The Development of Student Housing and the External Effect on Nearby Housing Prices

The Case of Amsterdam

Abstract.

The purpose of this paper is to gain insights in the problems on the student housing market in the Netherlands and more particularly, Amsterdam. The problems are the shortage of proper student housing and the idea that investing in student housing leads to a negative neighbourhood image. This paper estimates the effect of the (re)development of student housing complexes on residential property prices in the Amsterdam urban area. We operationalise the (re)development of student housing complexes by combining data about the neighbourhoods and the (re)development projects. In our main results, there exists a positive effect on nearby property prices resulted from the (re)development of a vacant plot into a student housing complex. The appreciation in price is, however, decreasing in distance and also in time. The findings advance the existing hedonic studies by verifying that the (re)development of vacant plots leads to economic benefits of living near to a (re)developed student housing complex. This has implications for governmental policies regarding the investment in student housing in general.

Keywords: Student housing investments, Hedonic pricing model, Studentification, (Re)development projects.

Colophon

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Title	The development of student housing and the external effect on nearby housing prices. The case of Amsterdam
Author	Evert Aries
Student Number	2379163
E-mail	evert_aries@hotmail.com
	e.b.r.aries@student.rug.nl
Date	27 August 2019
Word count	9,122 (ch. 1-6)
Supervisor	dr. X. (Xiaolong) Liu
University of Groningen	
Faculty of Spatial Sciences	

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Table of contents

1. Introduction

The shortage of student housing in the Netherlands is a problem in Dutch student cities. The problem is gaining importance because the amount of foreign student inhabitants is expected to grow still and thus could result in an even larger shortage (ABF Research, 2018). According to the Volkskrant (2018), it is expected that the student housing shortage will continue to grow the coming years. Furthermore, the Volkskrant points out that according to the student housing monitor, the shortage in Amsterdam is the biggest among the Dutch student cities. Up to 2020, 10,000 homes for students must be added. Policy makers in different cities search for solutions to cope with the shortage of student housing. In Amsterdam, the municipality is not doing enough to counter the shortage according to an article in the Parool (2017). The writer of the article argues that in the housing policy document of the municipality, 'Woonagenda 2025', the student inhabitants are not taken into account properly. However, the responsible councillor of the municipality of Amsterdam does assume that the student inhabitants are taken into account properly. The Parool (2017) mentioned two examples where the municipality designated buildings for students, but in fact were not inhabited by only students because the student designation is proven not to be legal. According to the Parool (2017), the municipality is not able to control the student housing market while the demand for student housing is growing. According to the NRC (2018), as a result of the inability to control the student housing market by the municipality, more and more commercial investors are stepping into the student housing market. Following the forementioned article, large investments (500 million euro in 2016) are made on the student housing market according to real estate advisor Savills. With the arrival of commercial investors on the student housing market, the supply of student housing has changed its form. Large complexes with small rooms and shared amenities are making room for independent studios.

According to the Algemeen Dagblad (2018), the neighbourhood solidarity decreases because of the student inhabitants in Wageningen. For instance, a student is a temporarily inhabitant of a neighbourhood which leads to lower feeling of solidarity with the neighbourhood that students are living in. The feeling of lower neighbourhood solidarity of inhabitants could reduce property prices in the neighbourhood since differences in socio-economic factors affect housing prices among other things like the physical characteristics (Knaap, 1998). On the other hand, more students moving in a certain neighbourhood cause spatial structure transformations. These spatial structure transformations on their turn cause social, economic, cultural, and physical impacts (Smith, 2004; Sabri and Ludin, 2009). Social impacts like the population composition will change as a result of students moving in. Moreover, with a higher percentage of students moving in, the composition of social amenities can be disturbed. Primary schools could for example be swapped for night clubs. Secondly, a higher number of students could affect the composition of wealth and also the composition of stores could change. Furthermore, a cultural impact could occur in a neighbourhood with more students. Due to a higher percentage and a different style of living, the composition of amenities could change. At last, also the physical environment of student rich areas tend to change. Since the majority of student does not own the place where they live, there is less connectedness with the physical status of properties.

All the above mentioned impacts influence amenities in a neighbourhood. In literature there exists a clear line that tells that amenities create external effects and that these effects are reflected in property values (Wilkinson, 1973; Cheshire & Sheppard, 1995). Droës & Koster (2016) for example argue in their paper that the existence of a windmill will lead to lower surrounding housing prices because of the pollution the windmill creates. In addition, airports have a lowering effect on housing prices according to Theebe (2004). Despite the amount of conducted research on housing price dynamics, the literature on the effects of student housing (re)developments on surrounding residential property prices is limited. For this reason, the aim of this study is to understand the consequence of the development of student housing on surrounding property values better. In this study the focus area is Amsterdam, which is the largest student city of the Netherlands and also that city is coping with a large challenge in creating enough housing for the increasing number of students. The municipality of Amsterdam has appointed numerous locations in the last decade for the development of student housing complexes. Several of the appointed locations are redevelopment projects of older buildings, as can be derived from the municipal Housing Plan 2018-2025 (Municipality of Amsterdam, 2018). The municipality is planning to support student housing corporations by the acquisition of ground positions in order to stimulate the development of student housing.

To gain insights in the student housing matter, a central research question is formulated as follows:

Do the external effects of student housing (re)development have an impact on local residential property prices?

In order to answer the research question a hedonic pricing model will be used, which takes the price of a property as a basis and is a function of measurable characteristics or utility-carrying attributes of this property (Gibbs et al., 2018). Moreover, a difference in difference approach will be used in order to measure the time effect of the (re)development of student housing complexes.

