0.568	0.007	-86.50	0.000	-0.581	-0.555	***
1034	-0.614	0.007	-82.21	0.000	-0.628	-0.599	***
1035	-0.600	0.009	-68.00	0.000	-0.617	-0.583	***
1036	-0.687	0.019	-35.68	0.000	-0.725	-0.649	***
1041	-0.773	0.014	-55.25	0.000	-0.801	-0.746	***
1051	-0.105	0.006	-18.55	0.000	-0.116	-0.094	***

1052	-0.063	0.006	-10.62	0.000	-0.075	-0.051	***
1053	-0.072	0.006	-12.88	0.000	-0.083	-0.061	***
1054	0.017	0.006	3.00	0.003	0.006	0.028	***
1055	-0.297	0.006	-51.44	0.000	-0.308	-0.286	***
1056	-0.182	0.006	-31.46	0.000	-0.193	-0.171	***
1057	-0.176	0.006	-29.73	0.000	-0.188	-0.165	***
1058	-0.111	0.006	-18.57	0.000	-0.123	-0.099	***
1059	-0.090	0.006	-14.86	0.000	-0.102	-0.078	***
1060	-0.582	0.007	-82.69	0.000	-0.596	-0.568	***
1061	-0.511	0.009	-56.25	0.000	-0.529	-0.493	***
1062	-0.500	0.007	-67.82	0.000	-0.515	-0.486	***
1063	-0.594	0.007	-86.58	0.000	-0.607	-0.580	***
1064	-0.546	0.007	-77.88	0.000	-0.560	-0.532	***
1065	-0.508	0.008	-67.23	0.000	-0.523	-0.493	***
1066	-0.551	0.007	-79.20	0.000	-0.565	-0.538	***
1067	-0.644	0.008	-83.97	0.000	-0.659	-0.629	***
1068	-0.589	0.007	-88.71	0.000	-0.602	-0.576	***
1069	-0.646	0.006	-101.16	0.000	-0.659	-0.634	***
1071	0.208	0.007	31.30	0.000	0.195	0.221	***
1072	-0.004	0.006	-0.66	0.512	-0.015	0.008	
1073	-0.038	0.006	-6.68	0.000	-0.049	-0.027	***
1074	-0.061	0.006	-9.44	0.000	-0.074	-0.048	***
1075	0.077	0.007	11.15	0.000	0.063	0.090	***
1076	0.024	0.006	3.75	0.000	0.011	0.036	***
1077	0.199	0.008	26.50	0.000	0.184	0.213	***
1078	0.028	0.006	4.56	0.000	0.016	0.040	***
1079	-0.017	0.006	-2.69	0.007	-0.029	-0.004	***
1081	-0.227	0.009	-26.68	0.000	-0.244	-0.211	***
1082	-0.303	0.007	-44.91	0.000	-0.317	-0.290	***
1083	-0.321	0.007	-43.71	0.000	-0.335	-0.307	***
1086	-0.396	0.011	-36.13	0.000	-0.417	-0.374	***
1087	-0.443	0.007	-62.85	0.000	-0.456	-0.429	***
1091	-0.154	0.006	-25.32	0.000	-0.165	-0.142	***
1092	-0.162	0.007	-24.82	0.000	-0.175	-0.149	***
1093	-0.198	0.007	-29.33	0.000	-0.211	-0.185	***
1094	-0.246	0.006	-42.39	0.000	-0.257	-0.235	***
1095	-0.270	0.007	-41.05	0.000	-0.283	-0.257	***
1096	-0.154	0.016	-9.92	0.000	-0.185	-0.124	***
1097	-0.201	0.008	-26.51	0.000	-0.216	-0.186	***
1098	-0.118	0.007	-16.95	0.000	-0.132	-0.105	***
1102	-0.758	0.007	-115.90	0.000	-0.771	-0.745	***
1103	-0.795	0.009	-90.13	0.000	-0.812	-0.777	***
1104	-0.816	0.010	-81.88	0.000	-0.836	-0.797	***
1106	-0.767	0.007	-104.84	0.000	-0.781	-0.753	***
1107	-0.745	0.008	-90.37	0.000	-0.761	-0.729	***
1108	-0.764	0.008	-91.20	0.000	-0.780	-0.747	***

1109	-0.614	0.018	-33.96	0.000	-0.649	-0.578	***
Quarter							
(b)2005Q1	0.000	.	.	.	.	.	
2005Q2	0.015	0.007	2.06	0.040	0.001	0.030	**
2005Q3	0.014	0.008	1.87	0.062	-0.001	0.029	*
2005Q4	0.031	0.006	4.91	0.000	0.019	0.044	***
2006Q1	0.052	0.007	7.88	0.000	0.039	0.064	***
2006Q2	0.071	0.006	11.09	0.000	0.058	0.083	***
2006Q3	0.087	0.006	14.14	0.000	0.075	0.099	***
2006Q4	0.114	0.006	18.65	0.000	0.102	0.126	***
2007Q1	0.134	0.006	22.58	0.000	0.122	0.146	***
2007Q2	0.184	0.006	30.90	0.000	0.172	0.196	***
2007Q3	0.202	0.006	34.35	0.000	0.190	0.213	***
2007Q4	0.216	0.006	37.28	0.000	0.205	0.227	***
2008Q1	0.235	0.006	38.83	0.000	0.223	0.246	***
2008Q2	0.252	0.006	43.14	0.000	0.240	0.263	***
2008Q3	0.245	0.006	41.77	0.000	0.234	0.257	***
2008Q4	0.213	0.006	33.99	0.000	0.201	0.226	***
2009Q1	0.181	0.006	28.41	0.000	0.168	0.193	***
2009Q2	0.188	0.006	30.43	0.000	0.176	0.200	***
2009Q3	0.176	0.006	28.99	0.000	0.164	0.188	***
2009Q4	0.172	0.006	28.98	0.000	0.161	0.184	***
2010Q1	0.178	0.006	29.72	0.000	0.167	0.190	***
2010Q2	0.190	0.006	31.31	0.000	0.178	0.202	***
2010Q3	0.193	0.006	30.89	0.000	0.180	0.205	***
2010Q4	0.195	0.006	32.56	0.000	0.183	0.206	***
2011Q1	0.188	0.006	29.03	0.000	0.175	0.200	***
2011Q2	0.192	0.006	31.00	0.000	0.180	0.204	***
2011Q3	0.188	0.006	30.54	0.000	0.176	0.200	***
2011Q4	0.160	0.006	25.43	0.000	0.148	0.172	***
2012Q1	0.144	0.006	22.78	0.000	0.132	0.156	***
2012Q2	0.143	0.006	23.02	0.000	0.131	0.155	***
2012Q3	0.124	0.006	19.64	0.000	0.112	0.137	***
2012Q4	0.110	0.006	18.79	0.000	0.099	0.122	***
2013Q1	0.090	0.007	12.70	0.000	0.076	0.104	***
2013Q2	0.095	0.006	14.97	0.000	0.083	0.108	***
2013Q3	0.098	0.006	15.94	0.000	0.086	0.110	***
2013Q4	0.119	0.006	19.83	0.000	0.107	0.131	***
2014Q1	0.141	0.006	23.29	0.000	0.129	0.153	***
2014Q2	0.167	0.006	28.63	0.000	0.155	0.178	***
2014Q3	0.185	0.006	31.84	0.000	0.173	0.196	***
2014Q4	0.227	0.006	39.56	0.000	0.215	0.238	***
2015Q1	0.233	0.006	39.62	0.000	0.222	0.245	***
2015Q2	0.286	0.006	49.59	0.000	0.275	0.297	***
2015Q3	0.320	0.006	54.32	0.000	0.308	0.331	***

2015Q4	0.345	0.006	59.81	0.000	0.334	0.357	***
2016Q1	0.383	0.006	63.46	0.000	0.371	0.395	***
2016Q2	0.425	0.006	73.42	0.000	0.414	0.436	***
2016Q3	0.455	0.006	76.61	0.000	0.444	0.467	***
2016Q4	0.495	0.006	84.00	0.000	0.483	0.507	***
2017Q1	0.531	0.006	87.55	0.000	0.519	0.543	***
2017Q2	0.568	0.006	96.69	0.000	0.557	0.580	***
2017Q3	0.585	0.006	96.78	0.000	0.574	0.597	***
2017Q4	0.619	0.006	99.97	0.000	0.607	0.632	***
Constant	8.577	0.014	622.40	0.000	8.550	8.604	***
Mean dependent var		12.489		SD dependent var		0.492	
R-squared		0.904		Number of obs		92025.000	
F-test		.		Prob > F		.	
Akaike crit. (AIC)		-84734.375		Bayesian crit. (BIC)		-83253.894	