This thesis is structured as follows. Chapter two focuses on the theoretical framework which includes theories and literature on student housing development projects and on residential property price dynamics in cities. Chapter three consists of a description of the methodology that is used in the analysis. A description of the empirical model can be found in chapter three. The dataset and the descriptive statistics of this research can be found in chapter four. In chapter five the results of the analysis will be discussed. At last, chapter six contains a discussion and a conclusion of the results.

2. Theory and hypotheses

2.1 Residential property prices

The residential property market is known to be very diversified (Palmquist, 2005). Residential properties differ from each other through their appearance from the outside and from the inside. Besides the appearance of a property, other factors play a role in the price-making of a property. Size, age and location are among the factors that determine the property price and thereby the composition of the residential property market (Wilkinson, 1973). According to Evans (2004), the residential property market is so diverse which makes it hard for home-buyers to determine the right price. Among literature it is common knowledge that properties are a diverse good and that the difference in characteristics determine the price of property. The seller and the buyer give value to these characteristics and try to reach an agreement at a price that satisfies both parties (Rosen, 1974).

Because of the diversity of property markets, hedonic price modelling is often used. Hedonic price modelling makes use of the property characteristics to determine the price (Rosen, 1974). According to Hodge et al. (2017), not only the accessibility and land regulations play a role in property value. The quality of public goods and tax rates are also important examples of determinants of property value. In literature the variety of characteristics can be distinguished in different groups of characteristics like property characteristics, locational characteristics, socio-economic characteristics and financial characteristics. A study in the Netherlands has shown that different groups of characteristics are important in the determination of the value of a property (Van Dam and Visser, 2006).

First, according to Knaap (1998) several studies have shown that housing prices reflect the physical characteristics of the house, such as the number of bedrooms and bathrooms, total square feet of living space, the age and condition of the house, the size of the garage, and many other characteristics. According to Van Dam and Visser (2006), approximately 25 per cent of the property value given by the buyers is determined by its physical characteristics.

Second, locational characteristics play a role in the valuation of a property. This theory goes back to the 19th century when Von Thünen (1826) defined the locational rent theory. This theory states that the decrease in price of land located further away from the central market due to productivity factors. The bid-rent theory of Alonso (1965) is based on the theory of Von Thünen and argues that the rents and thus the land value decreases when properties are located further away from the Central Business District (CBD). For larger cities, more than one CBD can be located within the city limits according to the multiple nuclei model of Harris and Ullman (1945).

Another locational characteristic that is important for the determination of property value is the proximity of nearby natural space. Studies explain that different types of natural space have different effects on property prices. Van Dam and Visser for example argue in their article that the size of the natural space impacts the effect of natural space on property prices. Furthermore, the type and permanence of natural space (Geoghegan, 2002) and the way how property buyers perceive the nearby natural space (Daams et al., 2016) have impact on the effect of natural space on property prices as well.

To continue, socio-economic and financial factors of a property play a role in the determination of property value. Among socio-economic factors are the level of education, income and health. Higher education, higher income levels and a higher health level result in higher property prices (Yinger, 1979; King and Mieskowski, 1973; Van Dam and Visser, 2006). However, in literature a clear line in this definition does not exists. The question whether higher education levels, higher income levels and higher health levels of a neighbourhood cause higher property value levels, or higher property value levels attract higher education, income and health levels is not clearly answered. Other determinants for the socio-economic or financial status of a neighbourhood, like the concentration of amenities (Brueckner et al., 1999) and the population density (Lazrak, 2014) of a neighbourhood are mentioned in literature.

At last, literature about externalities will be discussed. According to Wilkinson (1973), the idea that amenities create some sort of external effects is widely accepted. Moreover, these external effects are reflected in the property values. As mentioned in the previous chapter, research has shown many different types of external effects of different types of (real estate) projects. External effects can have a positive effect on property values when the externalities are perceived as valuable, like an increase of the variety of amenities in the neighbourhood. Buyers are willing to pay a premium because of nearby positive externalities. Other externalities like nuisance and litter have the opposite effect, they tend to lower the value of properties. (Chesire and Sheppard, 1995; Brander and Koetse, 2011).

2.2 Studentification

In order to understand the impacts of students moving into urban areas research has been conducted by several researchers. Smith (2004) defined the phenomenon of students moving into certain areas. According to Smith (2004), the phenomenon of studentification can be defined as the impacts of “the distinct social, cultural, economic and physical transformations within university towns, which are associated with the seasonal, in-migration of students. At a conceptual level, processes of studentification imply urban changes which are tied to the recommodification of ‘single-family’ housing or the repackaging of existing private rented housing, by small-scale institutional actors (e.g. property owners, investors and developers) to produce and supply housing in multiple occupation for students.”

In addition to Smith (2004), Sabri and Ludin (2009) researched the effects of studentification in urban areas. They discuss all findings of academic research on studentification until 2009 and compare Kuala Lumpur to cities researched by others. In order to do so, Sabri and Ludin (2009) summarized the key findings of earlier research into five dimensions of studentification. In the next section these five dimensions will be discussed.

The first dimension Sabri and Ludin (2009) compose is the economic impact dimension. Studentification leads to a situation where the property prices will set new levels as a consequence of inflation and revalorisation. Due to studentification, single-family homes will be transformed and private rented housing will be repackaged to supply housing to students. As a result, the housing stock will shift from a dominant owner-occupation situation to a dominant private-rented situation. Second, a dimension of social impacts is pointed out. In a social sense, studentification leads to a replacement of former residents by students. New patterns of social concentration and segregation occur. A third dimension Sabri and Ludin (2009) mention is the cultural impacts dimension. Studentification impacts the social construction of a neighbourhood. This results in the higher percentage of younger and higher education inhabitants with a more or less shared culture, lifestyle and consumption could lead to a concentration of certain types of retail and service infrastructure. Fourth, Sabri and Ludin (2009) observe a physical dimension. The rise of the percentage of student housing in an area could lead to downgrading of the physical environment. No building is immune to a conversion to student housing and therefore, not only less maintained houses will be vandalized by student occupation but also good quality mansions, shops or even offices. At last, Sabri and Ludin (2009) come up with an environmental dimension of studentification. Studentification will impact the environment because the student population lack care of the neighbourhood. Due to the lack of care, rubbish and other waste will not be recycled properly and could end up on the streets or nature.

Sabri and Ludin (2009) conclude their research by stating that the process of studentification definitely influences the urban spatial structures in urban areas. Studentification should, therefore, be taken into consideration by local authorities in order to anticipate the impacts of studentification.

Not only the aforementioned articles describe the impacts of student housing in urban areas. There is an extensive variety of papers about examples of the impacts of student housing and their positive or negative influence in different urban areas. In Canada, evidence has been found that by the influx of students, studentification occurs. However, the studentification in the three urban areas the writers researched is not merely negative, also positive effects of the influx of students are found. Because the student population is diverse in itself, diverse patterns of studentification impacts can be found (Moos et al., 2019). In Chile, similar effects of studentification were found. The profile of the students that move in and the location where the students live is important whether the neighbourhood shows an improving image or an image of deterioration (Prada, 2019). Avni and Alfasi (2018) researched the studentification phenomenon in Israel. Not only did they find that the neighbourhood around the university and the campus undergo changes due to an influx of student inhabitants, they also introduce the term 'student bubble'. Student bubble refers to the decreasing knowledge students have of the city they live in. They propose that the decreasing knowledge leads to lower connectedness with the city which eventually leads to a negative city image. In Great-Britain, Klinton et al. (2018), researched studentification by performing a novel study in Loughborough. They argue that the conceptualisation of studentification should be wider and not only be seen as a process of downgrading urban environment. According to Klinton et al. (2018), studentification is more diverse than just a process of downgrading and should therefore be included in the city's policies. Ackermann and Visser (2016), found evidence for studentification in South Africa. They also argue that studentification has negative effects, but the positive effects should not be forgotten. The aforementioned papers are among a broader stream of literature about studentification The common line of reasoning in the above mentioned articles is that the above-average influx of students in urban areas lead to changes in the (social and economic) structure of the area. It is clear that the influx of students in neighbourhoods will impact the local social and economic dynamics. However, the papers mentioned above focus primarily on the influx of students in former family owned houses, and thus 'pushing away' a large group of former residents to other (urban) areas.

This study will, on the other hand, focus on the (re)development of large student complexes, other than the influx of students in family housing used in the papers mentioned in previous sections. Therefore, this study follows the paper by Mulhearn and Franco (2018) which focuses on studentification impacts by (re)developing buildings for students. By focusing on the (re)development of student complexes often vacant plots or real estate are (re)developed. According to Koster and Van Ommeren (2013) investments in urban neighbourhoods cause a rise in surrounding housing prices. Also Schwarz et al. (2016), researched the effects of redevelopments within urban areas, or urban renewal, and found higher housing prices around the redevelopments. They do not only elaborate on the increasing housing prices, also the quality of the neighbourhood from a social point of view increases. Furthermore, Ooi and Le (2013), researched the effect of redeveloping vacant plots and real estate in Singapore by using a difference in difference model. Their research points out that by (re)developing vacant plots or real estate, higher housing prices around the (re)development are observed. Following literature it becomes clear that investments in vacant, desolate real estate have an influence on housing prices since they are perceived as a disamenity before (re)development (Van Duijn, 2018). The spill over effects followed by the urban renewal cause a positive effect on local housing prices.

2.3 Hypothesis

According to the papers mentioned in previous sections, it is possible that the (re)development of student housing complexes have a relationship with the nearby residential property prices. Student housing complexes can have negative as well as positive external effects. Policies of local governments play an important role in determining whether the external effects are more positive or more negative. On the basis of the existing literature, it is expected that the (re)development of student housing complexes will have an effect on the nearby residential property prices. Our expectations will be tested with the following hypotheses.

H_0. The (re)development of student housing complexes cause an effect on the sale price of local property prices.

H_1. The (re)development of student housing complexes cause a negative effect on the sale price of nearby residential properties

H_2. The (re)development of student housing complexes cause a positive effect on the sale price of nearby residential properties

3. Methodology

3.1 Hedonic Price Analysis

In the field of real estate studies, the use of hedonic models is a common way of research as many studies are based on hedonic models (Rosen 1974; Sheppard, 1999; Schwartz et al., 2006; Hill, 2013; Bokhari and Geltner, 2014; Lazrak et al., 2014; Daams et al., 2016; Van Duijn et al., 2016). With the use of hedonic models, the value of a property can be determined by treating a property as a package of valuable characteristics. By treating properties as a package of characteristics, hedonic models make it possible to estimate effects on and of heterogenous goods like properties. To summarize; goods can be decomposed into a bundle of characteristics and each characteristic can be valued by the market implicitly, even though the characteristics are neither produced nor consumed individually (Sheppard, 1999). In this study, the external effects of the (re)development of student housing complexes are determined by a hedonic regression model and data of residential property price and housing characteristics.