**** p<0.01, ** p<0.05, * p<0.1*

Model 2: Unrestricted, Outside ring road							
Log Transaction price	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Target or control							
Target	-0.065	0.009	-7.58	0.000	-0.081	-0.048	***
Target*Distance	2.427E-04	0.000	7.68	0.000	0.000	0.000	***
Target*Distance squared	-2.33E-07	0.000	-8.44	0.000	0.000	0.000	***
Target*During	0.038	0.017	2.25	0.025	0.005	0.072	**
Target*During*Distance	-1.741E-04	0.000	-2.46	0.014	0.000	0.000	**
Target*During*Distance squared	1.69E-07	0.000	2.71	0.007	0.000	0.000	***
Target*After	0.034	0.018	1.94	0.052	0.000	0.069	*
Target*After*Distance	1.46E-05	0.000	0.20	0.841	0.000	0.000	
Target*After*Distance squared	3.13E-08	0.000	0.47	0.635	0.000	0.000	
Log floorspace	0.765	0.006	121.88	0.000	0.753	0.778	***
Building period							
Unknown	-0.056	0.059	-0.94	0.346	-0.171	0.060	
1500-1905	-0.026	0.016	-1.65	0.099	-0.057	0.005	*
1906-1930	-0.088	0.007	-13.04	0.000	-0.101	-0.074	***
1931-1970	-0.140	0.005	-27.56	0.000	-0.150	-0.130	***
1971-2000	-0.064	0.004	-15.54	0.000	-0.072	-0.056	***
(b)≥2001	0.000	.	.	.	.	.	
House type							
Row-house or(Semi-)detached	0.150	0.004	35.25	0.000	0.141	0.158	***
(b)Apartment	0.000	.	.	.	.	.	
2-level apartment	0.069	0.004	19.40	0.000	0.062	0.076	***
Log rooms	-0.008	0.006	-1.42	0.155	-0.019	0.003	
Parking							
(b)No parking space	0.000	.	.	.	.	.	
Parking space	0.039	0.004	8.70	0.000	0.030	0.047	***
Carport	0.038	0.005	7.63	0.000	0.028	0.048	***
Garage	0.108	0.006	16.94	0.000	0.095	0.120	***
Garage and Carport	0.097	0.016	6.25	0.000	0.067	0.128	***
Multi-car garage	0.221	0.025	8.73	0.000	0.171	0.270	***
Garden							
(b)No garden	0.000	.	.	.	.	.	
Soil or neglected	0.003	0.030	0.11	0.916	-0.056	0.062	
Normal to beautiful	0.007	0.004	1.80	0.072	-0.001	0.014	*
Indoor maintenance							
Below average	-0.036	0.010	-3.79	0.000	-0.055	-0.017	***
(b)Average	0.000	.	.	.	.	.	

Above average	0.102	0.004	26.44	0.000	0.094	0.110	***
Outdoor maintenance							
Below average	0.051	0.035	1.45	0.146	-0.018	0.120	
(b)Average	0.000	.	.	.	.	.	
Above average	0.001	0.009	0.07	0.944	-0.017	0.018	
Insulation							
(b)No insulation	0.000	.	.	.	.	.	
1 type of insulation	-0.003	0.003	-1.09	0.277	-0.008	0.002	
2 types of insulation	0.053	0.005	9.80	0.000	0.042	0.064	***
3 types of insulation	0.039	0.006	6.35	0.000	0.027	0.051	***
4types of insulation	0.041	0.008	5.30	0.000	0.026	0.056	***
Fully insulated	0.038	0.003	11.45	0.000	0.031	0.044	***
Leasehold/freehold							
(b)Freehold	0.000	.	.	.	.	.	
Fixed leasehold	-0.066	0.004	-15.39	0.000	-0.075	-0.058	***
Postcode 4							
(b)1033	0.000	.	.	.	.	.	
1035	-0.093	0.007	-12.65	0.000	-0.107	-0.079	***
1041	-0.151	0.027	-5.53	0.000	-0.204	-0.097	***
1058	0.511	0.008	67.71	0.000	0.496	0.526	***
1059	0.523	0.008	68.36	0.000	0.508	0.538	***
1060	0.010	0.006	1.63	0.103	-0.002	0.022	
1061	0.060	0.011	5.28	0.000	0.038	0.083	***
1062	0.123	0.008	15.12	0.000	0.107	0.139	***
1063	0.033	0.006	5.14	0.000	0.021	0.046	***
1064	0.045	0.006	7.13	0.000	0.033	0.057	***
1065	0.142	0.008	18.09	0.000	0.127	0.158	***
1066	0.085	0.008	11.19	0.000	0.070	0.100	***
1067	-0.041	0.007	-6.03	0.000	-0.054	-0.028	***
1068	0.031	0.006	4.92	0.000	0.019	0.043	***
1069	-0.021	0.007	-3.25	0.001	-0.034	-0.008	***
1075	0.599	0.009	69.40	0.000	0.582	0.616	***
1076	0.638	0.007	89.64	0.000	0.624	0.651	***
1077	0.725	0.017	42.55	0.000	0.692	0.758	***
1079	0.560	0.032	17.63	0.000	0.498	0.622	***
1081	0.399	0.008	48.20	0.000	0.383	0.415	***
1082	0.336	0.007	46.03	0.000	0.322	0.351	***
1083	0.341	0.008	42.58	0.000	0.325	0.356	***
1087	0.212	0.023	9.15	0.000	0.166	0.257	***
1096	1542	0.038	40.98	0.000	1468	1615	***
1102	-0.189	0.006	-30.71	0.000	-0.201	-0.176	***
1103	-0.236	0.007	-31.68	0.000	-0.251	-0.222	***

1104	-0.258	0.008	-32.14	0.000	-0.274	-0.243	***
1106	-0.200	0.006	-31.40	0.000	-0.212	-0.187	***
1107	-0.185	0.007	-26.97	0.000	-0.199	-0.172	***
1108	-0.194	0.008	-25.24	0.000	-0.209	-0.179	***
1109	-0.014	0.017	-0.83	0.409	-0.046	0.019	
Quarter							
(b)2005Q1	0.000	.	.	.	.	.	
2005Q2	-0.001	0.012	-0.06	0.950	-0.025	0.024	
2005Q3	0.010	0.012	0.80	0.424	-0.014	0.033	
2005Q4	0.008	0.010	0.75	0.456	-0.012	0.028	
2006Q1	0.032	0.010	3.22	0.001	0.013	0.052	***
2006Q2	0.046	0.010	4.39	0.000	0.025	0.066	***
2006Q3	0.065	0.011	6.15	0.000	0.044	0.086	***
2006Q4	0.072	0.010	7.45	0.000	0.053	0.091	***
2007Q1	0.088	0.009	9.53	0.000	0.070	0.106	***
2007Q2	0.117	0.009	12.35	0.000	0.099	0.136	***
2007Q3	0.126	0.009	13.92	0.000	0.108	0.144	***
2007Q4	0.127	0.009	13.70	0.000	0.109	0.145	***
2008Q1	0.135	0.010	13.16	0.000	0.115	0.155	***
2008Q2	0.154	0.010	16.07	0.000	0.135	0.173	***
2008Q3	0.155	0.009	16.56	0.000	0.136	0.173	***
2008Q4	0.126	0.010	12.32	0.000	0.106	0.146	***
2009Q1	0.100	0.010	10.13	0.000	0.081	0.120	***
2009Q2	0.112	0.010	11.27	0.000	0.093	0.132	***
2009Q3	0.106	0.010	10.73	0.000	0.087	0.125	***
2009Q4	0.104	0.010	10.85	0.000	0.085	0.123	***
2010Q1	0.094	0.010	9.71	0.000	0.075	0.113	***
2010Q2	0.103	0.011	9.77	0.000	0.082	0.124	***
2010Q3	0.100	0.010	9.87	0.000	0.080	0.120	***
2010Q4	0.106	0.010	10.59	0.000	0.086	0.125	***
2011Q1	0.095	0.013	7.42	0.000	0.070	0.120	***
2011Q2	0.072	0.010	6.96	0.000	0.052	0.093	***
2011Q3	0.094	0.010	9.12	0.000	0.074	0.114	***
2011Q4	0.083	0.010	8.10	0.000	0.063	0.104	***
2012Q1	0.057	0.011	5.43	0.000	0.037	0.078	***
2012Q2	0.047	0.010	4.71	0.000	0.027	0.066	***
2012Q3	0.027	0.010	2.66	0.008	0.007	0.046	***
2012Q4	0.017	0.010	1.79	0.073	-0.002	0.036	*
2013Q1	-0.008	0.011	-0.74	0.460	-0.030	0.014	
2013Q2	-0.015	0.010	-1.40	0.161	-0.035	0.006	
2013Q3	-0.005	0.010	-0.46	0.649	-0.024	0.015	
2013Q4	0.010	0.010	0.99	0.323	-0.009	0.028	
2014Q1	0.013	0.010	1.33	0.183	-0.006	0.033	
2014Q2	0.035	0.010	3.73	0.000	0.017	0.054	***
2014Q3	0.042	0.010	4.36	0.000	0.023	0.060	***

2014Q4	0.088	0.009	9.34	0.000	0.069	0.106	***
2015Q1	0.086	0.010	8.80	0.000	0.067	0.105	***
2015Q2	0.112	0.009	12.23	0.000	0.094	0.130	***
2015Q3	0.146	0.009	15.34	0.000	0.127	0.164	***
2015Q4	0.159	0.009	18.05	0.000	0.142	0.176	***
2016Q1	0.195	0.009	20.57	0.000	0.176	0.214	***
2016Q2	0.254	0.009	27.61	0.000	0.236	0.272	***
2016Q3	0.285	0.010	29.89	0.000	0.266	0.304	***
2016Q4	0.341	0.009	36.57	0.000	0.323	0.359	***
2017Q1	0.380	0.010	39.28	0.000	0.361	0.399	***
2017Q2	0.426	0.009	45.71	0.000	0.407	0.444	***
2017Q3	0.439	0.009	46.34	0.000	0.420	0.457	***
2017Q4	0.493	0.010	50.25	0.000	0.474	0.512	***
Constant	8630	0.027	313.82	0.000	8576	8684	***

Mean dependent var	12.292	SD dependent var	0.433
R-squared	0.890	Number of obs	25558.000
F-test	.	Prob > F	.
Akaike crit. (AIC)	-26493.812	Bayesian crit. (BIC)	-25556.711