In order to analyse the impact of the (re)development of student housing complexes on residential property prices, a difference-in-difference model is used. With the difference-in-difference model, the outcomes of the regression are observed for two groups for two different time periods. In this study the three time periods are before the start of the (re)development, between the start and completion of the redevelopment and after the completion of the (re)development. The before time period will be used to research whether the vacant plot has an effect on housing prices prior to the start of the (re)development. The between variable will show whether there exists some sort of anticipation effect. Lastly, the after coefficient will give insights in whether the (re)development has affected surrounding housing prices. The two groups that are used in this study are the target and the control group. The target and control groups are determined in line with research of Van Duijn et al. (2016). The target group is defined as those sold houses that received some sort of treatment by the (re)development. A sold house receives treatment if the house falls within a certain area, the area is determined by the distance to the (re)development. In this study the distance, or, treatment area is set to 1000 m. The control group contains the sold houses outside the treatment area but within a 2000 m distance. The 1000 m and 2000 m distance for the target and control group are chosen on the basis of aforementioned papers. Among existing research papers the target group preferably lies within a 500-1000 m distance and the distance of the control group varies up to 2000 m.

3.2 Empirical Model

The hedonic pricing model uses the characteristics or attributes of a property to measure the implicit price of the property. Property prices are the product of a variety of characteristics which include: the characteristics of the property itself, the location of the property and the environment of the property. In the next section the hedonic model is constructed with the help of Boardman et al., (2001) and Schwartz et al., (2006) and on the basis of Van Duijn et al., (2016).

To start, the hedonic pricing method uses the characteristics or attributes of a property in order to measure the implicit price of the property. For the model, this includes the estimation of the relationship between the price of the property and its characteristics that affects its value. In this study, as mentioned in chapter 2, the price of a house, P, depends on the characteristics of the property, the characteristics of the location and the characteristics of the neighbourhood. Therefore, the simple hedonic model of the price of a property is:

$$P = f(Property, Location, Neighbourhood)$$

In order to perform a proper analysis for this study the simple model is used and extended. Also the variables needed for the analysis are included. The baseline specification of the model is then defined as:

$$\ln(P_{ijt}) = b_0 + \sum_{s=1}^{S} \alpha_s R_{itrs} + \sum_{s=1}^{S} \theta_s R_{itrs} D_i + \sum_{s=1}^{S} \varphi_s R_{itrs} D_i^2 + \sum_{k=1}^{K} \beta_k X_{kit} + \gamma_t Y_t + \pi_j N_j + \varepsilon_{it},$$

where the variable P_{ijt} is the transaction price of property i that is located in neighbourhood j at transaction year t; the variable R_{itrs} is a vector of ring variables s, that depend on where property i is located, the year of transaction t and the treatment radius r; the variable D_i is the distance between the property i and the nearest (re)development of a student housing complex; X_{kit} are the structural characteristics k of property i sold in year t; Y_t is a vector of dummy variables taking one for year t and zero for all other years; H_j is a neighbourhood dummy variable taking one for neighbourhood j and zero for all other neighbourhoods; ε_t is the error term; α_s, θ_s, φ_s, β_k, γ_t and π_j are parameters to be estimated.

Three different ring variables (R_{itrs}) are specified, which will allow us to capture the external effect of a (re)development of a student housing complex. First, a distance ring dummy (s = BEFORE) is included if the location of the property i falls within the treatment radius r

and the transaction happened before the start of construction of the new complex. The coefficient of the BEFORE dummy can be interpreted as the negative or positive external effect of the area of the (re)development, prior to the start of the (re)development. Second, a distance ring dummy is included if the location of the property falls within the treatment area and is transacted between the start and completion of the (re)development (s = BETWEEN). Third, a distance ring dummy is included if the location of a property falls within the treatment area and is transacted after the (re)development (s = AFTER). The coefficient of the AFTER dummy can be interpreted as the negative or positive effects after the completion of the (re)development of the student housing complex. Fourth, a trend variable (s = TRENDAFTER) is included for s that if the location falls within the treatment area in order to check whether the degree of external effects after the completion of the (re)development changes over time. The value of this variable is calculated by the difference between the completion date of the project and the date of the transaction.

Each of the mentioned ring variables are also interacted with the distance to the nearest (re)development site, D. That allows to gain insight into the spatial component that measures the decay of the external effects. Like in Van Duijn et al. (2016), the distance variable is also added as a quadratic form to see whether the distance decay is linear, concave or convex.

4. Data

4.1 Study area and dataset

This study concerns the (re)developments of student complexes in the greater Amsterdam region. In the Netherlands, Amsterdam is the city with the largest student population, with around 50,000 students living in the city of Amsterdam (Municipality of Amsterdam, 2018). As mentioned in the introduction, there is a shortage of student housing in Amsterdam. In order to cope with the shortage, a number of (re)development projects have taken place in the last decade. The (re)development of student housing complexes takes place throughout the whole municipality of Amsterdam and its neighbouring municipalities of Amstelveen, Diemen and Ouder-Amstel.

The dataset used in this study is built up out of three parts. The first part is a dataset received from the Dutch Association of Real Estate Agents (NVM) and contains information about the housing transactions in the municipality of Amsterdam, Amstelveen, Diemen and Ouder-Amstel. Data of the housing transactions in the neighboring municipalities of Amsterdam are incorporated in the dataset since the municipality of Amsterdam has surrounding urban areas directly at its municipal borders. Some of the (re)developments have taken place at or just over the municipal borders of Amsterdam. Therefore, it is important to extent the research area to the Amsterdam metropolitan area. The second part of the dataset contains the (re)developments of student housing complexes throughout the city of Amsterdam and its surroundings. This dataset is constructed by the help of multiple sources like the municipality of Amsterdam, the Kadaster and owners of the (re)development projects. The third part of the dataset is constructed by data retrieved from the ‘Wijk en Buurtkaart 2016, 2017, 2018’ from Statistics Netherlands (CBS) and contains information of all neighbourhoods in the Netherlands.