**** p<0.01, ** p<0.05, * p<0.1*

Model 3: Unrestricted, Inside ring road							
Log Transaction price	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Target or control							
Target	0.061	0.008	8.07	0.000	0.046	0.076	***
Target*Distance	6.44E-06	0.000	0.27	0.790	0.000	0.000	
Target*Distance squared	-6.01E-08	0.000	-3.11	0.002	0.000	0.000	***
Target*During	0.048	0.015	3.28	0.001	0.019	0.076	***
Target*During*Distance	-6.21E-05	0.000	-1.21	0.227	0.000	0.000	
Target*During*Distance squared	4.13E-08	0.000	0.98	0.327	0.000	0.000	
Target*After	0.022	0.018	1.22	0.222	-0.013	0.056	
Target*After*Distance	9.45E-05	0.000	1.47	0.142	0.000	0.000	
Target*After*Distance squared	-8.28E-08	0.000	-1.51	0.132	0.000	0.000	
Log floorspace	0.862	0.003	279.70	0.000	0.856	0.869	***
Building period							
Unknown	-0.025	0.045	-0.55	0.585	-0.113	0.064	
1500-1905	0.037	0.003	10.73	0.000	0.031	0.044	***
1906-1930	0.008	0.003	2.40	0.017	0.001	0.015	**
1931-1970	-0.032	0.004	-8.62	0.000	-0.039	-0.025	***
1971-2000	-0.055	0.003	-16.90	0.000	-0.061	-0.049	***
(b)≥2001	0.000	.	.	.	.	.	
House type							
Row-house or(Semi-)detached	0.148	0.005	30.80	0.000	0.138	0.157	***
(b)Apartment	0.000	.	.	.	.	.	
2-level apartment	0.069	0.002	42.22	0.000	0.066	0.073	***
Log rooms	0.049	0.003	15.29	0.000	0.043	0.055	***
Parking							
(b)No parking space	0.000	.	.	.	.	.	
Parking space	0.084	0.005	15.35	0.000	0.073	0.095	***
Carport	0.072	0.004	17.68	0.000	0.064	0.079	***
Garage	0.099	0.006	17.06	0.000	0.088	0.111	***
Garage and Carport	0.108	0.010	10.34	0.000	0.088	0.129	***
Multi-car garage	0.167	0.014	12.09	0.000	0.140	0.194	***
Garden							
(b)No garden	0.000	.	.	.	.	.	
Soil or neglected	-0.004	0.039	-0.11	0.909	-0.081	0.072	
Normal to beautiful	0.001	0.004	0.42	0.671	-0.005	0.008	
Indoor maintenance							
Below average	-0.020	0.006	-3.38	0.001	-0.031	-0.008	***
(b)Average	0.000	.	.	.	.	.	

Above average	0.106	0.003	37.40	0.000	0.100	0.111	***
Outdoor maintenance							
Below average	-0.035	0.018	-1.93	0.054	-0.071	0.001	*
(b)Average	0.000	.	.	.	.	.	
Above average	0.066	0.006	11.51	0.000	0.055	0.077	***
Insulation							
(b)No insulation	0.000	.	.	.	.	.	
1 type of insulation	0.000	0.002	-0.27	0.786	-0.003	0.003	
2 types of insulation	0.036	0.002	15.52	0.000	0.031	0.040	***
3 types of insulation	0.050	0.003	15.72	0.000	0.043	0.056	***
4types of insulation	0.074	0.005	16.18	0.000	0.065	0.083	***
Fully insulated	0.055	0.002	26.26	0.000	0.051	0.059	***
Leasehold/freehold							
(b)Freehold	0.000	.	.	.	.	.	
Fixed leasehold	-0.050	0.002	-32.44	0.000	-0.053	-0.047	***
Postcode 4							
(b)1011	0.000	.	.	.	.	.	
1012	-0.087	0.008	-11.46	0.000	-0.102	-0.072	***
1013	-0.044	0.006	-7.13	0.000	-0.056	-0.032	***
1014	-0.318	0.035	-9.03	0.000	-0.387	-0.249	***
1015	0.066	0.006	10.60	0.000	0.053	0.078	***
1016	0.088	0.007	13.03	0.000	0.075	0.101	***
1017	0.101	0.006	15.84	0.000	0.089	0.114	***
1018	-0.077	0.006	-13.24	0.000	-0.088	-0.065	***
1019	-0.140	0.006	-22.84	0.000	-0.152	-0.128	***
1021	-0.374	0.008	-47.33	0.000	-0.389	-0.358	***
1022	-0.412	0.016	-25.44	0.000	-0.444	-0.380	***
1023	-0.293	0.011	-26.04	0.000	-0.315	-0.271	***
1024	-0.612	0.007	-88.81	0.000	-0.626	-0.599	***
1025	-0.595	0.008	-78.70	0.000	-0.610	-0.580	***
1026	-0.067	0.026	-2.57	0.010	-0.118	-0.016	**
1027	-0.251	0.031	-8.05	0.000	-0.312	-0.190	***
1028	-0.181	0.040	-4.57	0.000	-0.259	-0.104	***
1031	-0.324	0.015	-21.97	0.000	-0.353	-0.295	***
1032	-0.505	0.008	-63.42	0.000	-0.521	-0.490	***
1033	-0.557	0.008	-70.31	0.000	-0.573	-0.542	***
1034	-0.611	0.008	-79.72	0.000	-0.626	-0.596	***
1035	-0.524	0.012	-45.14	0.000	-0.547	-0.502	***
1036	-0.726	0.020	-35.43	0.000	-0.766	-0.686	***
1051	-0.089	0.006	-15.88	0.000	-0.100	-0.078	***
1052	-0.051	0.006	-8.72	0.000	-0.063	-0.040	***
1053	-0.066	0.006	-11.94	0.000	-0.077	-0.055	***

1054	0.020	0.006	3.50	0.000	0.009	0.031	***
1055	-0.322	0.006	-55.41	0.000	-0.333	-0.311	***
1056	-0.184	0.006	-32.03	0.000	-0.195	-0.173	***
1057	-0.174	0.006	-29.71	0.000	-0.186	-0.163	***
1058	-0.128	0.006	-20.27	0.000	-0.140	-0.115	***
1061	-0.512	0.012	-43.59	0.000	-0.535	-0.489	***
1071	0.203	0.007	31.09	0.000	0.190	0.216	***
1072	0.009	0.006	1.63	0.103	-0.002	0.021	
1073	-0.033	0.006	-5.88	0.000	-0.044	-0.022	***
1074	-0.065	0.006	-10.21	0.000	-0.078	-0.053	***
1075	0.208	0.008	25.53	0.000	0.192	0.224	***
1076	0.037	0.009	4.29	0.000	0.020	0.054	***
1077	0.209	0.007	28.10	0.000	0.195	0.224	***
1078	0.022	0.006	3.58	0.000	0.010	0.034	***
1079	-0.030	0.006	-4.96	0.000	-0.043	-0.018	***
1086	-0.420	0.012	-35.92	0.000	-0.443	-0.397	***
1087	-0.461	0.007	-62.41	0.000	-0.476	-0.447	***
1091	-0.162	0.006	-26.53	0.000	-0.174	-0.150	***
1092	-0.167	0.006	-25.97	0.000	-0.179	-0.154	***
1093	-0.206	0.007	-30.29	0.000	-0.219	-0.192	***
1094	-0.242	0.006	-42.54	0.000	-0.253	-0.231	***
1095	-0.254	0.006	-39.41	0.000	-0.267	-0.242	***
1096	-0.156	0.014	-11.57	0.000	-0.183	-0.130	***
1097	-0.215	0.007	-29.00	0.000	-0.230	-0.201	***
1098	-0.128	0.007	-18.41	0.000	-0.142	-0.114	***
Quarter							
(b)2005Q1	0.000	.	.	.	.	.	
2005Q2	0.021	0.008	2.60	0.009	0.005	0.037	***
2005Q3	0.022	0.009	2.56	0.011	0.005	0.039	**
2005Q4	0.046	0.007	6.50	0.000	0.032	0.060	***
2006Q1	0.062	0.008	8.23	0.000	0.047	0.077	***
2006Q2	0.084	0.007	11.91	0.000	0.070	0.098	***
2006Q3	0.103	0.007	15.30	0.000	0.090	0.116	***
2006Q4	0.135	0.007	19.72	0.000	0.121	0.148	***
2007Q1	0.156	0.007	23.21	0.000	0.143	0.170	***
2007Q2	0.214	0.007	31.54	0.000	0.200	0.227	***
2007Q3	0.234	0.007	34.66	0.000	0.221	0.247	***
2007Q4	0.257	0.007	39.13	0.000	0.244	0.270	***
2008Q1	0.281	0.007	41.94	0.000	0.267	0.294	***
2008Q2	0.294	0.007	44.89	0.000	0.282	0.307	***
2008Q3	0.284	0.007	42.66	0.000	0.271	0.297	***
2008Q4	0.250	0.007	35.38	0.000	0.236	0.264	***
2009Q1	0.218	0.007	29.57	0.000	0.204	0.233	***
2009Q2	0.223	0.007	32.00	0.000	0.210	0.237	***
2009Q3	0.209	0.007	30.43	0.000	0.195	0.222	***