The NVM registers up to 75 per cent of all owner-occupied transactions in the Netherlands. This results for this study in a NVM dataset containing almost 200,000 observations between 01-01-2005 and 31-12-2017 with 82 different variables. The dataset not only contains information about the transaction date, transaction price and the location (X, Y, coordinates) of the property, it also contains information about its structural characteristics. The structural characteristics consist of, among others, floor area, number of rooms, maintenance status, house type, parking, monumental status et cetera. Based on Van Duijn et al. (2016), 11 of the 82 variables have been selected for this study. In Table 1, the selected variables are shown.

Table 1. Property characteristics used in this study.

Variable	Description
Transaction Price	Natural logarithm of the Transaction price
Floor space	Natural logarithm of the Floor space in each sold property
Housing type	Type of the property, divided over 5 classes: - Apartment - Terraced house - Semi Detached - Corner - Detached
Number of rooms	The number of rooms in the property
Balcony	Dummy variable, 1 = yes
Terrace	Dummy variable, 1 = yes
Parking	Dummy variable, 1 = yes
Garden	Dummy variable, 1 = yes
Maintenance inside	Dummy variable, 1 = yes
Maintenance outside	Dummy variable, 1 = yes
Central heating	Dummy variable, 1 = yes
Building period	Building period of the property divided over 4 classes: - <1945 - 1945-1980 - 1980-2000 - >2000

Based on the information provided by the municipality of Amsterdam (Basisbestand Woningbouwlocaties, 2019), over 100 (re)developments of student housing in Amsterdam and its neighbouring municipalities are identified. Criteria used by selecting relevant (re)development projects are the number of units per (re)development, the usage of the building and the year of construction as well as the year of opening. (Re)developments with less than 50 units are considered as not useful in this study since (re)developments with less than 50 units are not considered as large scale. The usage of the buildings is important since some of the (re)development projects also include housing for young professionals, elderly or status holders (refugees with a residence permit). The usage of (re)developments in our research may affect the outcome regarding student housing complexes. In contrast, we have identified multipurpose buildings that are incorporated in this study since next to student housing the other purpose of the building only consists of the ground floor. Lastly we used the construction and opening date as a criterion since the NVM dataset only contains transactions that took place between 2005 and 2017. Unfortunately, some relevant (re)development projects that satisfy our mentioned criteria are excluded due to the incompleteness of the provided data or the unwillingness of the project owners to participate in this research. This results in a dataset containing information about 21 of (re)developments in the greater Amsterdam region. See table 2 for a detailed list of the selected (re)development projects. With the help of an online tool (Simontex, 2019), location coordinates (X,Y) are added to the dataset. This is essential to the research in order to define the target and control area that is used in the analysis.

Table 2. Overview of the (re)development projects used in the analysis.

	Project	Number of rooms	City-district	Start Year of Project	Year of Opening	Multipurpose	Type
1	IJburg Blok 51	69	Oost	2007	2007	Housing Only	Development
2	Presto	97	Oost	2013	2015	Housing Only	Development
3	Tourniarestraat	140	Nieuw-West	2015	2015	Housing Only	Redevelopment
4	Pieter Vlamingstraat	145	Oost	2015	2016	Housing Only	Development
5	Amstelcampus Leeuwenhoek	154	Oost	2011	2013	Multi – Education	Development
7	K. Wilhelminaplein 18	154	Nieuw-West	2016	2016	Multi – Education	Development
8	Fraijlemaborg	170	Zuidoost	2009	2011	Housing Only	Redevelopment
9	Elseviergebouw	245	West	2013	2015	Multi – Catering	Redevelopment
10	De Feniks	342	Oost	2013	2014	Multi – Catering	Redevelopment
11	Hicondo	356	Zuidoost	2015	2015	Housing Only	Development
12	Laan van Spartaan	361	Nieuw-West	2016	2017	Housing Only	Development
13	Smiley	364	Oost	2015	2016	Housing Only	Development
14	NieuwDok	380	Noord	2015	2016	Multi – Education	Development
15	Paraplufabriek	419	Nieuw-West	2015	2016	Housing Only	Development
16	ACTA 1	464	Nieuw-West	2011	2012	Multi – Business	Redevelopment
17	AmstelHome	519	Oost	2015	2015	Multi – Catering	Development
18	Spinozacampus II	552	Zuidoost	2014	2015	Housing Only	Development
19	Science Park II	605	Oost	2011	2013	Housing Only	Development
20	Spinozacampus I	700	Oost	2012	2012	Housing Only	Development
21	Science Park I	721	Oost	2006	2007	Housing Only	Development
22	Ravel Residence	801	Zuid	2014	2015	Multi – Catering	Development

Furthermore, the third part of the dataset is constructed by joining the ‘Wijk en Buurtkaart 2016, 2017, 2018’ dataset of the CBS (‘Buurten’) with the dataset of the NVM. The ‘Buurten’ data is added to the NVM dataset through a spatial join with the help of GIS-software. The ‘Buurten’ dataset contains a variety of variables. In this study, variables that typify and distinguish neighbourhoods are included. Among others, these variables include the population density, percentage foreign migrants, percentage of young and elderly people and average income. These variables are added to the model as ‘neighbourhood characteristics’.