2009Q4	0.205	0.007	30.54	0.000	0.192	0.218	***
2010Q1	0.216	0.007	31.72	0.000	0.202	0.229	***
2010Q2	0.228	0.007	33.65	0.000	0.215	0.242	***
2010Q3	0.233	0.007	33.04	0.000	0.219	0.247	***
2010Q4	0.232	0.007	34.62	0.000	0.219	0.245	***
2011Q1	0.227	0.007	32.60	0.000	0.214	0.241	***
2011Q2	0.240	0.007	34.40	0.000	0.226	0.254	***
2011Q3	0.229	0.007	33.29	0.000	0.215	0.242	***
2011Q4	0.196	0.007	27.54	0.000	0.182	0.210	***
2012Q1	0.184	0.007	25.74	0.000	0.170	0.198	***
2012Q2	0.185	0.007	26.11	0.000	0.171	0.199	***
2012Q3	0.165	0.007	22.84	0.000	0.151	0.179	***
2012Q4	0.152	0.007	23.00	0.000	0.139	0.165	***
2013Q1	0.136	0.008	16.72	0.000	0.120	0.152	***
2013Q2	0.142	0.007	19.82	0.000	0.128	0.157	***
2013Q3	0.143	0.007	20.43	0.000	0.129	0.156	***
2013Q4	0.166	0.007	24.36	0.000	0.153	0.179	***
2014Q1	0.194	0.007	28.54	0.000	0.181	0.207	***
2014Q2	0.221	0.007	33.96	0.000	0.209	0.234	***
2014Q3	0.245	0.006	37.73	0.000	0.232	0.258	***
2014Q4	0.287	0.006	44.65	0.000	0.274	0.299	***
2015Q1	0.296	0.007	44.84	0.000	0.283	0.309	***
2015Q2	0.357	0.006	55.16	0.000	0.344	0.369	***
2015Q3	0.394	0.007	60.03	0.000	0.381	0.407	***
2015Q4	0.423	0.006	65.35	0.000	0.411	0.436	***
2016Q1	0.465	0.007	69.08	0.000	0.452	0.478	***
2016Q2	0.500	0.006	77.63	0.000	0.487	0.513	***
2016Q3	0.529	0.007	79.81	0.000	0.516	0.542	***
2016Q4	0.563	0.007	84.96	0.000	0.550	0.576	***
2017Q1	0.597	0.007	87.14	0.000	0.584	0.610	***
2017Q2	0.629	0.007	94.83	0.000	0.616	0.642	***
2017Q3	0.651	0.007	95.06	0.000	0.638	0.664	***
2017Q4	0.673	0.007	95.33	0.000	0.660	0.687	***
Constant	8432	0.015	560.83	0.000	8403	8462	***

Mean dependent var	12.565	SD dependent var	0.493
R-squared	0.911	Number of obs	66467.000
F-test	4185610	Prob > F	0.000
Akaike crit. (AIC)	-65627.380	Bayesian crit. (BIC)	-64380.069

**** p<0.01, ** p<0.05, * p<0.1*

Model 4: Unrestricted, Nfun=Housing							
Log Transaction price	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Target or control							
Target	0.011	0.007	1.66	0.097	-0.002	0.024	*
Target*Distance	4.19E-05	0.000	1.91	0.056	0.000	0.000	*
Target*Distance squared	-6.71E-08	0.000	-3.78	0.000	0.000	0.000	***
Target*During	0.012	0.013	0.89	0.372	-0.014	0.037	
Target*During*Distance	-1.99E-05	0.000	-0.42	0.675	0.000	0.000	
Target*During*Distance squared	2.97E-08	0.000	0.76	0.447	0.000	0.000	
Target*After	-0.013	0.016	-0.81	0.416	-0.043	0.018	
Target*After*Distance	1.56E-04	0.000	2.66	0.008	0.000	0.000	***
Target*After*Distance squared	-1.04E-07	0.000	-2.05	0.041	0.000	0.000	**
Log floorspace	0.864	0.003	274.82	0.000	0.858	0.870	***
Building period							
Unknown	0.019	0.031	0.62	0.536	-0.041	0.079	
1500-1905	0.043	0.004	11.68	0.000	0.036	0.050	***
1906-1930	0.003	0.003	0.79	0.431	-0.004	0.009	
1931-1970	-0.048	0.004	-13.15	0.000	-0.055	-0.040	***
1971-2000	-0.052	0.003	-16.18	0.000	-0.058	-0.046	***
(b)≥2001	0.000	.	.	.	.	.	
House type							
Row-house or(Semi-)detached	0.128	0.005	28.17	0.000	0.119	0.137	***
(b)Apartment	0.000	.	.	.	.	.	
2-level apartment	0.078	0.002	46.22	0.000	0.075	0.082	***
Log rooms	0.042	0.003	13.15	0.000	0.036	0.049	***
Parking							
(b)No parking space	0.000	.	.	.	.	.	
Parking space	0.064	0.005	13.99	0.000	0.055	0.072	***
Carport	0.052	0.004	12.96	0.000	0.044	0.060	***
Garage	0.079	0.005	15.33	0.000	0.069	0.089	***
Garage and Carport	0.089	0.010	9.01	0.000	0.070	0.108	***
Multi-car garage	0.158	0.014	11.02	0.000	0.130	0.186	***
Garden							
(b)No garden	0.000	.	.	.	.	.	
Soil or neglected	-0.038	0.041	-0.92	0.358	-0.118	0.043	
Normal to beautiful	-0.009	0.003	-2.55	0.011	-0.015	-0.002	**
Indoor maintenance							
Below average	-0.023	0.006	-3.91	0.000	-0.035	-0.012	***
(b)Average	0.000	.	.	.	.	.	

Above average	0.112	0.003	41.38	0.000	0.107	0.117	***
Outdoor maintenance							
Below average	0.018	0.020	0.94	0.349	-0.020	0.057	
(b)Average	0.000	.	.	.	.	.	
Above average	0.056	0.006	9.79	0.000	0.045	0.067	***
Insulation							
(b)No insulation	0.000	.	.	.	.	.	
1 type of insulation	-0.006	0.002	-3.59	0.000	-0.009	-0.003	***
2 types of insulation	0.037	0.002	15.71	0.000	0.033	0.042	***
3 types of insulation	0.056	0.003	17.01	0.000	0.050	0.063	***
4types of insulation	0.071	0.005	15.49	0.000	0.062	0.079	***
Fully insulated	0.052	0.002	24.61	0.000	0.048	0.056	***
Leasehold/freehold							
(b)Freehold	0.000	.	.	.	.	.	
Fixed leasehold	-0.054	0.002	-32.35	0.000	-0.057	-0.051	***
Postcode 4							
(b)1011	0.000	.	.	.	.	.	
1013	-0.121	0.012	-9.85	0.000	-0.146	-0.097	***
1014	-0.286	0.034	-8.36	0.000	-0.354	-0.219	***
1016	0.084	0.014	5.79	0.000	0.055	0.112	***
1017	0.084	0.011	7.67	0.000	0.063	0.105	***
1018	-0.080	0.011	-7.59	0.000	-0.101	-0.060	***
1019	-0.153	0.011	-14.43	0.000	-0.174	-0.133	***
1022	-0.505	0.039	-13.07	0.000	-0.580	-0.429	***
1023	-0.280	0.015	-19.32	0.000	-0.309	-0.252	***
1024	-0.619	0.011	-55.82	0.000	-0.641	-0.597	***
1025	-0.503	0.018	-27.38	0.000	-0.539	-0.467	***
1026	-0.064	0.027	-2.36	0.018	-0.117	-0.011	**
1027	-0.245	0.031	-7.92	0.000	-0.305	-0.184	***
1028	-0.178	0.039	-4.54	0.000	-0.255	-0.101	***
1051	-0.117	0.011	-10.92	0.000	-0.138	-0.096	***
1052	-0.059	0.013	-4.62	0.000	-0.084	-0.034	***
1053	-0.077	0.010	-7.42	0.000	-0.098	-0.057	***
1054	0.007	0.010	0.68	0.498	-0.013	0.028	
1055	-0.304	0.011	-28.77	0.000	-0.324	-0.283	***
1056	-0.201	0.011	-19.15	0.000	-0.222	-0.181	***
1057	-0.194	0.011	-18.34	0.000	-0.215	-0.173	***
1058	-0.132	0.011	-12.40	0.000	-0.153	-0.111	***
1059	-0.104	0.011	-9.80	0.000	-0.125	-0.083	***
1060	-0.589	0.011	-51.26	0.000	-0.611	-0.566	***
1061	-0.526	0.013	-41.24	0.000	-0.551	-0.501	***
1062	-0.504	0.012	-43.19	0.000	-0.527	-0.481	***

1064	-0.546	0.014	-40.27	0.000	-0.573	-0.520	***
1065	-0.509	0.012	-43.39	0.000	-0.532	-0.486	***
1066	-0.538	0.011	-47.02	0.000	-0.561	-0.516	***
1067	-0.647	0.013	-51.24	0.000	-0.672	-0.622	***
1068	-0.605	0.011	-54.63	0.000	-0.626	-0.583	***
1069	-0.655	0.011	-59.74	0.000	-0.676	-0.633	***
1071	0.192	0.011	17.45	0.000	0.170	0.214	***
1072	-0.018	0.011	-1.71	0.088	-0.039	0.003	*
1073	-0.045	0.010	-4.34	0.000	-0.066	-0.025	***
1074	-0.060	0.011	-5.51	0.000	-0.082	-0.039	***
1075	0.056	0.011	5.08	0.000	0.035	0.078	***
1076	0.003	0.011	0.23	0.816	-0.019	0.024	
1077	0.169	0.012	14.66	0.000	0.146	0.191	***
1078	0.009	0.011	0.85	0.394	-0.012	0.030	
1079	-0.042	0.011	-3.97	0.000	-0.063	-0.022	***
1081	-0.247	0.012	-20.05	0.000	-0.271	-0.223	***
1082	-0.314	0.011	-28.14	0.000	-0.336	-0.292	***
1083	-0.325	0.012	-28.12	0.000	-0.347	-0.302	***
1086	-0.411	0.014	-28.42	0.000	-0.440	-0.383	***
1087	-0.466	0.012	-37.99	0.000	-0.490	-0.442	***
1091	-0.146	0.011	-13.61	0.000	-0.167	-0.125	***
1092	-0.160	0.011	-14.51	0.000	-0.181	-0.138	***
1093	-0.188	0.011	-16.87	0.000	-0.210	-0.166	***
1094	-0.244	0.011	-23.19	0.000	-0.265	-0.223	***
1095	-0.280	0.011	-25.60	0.000	-0.301	-0.258	***
1096	1039	0.022	47.21	0.000	0.996	1082	***
1097	-0.128	0.015	-8.43	0.000	-0.158	-0.098	***
1098	-0.087	0.013	-6.95	0.000	-0.112	-0.063	***
Quarter							
(b)2005Q1	0.000	.	.	.	.	.	
2005Q2	0.010	0.008	1.18	0.240	-0.007	0.026	
2005Q3	0.016	0.009	1.88	0.060	-0.001	0.033	*
2005Q4	0.041	0.007	5.59	0.000	0.026	0.055	***
2006Q1	0.057	0.008	7.57	0.000	0.042	0.072	***
2006Q2	0.086	0.007	11.65	0.000	0.072	0.101	***
2006Q3	0.100	0.007	14.05	0.000	0.086	0.114	***
2006Q4	0.134	0.007	19.79	0.000	0.121	0.148	***
2007Q1	0.144	0.007	21.18	0.000	0.131	0.157	***
2007Q2	0.207	0.007	30.42	0.000	0.194	0.221	***
2007Q3	0.228	0.007	34.34	0.000	0.215	0.240	***
2007Q4	0.242	0.007	36.63	0.000	0.230	0.255	***
2008Q1	0.257	0.007	38.40	0.000	0.244	0.270	***
2008Q2	0.275	0.007	41.33	0.000	0.262	0.288	***
2008Q3	0.263	0.007	39.91	0.000	0.250	0.276	***
2008Q4	0.230	0.007	32.02	0.000	0.216	0.244	***

2009Q1	0.203	0.007	27.69	0.000	0.189	0.217	***
2009Q2	0.208	0.007	29.93	0.000	0.194	0.221	***
2009Q3	0.188	0.007	27.40	0.000	0.175	0.202	***
2009Q4	0.189	0.007	28.31	0.000	0.176	0.202	***
2010Q1	0.192	0.007	28.25	0.000	0.178	0.205	***
2010Q2	0.206	0.007	30.58	0.000	0.193	0.219	***
2010Q3	0.208	0.007	29.87	0.000	0.195	0.222	***
2010Q4	0.212	0.007	31.23	0.000	0.198	0.225	***
2011Q1	0.208	0.007	27.93	0.000	0.193	0.222	***
2011Q2	0.216	0.007	30.47	0.000	0.202	0.229	***
2011Q3	0.207	0.007	30.04	0.000	0.193	0.220	***
2011Q4	0.182	0.007	25.42	0.000	0.168	0.196	***
2012Q1	0.166	0.007	23.10	0.000	0.152	0.180	***
2012Q2	0.167	0.007	23.76	0.000	0.153	0.181	***
2012Q3	0.146	0.007	20.31	0.000	0.132	0.160	***
2012Q4	0.133	0.007	20.20	0.000	0.120	0.146	***
2013Q1	0.115	0.008	14.01	0.000	0.099	0.132	***
2013Q2	0.119	0.007	16.65	0.000	0.105	0.133	***
2013Q3	0.125	0.007	18.09	0.000	0.112	0.139	***
2013Q4	0.143	0.007	21.41	0.000	0.130	0.156	***
2014Q1	0.170	0.007	25.14	0.000	0.157	0.183	***
2014Q2	0.198	0.006	30.71	0.000	0.185	0.210	***
2014Q3	0.217	0.006	33.68	0.000	0.205	0.230	***
2014Q4	0.264	0.006	41.35	0.000	0.252	0.277	***
2015Q1	0.273	0.007	41.32	0.000	0.260	0.286	***
2015Q2	0.333	0.006	51.57	0.000	0.320	0.345	***
2015Q3	0.366	0.007	55.66	0.000	0.353	0.379	***
2015Q4	0.391	0.007	60.19	0.000	0.379	0.404	***
2016Q1	0.434	0.007	63.83	0.000	0.421	0.447	***
2016Q2	0.471	0.006	73.15	0.000	0.459	0.484	***
2016Q3	0.504	0.007	75.10	0.000	0.491	0.517	***
2016Q4	0.538	0.007	81.20	0.000	0.525	0.551	***
2017Q1	0.569	0.007	83.63	0.000	0.556	0.583	***
2017Q2	0.606	0.007	91.86	0.000	0.593	0.619	***
2017Q3	0.624	0.007	91.17	0.000	0.610	0.637	***
2017Q4	0.655	0.007	93.07	0.000	0.641	0.669	***
Constant	8488	0.018	475.30	0.000	8453	8523	***

Mean dependent var	12.535	SD dependent var	0.474
R-squared	0.905	Number of obs	65230.000
F-test	.	Prob > F	.
Akaike crit. (AIC)	-65737.592	Bayesian crit. (BIC)	-64474.684

**** p<0.01, ** p<0.05, * p<0.1*

Model 5: Unrestricted, Nfun=Hotel							
Log Transaction price	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Target or control							
Target	0.125	0.016	7.78	0.000	0.093	0.156	***
Target*Distance	1.07E-05	0.000	0.18	0.855	0.000	0.000	
Target*Distance squared	-1.37E-07	0.000	-2.76	0.006	0.000	0.000	***
Target*During	0.112	0.041	2.69	0.007	0.030	0.193	***
Target*During*Distance	-1.928E-04	0.000	-1.25	0.213	0.000	0.000	
Target*During*Distance squared	1.20E-07	0.000	0.90	0.369	0.000	0.000	
Target*After	0.063	0.042	1.49	0.135	-0.020	0.146	
Target*After*Distance	-8.99E-05	0.000	-0.61	0.544	0.000	0.000	
Target*After*Distance squared	6.58E-08	0.000	0.54	0.589	0.000	0.000	
Log floorspace	0.831	0.008	109.72	0.000	0.816	0.846	***
Building period							
Unknown	0.002	0.075	0.03	0.974	-0.144	0.149	
1500-1905	0.056	0.007	7.79	0.000	0.042	0.070	***
1906-1930	0.042	0.007	5.91	0.000	0.028	0.056	***
1931-1970	-0.046	0.007	-6.37	0.000	-0.060	-0.032	***
1971-2000	0.012	0.006	2.05	0.040	0.001	0.023	**
(b)≥2001	0.000	.	.	.	.	.	
House type							
Row-house or(Semi-)detached	0.107	0.008	14.06	0.000	0.092	0.121	***
(b)Apartment	0.000	.	.	.	.	.	
2-level apartment	0.051	0.004	11.84	0.000	0.042	0.059	***
Log rooms	0.039	0.008	5.07	0.000	0.024	0.054	***
Parking							
(b)No parking space	0.000	.	.	.	.	.	
Parking space	0.038	0.008	5.00	0.000	0.023	0.053	***
Carport	0.037	0.007	5.27	0.000	0.023	0.051	***
Garage	0.098	0.010	9.39	0.000	0.077	0.118	***
Garage and Carport	0.087	0.021	4.20	0.000	0.046	0.128	***
Multi-car garage	0.185	0.019	9.70	0.000	0.148	0.223	***
Garden							
(b)No garden	0.000	.	.	.	.	.	
Soil or neglected	0.012	0.042	0.28	0.782	-0.071	0.094	
Normal to beautiful	0.008	0.007	1.18	0.240	-0.005	0.021	
Indoor maintenance							
Below average	-0.027	0.012	-2.24	0.025	-0.051	-0.003	**
(b)Average	0.000	.	.	.	.	.	

Above average	0.108	0.006	18.18	0.000	0.096	0.120	***
Outdoor maintenance							
Below average	-0.046	0.038	-1.20	0.231	-0.121	0.029	
(b)Average	0.000	.	.	.	.	.	
Above average	0.055	0.011	4.95	0.000	0.033	0.077	***
Insulation							
(b)No insulation	0.000	.	.	.	.	.	
1 type of insulation	0.004	0.004	1.20	0.229	-0.003	0.012	
2 types of insulation	0.032	0.006	5.33	0.000	0.021	0.044	***
3 types of insulation	0.032	0.007	4.50	0.000	0.018	0.046	***
4types of insulation	0.054	0.011	5.13	0.000	0.033	0.075	***
Fully insulated	0.044	0.004	9.92	0.000	0.036	0.053	***
Leasehold/freehold							
(b)Freehold	0.000	.	.	.	.	.	
Fixed leasehold	-0.034	0.004	-8.58	0.000	-0.042	-0.026	***
Postcode 4							
(b)1012	0.000	.	.	.	.	.	
1015	0.108	0.015	7.29	0.000	0.079	0.137	***
1016	0.140	0.014	9.67	0.000	0.112	0.168	***
1017	0.239	0.022	10.81	0.000	0.195	0.282	***
1033	-0.511	0.016	-32.07	0.000	-0.542	-0.480	***
1035	-0.623	0.017	-37.23	0.000	-0.656	-0.590	***
1041	-0.617	0.027	-23.20	0.000	-0.669	-0.565	***
1051	-0.025	0.015	-1.70	0.089	-0.055	0.004	*
1052	0.013	0.015	0.88	0.380	-0.016	0.042	
1063	-0.546	0.015	-35.45	0.000	-0.576	-0.516	***
1064	-0.469	0.016	-29.06	0.000	-0.500	-0.437	***
1067	-0.549	0.017	-31.89	0.000	-0.582	-0.515	***
1079	0.080	0.019	4.15	0.000	0.042	0.118	***
1087	-0.299	0.017	-17.88	0.000	-0.331	-0.266	***
1096	-0.136	0.019	-7.27	0.000	-0.173	-0.099	***
1097	-0.177	0.015	-11.50	0.000	-0.208	-0.147	***
1098	-0.047	0.016	-2.98	0.003	-0.078	-0.016	***
1102	-0.729	0.015	-48.28	0.000	-0.759	-0.700	***
1103	-0.731	0.016	-44.49	0.000	-0.763	-0.699	***
1104	-0.745	0.017	-43.89	0.000	-0.779	-0.712	***
1109	-0.190	0.021	-9.09	0.000	-0.231	-0.149	***
Quarter							
(b)2005Q1	0.000	.	.	.	.	.	
2005Q2	0.032	0.018	1.77	0.076	-0.003	0.067	*
2005Q3	0.028	0.019	1.51	0.130	-0.008	0.065	