4.2 Descriptive Statistics

In table 3 the descriptive statistics of the target, control and total group are shown. The mean and the standard deviations of the variables are given in the table. The target area (0-1000m) contains 31,632 observations and the control area (1000-2000m) contains 41,480 observations. This means that within the control area more transactions are registered. Another detail that attracts attention is the difference in the mean transaction price between the target and control group. The (re)developments of student housing complexes occur mostly around the city centre of Amsterdam, as can be derived from the map added in the appendix. The same phenomenon can be found in the descriptive statistics. The observation in the target group have less gardens, more balconies and is more often an apartment than in the control group, which indicates the relative central location of the (re)developments in Amsterdam.

Table 3. Descriptive Statistics for the target, control and total group.

		total mean *n=73112*	total SD	target mean *n=31632*	target SD	control mean *n=41480*	control SD
Structural Characteristics							
Transaction price	€	293538.6	181502.1	271915.4	161131.2	310028	194005
Distance to student housing complex	m	1105.418	493.9885	622.5582	232.4755	1473.64	274.7923
Floor space	m2	84.56688	36.66768	80.41806	34.2918	87.73071	38.07859
Number of Rooms	#	3.235707	1.323014	3.120701	1.187986	3.323409	1.411094
Balcony	1=yes	.5707408	.4949738	.5981917	.4902713	.5498071	.4975191
Terrace	1=yes	.1144956	.3184144	.1017956	.3023842	.1241803	.3297911
Parking	1=yes	.1233997	.3288977	.1120384	.3154187	.1320636	.338564
Garden	1=yes	.0739414	.2616772	.0632587	.2434316	.0820878	.2745017
Bad interior maintenance	1=yes	.2047543	.4035248	.208934	.4065536	.201567	.4011753
Bad exterior maintenance	1=yes	.1570057	.3638086	.167046	.3730229	.1493491	.3564365
Central heating	1=yes	.9062808	.2914397	.8987734	.3016333	.9120058	.2832899
Housing type - Apartment	1=yes	.8883083	.3149889	.9283005	.2579938	.857811	.3492481
Housing type - Terraced	1=yes	.0746116	.2627653	.0517514	.2215282	.0920444	.289092
Housing type - Semi detached	1=yes	.0094239	.0966189	.0055324	.0741751	.0123915	.1106267
Housing type - Corner	1=yes	.0217064	.1457242	.0116654	.1073764	.0293635	.1688254
Housing type - Detached	1=yes	.0059498	.0769055	.0027504	.0523727	.0083896	.0912107
Building periods							
Building period <1945	1=yes	.5159345	.4997494	.4722117	.4992351	.5492768	.4975719
Building period 1946-1980	1=yes	.1905159	.3927107	.1896813	.3920551	.1911524	.3932135
Building period 1980-2000	1=yes	.2088987	.4065246	.2419385	.428264	.183703	.3872465
Building period >2000	1=yes	.0846509	.2783635	.0961684	.2948268	.0758679	.2647898
Student housing complex characteristics							
Rooms student housing complex	#	321.4985	217.7364	264.6367	184.5121	364.8605	230.772
Multipurpose	1=yes	.6205411	.4852557	.5425518	.4981939	.6800145	.4664762
Redevelopment	1=yes	.2341339	.4234592	.2751328	.4465882	.2028689	.4021405
Neighbourhood characteristics							
Population density	#/km2	13838.29	7641.367	13629.95	7029.75	13997.16	8073.18
Foreign migrants	%	48.09241	13.06586	52.3156	13.86915	44.87187	11.41262
Distance to nearest train station	km	2.06426	1.229367	1.75998	1.087739	2.296299	1.279525
Average household size	#	1.795891	.243019	1.795324	.2150908	1.796324	.2623276
Young people	%	12.67278	3.220632	13.78664	3.247366	11.82336	2.927999
Elderly people	%	11.69502	5.235335	10.7144	4.927497	12.44282	5.33878
Average income per person	€	26396.83	7029.76	24426.19	5729.778	27899.6	7539.752

How can the minimum of household size be 0,24 (which is a quarter of 1 person?)

5. Results

5.1 Empirical Results

The coefficients of the estimation result and the standard errors of the empirical model are shown in table 4,. As a result of the transformation of the transaction price variable with the natural logarithm, the coefficients represent percentage changes. The adjusted R-squared represents whether the model fits the data properly. A relative high R-squared can be interpreted as a proper fit of the model used. In the table, model 1 is the simplest model we used in the regression. Only the before, between, after and trend after variables with the year fixed effects are used. This results in a relative low R-squared of 0.12. In model 2 the structural characteristics of the properties are added. The R-squared of model 2 increases significantly as can be derived from the estimation results of model 2. The R-squared of model 2 is 0.79, which means that 79 per cent of the variance in transaction prices is explained by variables included in the model. In model 3 and 4 more variables are added. In model 3 neighbourhood characteristics are added as variables to the model. The R-squared of model 3 (0.7942) is slightly higher than model 2 (0.7938), this implies that the neighbourhood characteristics add marginal to the model fit. Model 4 represents the full model as proposed in chapter 3 and has the highest R-squared of the regression results. The R-squared of model 4 is 0.86, this implies that approximately 86 per cent of the variance in transaction prices can be explained by the model.