2005Q4	0.024	0.016	1.49	0.136	-0.008	0.056	
2006Q1	0.064	0.016	3.91	0.000	0.032	0.096	***
2006Q2	0.060	0.015	3.89	0.000	0.030	0.090	***
2006Q3	0.085	0.016	5.35	0.000	0.054	0.116	***
2006Q4	0.085	0.016	5.42	0.000	0.054	0.116	***
2007Q1	0.120	0.015	8.21	0.000	0.092	0.149	***
2007Q2	0.149	0.015	9.99	0.000	0.120	0.178	***
2007Q3	0.164	0.015	10.83	0.000	0.135	0.194	***
2007Q4	0.186	0.015	12.56	0.000	0.157	0.215	***
2008Q1	0.193	0.015	12.83	0.000	0.164	0.223	***
2008Q2	0.216	0.015	14.49	0.000	0.186	0.245	***
2008Q3	0.212	0.015	14.46	0.000	0.183	0.241	***
2008Q4	0.191	0.016	11.72	0.000	0.159	0.223	***
2009Q1	0.156	0.016	9.52	0.000	0.124	0.188	***
2009Q2	0.153	0.016	9.47	0.000	0.121	0.184	***
2009Q3	0.152	0.015	10.13	0.000	0.123	0.182	***
2009Q4	0.156	0.015	10.16	0.000	0.126	0.186	***
2010Q1	0.157	0.015	10.48	0.000	0.128	0.187	***
2010Q2	0.169	0.017	10.17	0.000	0.136	0.201	***
2010Q3	0.183	0.016	11.57	0.000	0.152	0.214	***
2010Q4	0.177	0.015	11.55	0.000	0.147	0.207	***
2011Q1	0.156	0.016	9.70	0.000	0.124	0.188	***
2011Q2	0.161	0.016	10.29	0.000	0.131	0.192	***
2011Q3	0.166	0.015	10.84	0.000	0.136	0.196	***
2011Q4	0.141	0.016	8.97	0.000	0.110	0.172	***
2012Q1	0.116	0.016	7.14	0.000	0.084	0.147	***
2012Q2	0.117	0.016	7.25	0.000	0.085	0.149	***
2012Q3	0.094	0.016	5.76	0.000	0.062	0.126	***
2012Q4	0.085	0.015	5.56	0.000	0.055	0.115	***
2013Q1	0.054	0.018	3.00	0.003	0.019	0.090	***
2013Q2	0.079	0.016	4.80	0.000	0.047	0.111	***
2013Q3	0.068	0.016	4.24	0.000	0.037	0.100	***
2013Q4	0.118	0.017	7.09	0.000	0.085	0.151	***
2014Q1	0.094	0.017	5.69	0.000	0.062	0.126	***
2014Q2	0.113	0.015	7.34	0.000	0.083	0.143	***
2014Q3	0.137	0.016	8.67	0.000	0.106	0.168	***
2014Q4	0.167	0.015	11.26	0.000	0.138	0.196	***
2015Q1	0.169	0.015	11.22	0.000	0.139	0.198	***
2015Q2	0.212	0.015	14.21	0.000	0.183	0.241	***
2015Q3	0.236	0.015	15.43	0.000	0.206	0.266	***
2015Q4	0.268	0.015	18.22	0.000	0.239	0.297	***
2016Q1	0.304	0.015	19.68	0.000	0.274	0.334	***
2016Q2	0.353	0.015	23.45	0.000	0.323	0.382	***
2016Q3	0.377	0.015	24.93	0.000	0.348	0.407	***
2016Q4	0.431	0.015	28.36	0.000	0.401	0.460	***
2017Q1	0.471	0.016	30.20	0.000	0.441	0.502	***

2017Q2	0.506	0.015	33.88	0.000	0.476	0.535	***
2017Q3	0.521	0.015	34.25	0.000	0.491	0.551	***
2017Q4	0.550	0.016	34.48	0.000	0.518	0.581	***
Constant	8572	0.037	233.58	0.000	8500	8644	***

Mean dependent var	12.392	SD dependent var	0.523
R-squared	0.915	Number of obs	14340.000
F-test	.	Prob > F	.
Akaike crit. (AIC)	-13094.865	Bayesian crit. (BIC)	-12299.930

**** p<0.01, ** p<0.05, * p<0.1*

Model 6: Unrestricted, Nfun=Commercial							
Log Transaction price	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Target or control							
Target	0.044	0.029	1.52	0.129	-0.013	0.100	
Target*Distance	3.27E-04	0.000	3.85	0.000	0.000	0.000	***
Target*Distance squared	-3.79E-07	0.000	-5.59	0.000	0.000	0.000	***
Target*During	0.060	0.051	1.18	0.240	-0.040	0.160	
Target*During*Distance	3.611E-04	0.000	1.83	0.067	0.000	0.001	*
Target*During*Distance squared	-3.93E-07	0.000	-2.34	0.020	0.000	0.000	**
Target*After	0.103	0.042	2.49	0.013	0.022	0.185	**
Target*After*Distance	-3.27E-05	0.000	-0.20	0.844	0.000	0.000	
Target*After*Distance squared	-3.36E-08	0.000	-0.23	0.822	0.000	0.000	
Log floorspace	0.801	0.009	91.04	0.000	0.783	0.818	***
Building period							
Unknown	-0.278	0.104	-2.68	0.007	-0.482	-0.075	***
1500-1905	-0.088	0.009	-9.59	0.000	-0.107	-0.070	***
1906-1930	-0.120	0.009	-12.74	0.000	-0.138	-0.101	***
1931-1970	-0.191	0.010	-19.48	0.000	-0.210	-0.172	***
1971-2000	-0.154	0.008	-18.13	0.000	-0.170	-0.137	***
(b)≥2001	0.000	.	.	.	.	.	
House type							
Row-house or(Semi-)detached	0.171	0.007	24.45	0.000	0.157	0.184	***
(b)Apartment	0.000	.	.	.	.	.	
2-level apartment	0.056	0.005	11.60	0.000	0.047	0.065	***
Log rooms	-0.007	0.009	-0.86	0.389	-0.024	0.009	
Parking							
(b)No parking space	0.000	.	.	.	.	.	
Parking space	0.088	0.009	9.54	0.000	0.070	0.107	***
Carport	0.099	0.008	11.84	0.000	0.082	0.115	***
Garage	0.140	0.012	11.82	0.000	0.117	0.163	***
Garage and Carport	0.199	0.036	5.59	0.000	0.129	0.269	***
Multi-car garage	0.246	0.036	6.92	0.000	0.176	0.315	***
Garden							
(b)No garden	0.000	.	.	.	.	.	
Soil or neglected	0.018	0.036	0.49	0.623	-0.053	0.088	
Normal to beautiful	0.013	0.006	2.10	0.035	0.001	0.025	**
Indoor maintenance							
Below average	0.003	0.015	0.20	0.839	-0.026	0.032	
(b)Average	0.000	.	.	.	.	.	

Above average	0.077	0.007	11.17	0.000	0.064	0.091	***
Outdoor maintenance							
Below average	-0.099	0.045	-2.21	0.027	-0.187	-0.011	**
(b)Average	0.000	.	.	.	.	.	
Above average	0.041	0.015	2.66	0.008	0.011	0.071	***
Insulation							
(b)No insulation	0.000	.	.	.	.	.	
1 type of insulation	-0.009	0.004	-1.95	0.051	-0.017	0.000	*
2 types of insulation	0.029	0.007	4.18	0.000	0.015	0.043	***
3 types of insulation	0.030	0.008	4.03	0.000	0.016	0.045	***
4types of insulation	0.044	0.012	3.71	0.000	0.021	0.067	***
Fully insulated	0.051	0.006	8.95	0.000	0.039	0.062	***
Leasehold/freehold							
(b)Freehold	0.000	.	.	.	.	.	
Fixed leasehold	-0.081	0.006	-13.59	0.000	-0.093	-0.070	***
Postcode 4							
(b)1011	0.000	.	.	.	.	.	
1012	-0.131	0.014	-9.35	0.000	-0.158	-0.103	***
1013	0.002	0.009	0.21	0.833	-0.015	0.019	
1015	0.086	0.009	9.77	0.000	0.069	0.104	***
1017	0.123	0.028	4.41	0.000	0.068	0.178	***
1019	0.147	0.030	4.96	0.000	0.089	0.204	***
1021	-0.320	0.011	-30.34	0.000	-0.341	-0.300	***
1022	-0.379	0.019	-19.52	0.000	-0.417	-0.341	***
1023	-0.281	0.024	-11.97	0.000	-0.327	-0.235	***
1025	-0.522	0.010	-49.93	0.000	-0.542	-0.501	***
1031	-0.271	0.017	-15.64	0.000	-0.306	-0.237	***
1032	-0.432	0.012	-37.34	0.000	-0.455	-0.410	***
1033	-0.503	0.011	-47.35	0.000	-0.524	-0.482	***
1034	-0.534	0.010	-52.12	0.000	-0.554	-0.514	***
1035	-0.461	0.013	-35.46	0.000	-0.486	-0.435	***
1036	-0.738	0.021	-34.55	0.000	-0.780	-0.696	***
1051	-0.067	0.015	-4.40	0.000	-0.096	-0.037	***
1052	0.006	0.015	0.37	0.713	-0.025	0.036	
1102	-0.575	0.047	-12.12	0.000	-0.668	-0.482	***
1106	-0.695	0.010	-68.32	0.000	-0.715	-0.675	***
1107	-0.672	0.011	-62.60	0.000	-0.693	-0.651	***
1108	-0.708	0.012	-58.23	0.000	-0.732	-0.685	***
1109	-0.570	0.018	-31.72	0.000	-0.605	-0.535	***
Quarter							
(b)2005Q1	0.000	.	.	.	.	.	

2005Q2	0.021	0.020	1.07	0.286	-0.018	0.060	
2005Q3	-0.008	0.022	-0.36	0.722	-0.050	0.035	
2005Q4	-0.001	0.016	-0.05	0.959	-0.033	0.031	
2006Q1	0.010	0.017	0.58	0.564	-0.023	0.043	
2006Q2	0.016	0.017	0.96	0.337	-0.017	0.049	
2006Q3	0.032	0.016	2.07	0.039	0.002	0.063	**
2006Q4	0.036	0.016	2.24	0.025	0.005	0.068	**
2007Q1	0.087	0.015	5.67	0.000	0.057	0.118	***
2007Q2	0.116	0.016	7.45	0.000	0.085	0.146	***
2007Q3	0.119	0.016	7.53	0.000	0.088	0.150	***
2007Q4	0.126	0.015	8.48	0.000	0.097	0.155	***
2008Q1	0.172	0.018	9.77	0.000	0.138	0.207	***
2008Q2	0.180	0.015	11.80	0.000	0.150	0.210	***
2008Q3	0.194	0.017	11.74	0.000	0.162	0.227	***
2008Q4	0.159	0.016	10.06	0.000	0.128	0.190	***
2009Q1	0.103	0.016	6.46	0.000	0.071	0.134	***
2009Q2	0.128	0.017	7.57	0.000	0.094	0.161	***
2009Q3	0.138	0.017	8.23	0.000	0.105	0.171	***
2009Q4	0.122	0.017	7.30	0.000	0.089	0.155	***
2010Q1	0.144	0.016	8.79	0.000	0.112	0.176	***
2010Q2	0.153	0.017	8.96	0.000	0.119	0.186	***
2010Q3	0.126	0.019	6.74	0.000	0.090	0.163	***
2010Q4	0.140	0.016	8.94	0.000	0.110	0.171	***
2011Q1	0.125	0.018	7.04	0.000	0.090	0.160	***
2011Q2	0.124	0.017	7.38	0.000	0.091	0.157	***
2011Q3	0.125	0.018	6.88	0.000	0.089	0.161	***
2011Q4	0.077	0.018	4.33	0.000	0.042	0.112	***
2012Q1	0.083	0.017	4.82	0.000	0.049	0.117	***
2012Q2	0.062	0.017	3.68	0.000	0.029	0.095	***
2012Q3	0.059	0.017	3.45	0.001	0.025	0.092	***
2012Q4	0.041	0.016	2.59	0.010	0.010	0.073	**
2013Q1	0.019	0.017	1.10	0.272	-0.015	0.052	
2013Q2	0.012	0.018	0.67	0.500	-0.023	0.047	
2013Q3	0.013	0.017	0.77	0.442	-0.020	0.045	
2013Q4	0.022	0.016	1.40	0.163	-0.009	0.054	
2014Q1	0.060	0.016	3.68	0.000	0.028	0.093	***
2014Q2	0.079	0.017	4.74	0.000	0.046	0.112	***
2014Q3	0.086	0.016	5.44	0.000	0.055	0.117	***
2014Q4	0.116	0.016	7.26	0.000	0.085	0.148	***
2015Q1	0.106	0.016	6.81	0.000	0.076	0.137	***
2015Q2	0.133	0.016	8.51	0.000	0.102	0.164	***
2015Q3	0.177	0.015	11.46	0.000	0.147	0.208	***
2015Q4	0.200	0.015	12.96	0.000	0.170	0.230	***
2016Q1	0.244	0.016	15.43	0.000	0.213	0.275	***
2016Q2	0.308	0.016	19.34	0.000	0.277	0.339	***
2016Q3	0.331	0.016	20.96	0.000	0.300	0.362	***

2016Q4	0.372	0.016	23.48	0.000	0.341	0.403	***
2017Q1	0.433	0.016	26.34	0.000	0.401	0.466	***
2017Q2	0.472	0.016	29.25	0.000	0.441	0.504	***
2017Q3	0.485	0.016	30.12	0.000	0.454	0.517	***
2017Q4	0.532	0.017	31.64	0.000	0.499	0.565	***
Constant	9019	0.039	228.85	0.000	8942	9096	***
Mean dependent var		12.360		SD dependent var		0.513	
R-squared		0.902		Number of obs		12455.000	
F-test		995174		Prob > F		0.000	
Akaike crit. (AIC)		-9991.079		Bayesian crit. (BIC)		-9181.223	

**** p<0.01, ** p<0.05, * p<0.1*

Model 7: Unrestricted, Target=600m							
Log Transaction price	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
Target or control							
Target	0.101	0.009	11.12	0.000	0.083	0.118	***
Target*Distance	-0.000	0.000	-7.86	0.000	-0.001	0.000	***
Target*Distance squared	0.000	0.000	7.51	0.000	0.000	0.000	***
Target*During	0.007	0.019	0.37	0.713	-0.031	0.045	
Target*During*Distance	0.000	0.000	1.46	0.144	0.000	0.000	
Target*During*Distance squared	-0.000	0.000	-1.34	0.181	0.000	0.000	
Target*After	-0.036	0.022	-1.61	0.107	-0.079	0.008	
Target*After*Distance	0.000	0.000	3.31	0.001	0.000	0.001	***
Target*After*Distance squared	-0.000	0.000	-2.96	0.003	0.000	0.000	***
Log floorspace	0.851	0.003	261.01	0.000	0.845	0.858	***
Building period							
Unknown	-0.060	0.040	-1.49	0.137	-0.138	0.019	
1500-1905	0.029	0.004	7.92	0.000	0.022	0.036	***
1906-1930	-0.011	0.003	-3.20	0.001	-0.018	-0.004	***
1931-1970	-0.070	0.004	-19.69	0.000	-0.077	-0.063	***
1971-2000	-0.055	0.003	-17.95	0.000	-0.061	-0.049	***
(b)≥2001	0.000	.	.	.	.	.	
House type							
Row-house or(Semi-)detached	0.135	0.004	36.56	0.000	0.128	0.143	***
(b)Apartment	0.000	.	.	.	.	.	
2-level apartment	0.076	0.002	43.49	0.000	0.073	0.080	***
Log rooms	0.031	0.003	9.39	0.000	0.025	0.038	***
Parking							
(b)No parking space	0.000	.	.	.	.	.	
Parking space	0.049	0.004	11.59	0.000	0.041	0.057	***
Carport	0.050	0.004	14.01	0.000	0.043	0.057	***
Garage	0.085	0.005	18.09	0.000	0.076	0.094	***
Garage and Carport	0.097	0.010	9.96	0.000	0.078	0.116	***
Multi-car garage	0.176	0.013	13.46	0.000	0.151	0.202	***
Garden							
(b)No garden	0.000	.	.	.	.	.	
Soil or neglected	-0.001	0.025	-0.04	0.967	-0.051	0.049	
Normal to beautiful	0.008	0.003	2.46	0.014	0.002	0.014	**
Indoor maintenance							
Below average	-0.015	0.006	-2.56	0.011	-0.027	-0.004	**
(b)Average	0.000	.	.	.	.	.	

Above average	0.106	0.003	38.30	0.000	0.100	0.111	***
Outdoor maintenance							
Below average	-0.022	0.019	-1.13	0.261	-0.059	0.016	
(b)Average	0.000	.	.	.	.	.	
Above average	0.046	0.006	7.89	0.000	0.035	0.058	***
Insulation							
(b)No insulation	0.000	.	.	.	.	.	
1 type of insulation	-0.006	0.002	-3.46	0.001	-0.009	-0.002	***
2 types of insulation	0.032	0.003	12.79	0.000	0.027	0.037	***
3 types of insulation	0.045	0.003	13.31	0.000	0.039	0.052	***
4types of insulation	0.064	0.005	13.25	0.000	0.054	0.073	***
Fully insulated	0.049	0.002	22.98	0.000	0.044	0.053	***
Leasehold/freehold							
(b)Freehold	0.000	.	.	.	.	.	
Fixed leasehold	-0.054	0.002	-31.06	0.000	-0.058	-0.051	***
Postcode 4							
(b)1011	0.000	.	.	.	.	.	
1012	-0.059	0.010	-5.86	0.000	-0.079	-0.040	***
1013	-0.026	0.009	-2.85	0.004	-0.045	-0.008	***
1014	-0.271	0.033	-8.11	0.000	-0.336	-0.205	***
1015	0.103	0.011	9.76	0.000	0.082	0.123	***
1016	0.146	0.011	13.45	0.000	0.125	0.168	***
1017	0.109	0.010	10.74	0.000	0.089	0.128	***
1018	-0.035	0.009	-3.74	0.000	-0.053	-0.017	***
1019	-0.113	0.009	-12.52	0.000	-0.131	-0.095	***
1021	-0.356	0.010	-34.79	0.000	-0.376	-0.336	***
1022	-0.380	0.017	-22.73	0.000	-0.412	-0.347	***
1023	-0.251	0.013	-19.32	0.000	-0.276	-0.225	***
1024	-0.563	0.009	-59.32	0.000	-0.582	-0.544	***
1025	-0.554	0.010	-55.69	0.000	-0.574	-0.535	***
1026	-0.017	0.025	-0.66	0.511	-0.066	0.033	
1027	-0.206	0.029	-7.02	0.000	-0.263	-0.148	***
1028	-0.136	0.037	-3.69	0.000	-0.209	-0.064	***
1031	-0.292	0.017	-17.45	0.000	-0.325	-0.259	***
1032	-0.471	0.010	-45.20	0.000	-0.491	-0.450	***
1033	-0.539	0.009	-56.99	0.000	-0.557	-0.520	***
1034	-0.582	0.010	-57.98	0.000	-0.601	-0.562	***
1035	-0.570	0.011	-51.44	0.000	-0.592	-0.548	***
1036	-0.660	0.020	-32.57	0.000	-0.699	-0.620	***
1041	-0.747	0.016	-45.34	0.000	-0.779	-0.715	***
1051	-0.072	0.009	-8.13	0.000	-0.089	-0.054	***
1052	-0.030	0.009	-3.32	0.001	-0.048	-0.012	***