In this section the coefficients of the estimation results of the regression will be interpreted. As a result of the relatively low R-squared of the simpler, or naïve, models, model 4 will receive the main focus by interpreting the coefficients and thus is the preferred model in this research. Model 1 starts with only the key-variables (before, between, after and trend after) and a year fixed effect. In model 2, the building period dummies, the structural characteristic variables of the property and the student housing complex characteristics are added. Model 3 adds neighbourhood fixed effects to the model and in model 4, the neighbourhood characteristics are added. Model 4 is therefore the most complete and that results in the highest R-squared. The before coefficient of the model 4 specification is significantly different from zero at a 1 per cent level. Furthermore, the coefficient is negative, which implies that the transaction prices are relatively lower in the target group in comparison to the control group. This could mean that the place or plot, where the student housing complex is located, has a negative effect on transaction prices before the opening of the complex. The locations of the (re)developments of the student housing complexes are all well within the Amsterdam urban area, and were vacant before the (re)development. The negative coefficient could therefore imply, in line with Van Duijn et al. (2016), that the vacant locations were perceived as a disamenity, resulting in lower housing transaction prices. The coefficient of the interaction variable of the before dummy and the distance variable is negative and significantly differs from zero at the 5 per cent level, which indicates that the negative effect increases if the distance to the place of the (re)development increases. This is against expectations since it makes more sense if the negative effects of the vacant plot decreases over distance. A explanation could be that other factors may have also impacted the interaction variable between before and distance.

In this section the results of the between variable will be discussed on the basis of the results of the preferred model, shown in table 4. The between variable is significantly different from zero at the 1 per cent level. The variable is positive, which indicates that the transaction prices in the target area are relatively higher than the transaction prices in the control area. This implies that there exists some sort of anticipation effect. An anticipation effect can occur when it is known that there will be a transformation. As a result people sell and buy properties close by the transformation because it is expected that the surrounding neighbourhoods will be upgraded by the (re)development. Because the student housing complexes used in this study are developed on vacant plots or desolate real estate, it makes sense that there exists some sort of anticipation effect. Following the interaction variable of the between variable and the distance the positive effect, and thus the anticipation effect, decreases over time. This implies that the anticipation effect is the strongest close by the (re)development.

In the following section the coefficient of the regression model after the completion of the (re)development will be discussed. In the preferred model, both the after and trend after variables capture the effects of the (re)developments on transaction prices. Both the coefficients of the after and trend after variables are significant at the, respectively, 10 and 1 per cent level. The coefficient of the after variable is positive and the coefficient of the trend after variable is negative. The significant and positive coefficient of the after variable implies that there exists a positive effect of rising property transaction prices directly after the opening of the student housing complex within the target area. However, the negative coefficient of the trend after variable implies that the effect of the newly built student housing complexes decreases over time. The coefficient of the variable of the after dummy and the distance variable is not significant, this means no difference is found between the target and control area. The trend after coefficient is, however, significant at the 1 per cent level, this implies that the effects will decrease over distance in the years after the project is completed. Overall, the after and trend after coefficients imply that the (re)development of the student housing complexes used in this study cause higher property prices. This result makes sense since the (re)developments have taken place on less valued grounds and have added a new group of people in their neighbourhoods. Also, as a result of the (re)development project new amenities are added to the neighbourhoods which are also likely to cause higher property prices.

Table 4. Regression results for the baseline specification.

	(1)	(2)	(3)	(4)
Sample size	<2000 m	<2000 m	<2000 m	<2000 m
Target area	0 - 1000 m	0 - 1000 m	0 - 1000 m	0 - 1000 m
Control Area	1000 - 2000 m	1000 - 2000 m	1000 - 2000 m	1000 - 2000 m
Before	-.1418708***	-.0240326***	-.0275657***	-.0182131***
	(.0168338)	(.0084782)	(.0084681)	(.0068954)
Before * D	-.0005163***	-.0001778***	-.0001743***	-.000052**
	(.0000631)	(.0000313)	(.0000313)	(.0000255)
Before * D^2	6.08e-07***	2.14e-07***	2.11e-07***	7.94e-08***
	(5.39e-08)	(2.66e-08)	(2.65e-08)	(2.19e-08)
Between	-.0902838***	.0655694***	.0630992***	.0543911***
	(.034676)	(.0161309)	(.0161051)	(.0130514)
Between * D	-.0002907**	-.0003246***	-.0003225***	-.0001735***
	(.0001277)	(.0000609)	(.0000608)	(.0000495)
Between * D^2	4.11e-07***	3.07e-07***	3.06e-07***	1.46e-07***
	(1.07e-07)	(5.15e-08)	(5.15e-08)	(4.22e-08)
After	-.0827722*	.0339493	.0332276	.0335537*
	(.0485116)	(.0218394)	(.0218203)	(.0192632)
After * D	-.0002459	-.0001314	-.0001322	-.0000963
	(.0001808)	(.0000834)	(.0000833)	(.0000713)
After * D^2	4.76e-07***	2.12e-07***	2.12e-07***	1.39e-07**
	(1.53e-07)	(7.14e-08)	(7.14e-08)	(6.02e-08)
Trend after	.0370824***	-.0258303***	-.0259351***	-.0228916***
	(.0110958)	(.00498)	(.0049742)	(.0048971)
Trend after * D	-.0000575	.000063***	.0000628***	.0000705***
	(.0000438)	(.0000204)	(.0000204)	(.0000189)
Trend after * D^2	3.20e-08	-5.11e-08***	-5.10e-08***	-6.02e-08***
	(3.77e-08)	(1.80e-08)	(1.80e-08)	(1.63e-08)
Year fixed effects (12)	YES	YES	YES	YES
Structural characteristics (13)	NO	YES	YES	YES
Building period dummies (4)	NO	YES	YES	YES
Student housing complex characteristics (4)	NO	YES	YES	YES
Neighbourhood fixed effects (7)	NO	NO	YES	YES
Neighbourhood characteristics (7)	NO	NO	NO	YES
Observations	73,112	73,112	73,112	73,112
Adjusted R-squared	0.1233	0.7938	0.7941	0.8648