1053	-0.036	0.009	-3.90	0.000	-0.055	-0.018	***
1054	0.058	0.009	6.41	0.000	0.040	0.076	***
1055	-0.287	0.010	-29.63	0.000	-0.306	-0.268	***
1056	-0.144	0.009	-16.07	0.000	-0.161	-0.126	***
1057	-0.143	0.009	-15.82	0.000	-0.160	-0.125	***
1058	-0.077	0.009	-8.45	0.000	-0.094	-0.059	***
1059	-0.043	0.010	-4.47	0.000	-0.062	-0.024	***
1060	-0.553	0.010	-56.69	0.000	-0.572	-0.534	***
1061	-0.481	0.012	-39.80	0.000	-0.505	-0.458	***
1062	-0.528	0.011	-49.07	0.000	-0.550	-0.507	***
1063	-0.593	0.010	-58.48	0.000	-0.613	-0.573	***
1064	-0.515	0.010	-52.81	0.000	-0.534	-0.496	***
1065	-0.479	0.011	-43.98	0.000	-0.501	-0.458	***
1066	-0.541	0.010	-53.09	0.000	-0.561	-0.521	***
1067	-0.613	0.010	-59.98	0.000	-0.633	-0.593	***
1068	-0.542	0.010	-54.35	0.000	-0.561	-0.522	***
1069	-0.587	0.010	-57.81	0.000	-0.607	-0.568	***
1071	0.205	0.011	19.53	0.000	0.185	0.226	***
1072	0.021	0.009	2.35	0.019	0.003	0.039	**
1073	-0.003	0.009	-0.36	0.720	-0.022	0.015	
1074	-0.059	0.010	-5.70	0.000	-0.079	-0.038	***
1075	0.111	0.010	11.46	0.000	0.092	0.130	***
1076	0.057	0.009	6.16	0.000	0.039	0.075	***
1077	0.232	0.010	22.94	0.000	0.212	0.252	***
1078	0.070	0.009	7.57	0.000	0.052	0.088	***
1079	0.023	0.009	2.42	0.016	0.004	0.041	**
1081	-0.179	0.011	-16.22	0.000	-0.201	-0.158	***
1082	-0.274	0.011	-25.21	0.000	-0.296	-0.253	***
1083	-0.292	0.011	-27.70	0.000	-0.313	-0.271	***
1086	-0.367	0.013	-28.37	0.000	-0.393	-0.342	***
1087	-0.412	0.010	-41.97	0.000	-0.431	-0.393	***
1091	-0.119	0.009	-12.96	0.000	-0.138	-0.101	***
1092	-0.106	0.010	-10.31	0.000	-0.126	-0.085	***
1093	-0.169	0.010	-17.53	0.000	-0.188	-0.151	***
1094	-0.220	0.011	-19.49	0.000	-0.242	-0.197	***
1095	-0.238	0.009	-25.17	0.000	-0.256	-0.219	***
1096	1.086	0.021	52.13	0.000	1.046	1.127	***
1097	-0.231	0.011	-21.37	0.000	-0.252	-0.210	***
1098	-0.101	0.010	-10.04	0.000	-0.120	-0.081	***
1102	-0.707	0.010	-72.21	0.000	-0.726	-0.688	***
1103	-0.764	0.011	-69.02	0.000	-0.786	-0.742	***
1104	-0.787	0.012	-65.42	0.000	-0.810	-0.763	***
1106	-0.732	0.010	-72.75	0.000	-0.751	-0.712	***
1107	-0.714	0.011	-67.22	0.000	-0.735	-0.694	***
1108	-0.726	0.011	-67.44	0.000	-0.747	-0.705	***
1109	-0.585	0.019	-30.34	0.000	-0.623	-0.547	***

Quarter							
(b)2005Q1	0.000	.	.	.	.	.	
2005Q2	0.016	0.008	1.86	0.063	-0.001	0.032	*
2005Q3	0.020	0.009	2.17	0.030	0.002	0.037	**
2005Q4	0.026	0.007	3.63	0.000	0.012	0.041	***
2006Q1	0.048	0.007	6.50	0.000	0.034	0.063	***
2006Q2	0.065	0.007	8.84	0.000	0.051	0.079	***
2006Q3	0.081	0.007	11.51	0.000	0.067	0.094	***
2006Q4	0.104	0.007	15.29	0.000	0.091	0.117	***
2007Q1	0.122	0.007	18.26	0.000	0.109	0.136	***
2007Q2	0.178	0.007	26.32	0.000	0.165	0.191	***
2007Q3	0.190	0.007	28.65	0.000	0.177	0.204	***
2007Q4	0.207	0.007	31.63	0.000	0.194	0.219	***
2008Q1	0.227	0.007	33.23	0.000	0.213	0.240	***
2008Q2	0.242	0.007	36.54	0.000	0.229	0.255	***
2008Q3	0.235	0.007	35.34	0.000	0.222	0.248	***
2008Q4	0.204	0.007	28.65	0.000	0.190	0.218	***
2009Q1	0.176	0.007	24.22	0.000	0.161	0.190	***
2009Q2	0.181	0.007	25.95	0.000	0.167	0.195	***
2009Q3	0.168	0.007	24.45	0.000	0.154	0.181	***
2009Q4	0.163	0.007	24.11	0.000	0.150	0.176	***
2010Q1	0.169	0.007	24.63	0.000	0.155	0.182	***
2010Q2	0.184	0.007	26.40	0.000	0.170	0.197	***
2010Q3	0.184	0.007	25.87	0.000	0.170	0.198	***
2010Q4	0.186	0.007	27.42	0.000	0.173	0.199	***
2011Q1	0.177	0.007	23.57	0.000	0.162	0.191	***
2011Q2	0.181	0.007	25.64	0.000	0.167	0.195	***
2011Q3	0.176	0.007	25.04	0.000	0.162	0.190	***
2011Q4	0.145	0.007	20.20	0.000	0.131	0.159	***
2012Q1	0.131	0.007	18.35	0.000	0.117	0.145	***
2012Q2	0.131	0.007	18.95	0.000	0.118	0.145	***
2012Q3	0.113	0.007	15.60	0.000	0.099	0.128	***
2012Q4	0.098	0.007	14.81	0.000	0.085	0.111	***
2013Q1	0.077	0.008	9.71	0.000	0.062	0.093	***
2013Q2	0.078	0.007	10.78	0.000	0.064	0.092	***
2013Q3	0.088	0.007	12.67	0.000	0.074	0.101	***
2013Q4	0.103	0.007	15.44	0.000	0.090	0.117	***
2014Q1	0.127	0.007	18.64	0.000	0.114	0.141	***
2014Q2	0.154	0.007	23.53	0.000	0.141	0.167	***
2014Q3	0.169	0.007	25.79	0.000	0.156	0.182	***
2014Q4	0.213	0.006	32.75	0.000	0.200	0.225	***
2015Q1	0.219	0.007	33.09	0.000	0.206	0.232	***
2015Q2	0.272	0.007	41.78	0.000	0.260	0.285	***
2015Q3	0.306	0.007	46.38	0.000	0.293	0.319	***
2015Q4	0.330	0.007	50.80	0.000	0.318	0.343	***

2016Q1	0.369	0.007	54.44	0.000	0.356	0.383	***
2016Q2	0.414	0.006	63.84	0.000	0.401	0.427	***
2016Q3	0.441	0.007	65.98	0.000	0.428	0.454	***
2016Q4	0.482	0.007	72.36	0.000	0.469	0.495	***
2017Q1	0.519	0.007	76.35	0.000	0.506	0.532	***
2017Q2	0.558	0.007	84.71	0.000	0.545	0.571	***
2017Q3	0.579	0.007	84.77	0.000	0.565	0.592	***
2017Q4	0.614	0.007	87.60	0.000	0.601	0.628	***
Constant	8.572	0.017	498.60	0.000	8.538	8.606	***

Mean dependent var	12.482	SD dependent var	0.487
R-squared	0.901	Number of obs	70990.000
F-test	.	Prob > F	.
Akaike crit. (AIC)	-64657.230	Bayesian crit. (BIC)	-63226.664

**** p<0.01, ** p<0.05, * p<0.1*

Appendix V: Chow test calculations

n=	observations
m(df)=	indep. vars
k=	m+constant
g=	no. groups

Chow F(g*k-k, n-g*k)
F=(RSSres - (ΣRSSunres))/(g*k-k)/(ΣRSSunres)/(n-g*k)

Oloc	N	m	k	RSS
restricted	92025	86	87	5611,591
1	25558			1356,777
2	66467			3054,219
			ΣRSS1,2:	**4410,996**

Chow F=(87, 91851)
F=(5611,591 - (4410,996))/(2*87-87)/(4410,996)/(92025-2*87)
F= 3,41E-08 Fcrit=1,26 **Models are equal**

Nfun	N	m	k	RSS
restricted	92025	86	87	5611,591
1	65230			3100,622
2	14340			954,3273
3	12455			723,7116
			ΣRSS1,2,3:	**4778,66**

Chow F=(87, 91764)
F=(5611,591 - (4778,66))/(3*87-87)/(4778,66)/(92025-3*87)
F= 1,09E-08 Fcrit=1,26 **Models are equal**