Note: Dependent variable is ln(transaction price). Robust standard errors are reported between parentheses
* $p < 0.10$
** $p < 0.05$
*** $p < 0.01$

In the next section the target and control areas have different specifications. Table 5 shows the result of model 5 and 6. Model 5 is carried out using a smaller target area of 500 m, the control area is made larger and is now 500-1500 m. Model 6 is executed with a larger target area of 1500 m and a smaller control area (500-2000 m). Other conditions of the regression will stay the same as our preferred model (4). In table 5, the results of the regression are shown. This regression is done to check the robustness of the model and whether a proper target and control area has been used in our preferred model.

As said, model 5 differs from our preferred model (4) in terms of target and control area size. The target area in model 5 (model 4) is set to 500 m (1500 m) and the control area is set to 500-2000 m (1500-2000 m). In table 5 the results of the regression are presented. Model 5 has a smaller target area relative to our preferred model and almost all coefficients are not significant. This indicates that the effect of the (re)development cannot be fully measured within a target area of 500 m. Model 6, on the other hand, shows similar results to out preferred model. However, model 6 results in a not significant between coefficients. The effect of the (re)development between the start and completion of the project cannot be fully measured with a larger target area of 1500 m. The same goes for the after variable in model 6, which implies that the model with a target area of 1500 m is not able to measure the effects.

Table 5. Regression results for alternative specifications.

	(5)	(6)
Sample size	<2000 m	<2000 m
Target area	0 - 500 m	0 - 1500 m
Control Area	500 - 2000 m	1500 - 2000 m
Before	-.0397334***	-.0442652***
	(.0139829)	(.0051111)
Before * D	.0000502	.0001115***
	(.0000987)	(.0000119)
Before * D^2	2.96e-08	-4.54e-08***
	(1.62e-07)	(6.84e-09)
Between	.0297255	.0175305*
	(.0286591)	(.0090155)
Between * D	-.0001676	.0000189
	(.000197)	(.0000229)
Between * D^2	3.54e-07	-7.87e-09
	(3.11e-07)	(1.34e-08)
After	.0302527	-.0165846
	(.0467927)	(.0130924)
After * D	-.0001514	.0001659***
	(.0003136)	(.0000339)
After * D^2	3.16e-07	-9.66e-08***
	(4.93e-07)	(1.98e-08)
Trend after	-.0284301**	-.0145583***
	(.0127062)	(.0032181)
Trend after * D	.0001239	.0000302***
	(.0000859)	(8.80e-06)
Trend after * D^2	-1.69e-07	-2.45e-08***
	(1.38e-07)	(5.30e-09)
Year fixed effects (12)	YES	YES
Structural characteristics (13)	YES	YES
Building period dummies (4)	YES	YES
Student housing complex characteristics (4)	YES	YES
Neighbourhood fixed effects (7)	YES	YES
Neighbourhood characteristics (7)	YES	YES
Observations	73,112	73,112
Adjusted R-squared	0.8643	0.8654

Note: Dependent variable is ln(transaction price). Robust standard errors are reported between parentheses
* $p < 0.10$
** $p < 0.05$
*** $p < 0.01$

5.2 Sensitivity specification

It is likely that in higher income neighbourhoods result will be different from that in lower income neighbourhoods. The difference in average income in neighbourhoods could result in in driving up of down some of the coefficients. Therefore, the dataset is split up in different parts using the average income level in the neighbourhood of the property. With the help of a Chow-test, the differences between groups can be measured. The null-hypothesis of a Chow-test is that there are no differences between the subsets. As said, in this test the subsets will be based on neighbourhoods income. The subsets will be conducted by approximately the highest 1/3 of the dataset in terms of neighbourhood income and the lowest 1/3. Both samples will be regressed separately. The highest 1/3 of the subset is conducted with all observations in neighbourhoods with an average income of over 29,000. The lowest 1/3 sample is conducted by taking all observations in neighbourhoods lower than 22,500. The higher income subset contains approximately 23,000 observations. The lower income subset contains 24,000 observations. The other approximately 24,000 observations will not be used in this analysis since those are considered as average. The results are given in table 6.

In contrast to the empirical model (4), model 5 and 6 show similar results. Only the before coefficient of the lowest income subset is different from the empirical model. The empirical model points out that prior to the (re)development the property prices are lower around the (re)development site. In model 6 however, the area close to the (re)development site shows higher property prices. This result seems inconsistent, but by looking to the between coefficient of model 6 (re)development projects cause anticipation effects. This could mean that the anticipation effects are already in place before the start of the redevelopment. Another factor that may cause this inconsistency is the perception of a disamenity. In lower income neighbourhoods a vacant plot or piece of real estate may not always be seen as property price lowering object, but rather as a chance of positive change.

Lastly, the Chow F-statistic is significantly different from zero at the 1 per cent level, which means that the null-hypothesis is rejected. This also means that the subsets are not identical to each other.

Table 6. Regression results after splitting the dataset.

	(5)	(6)
	Highest Income (>29,000)	Lowest Income (<22,500)
Sample size	<2000 m	<2000 m
Target area	0 - 1000 m	0 - 1000 m
Control Area	1000 - 2000 m	1000 - 2000 m
Before	-.0592831***	.0427931***
	(.0215886)	(.0096299)
Before * D	.0000862	-.0004171***
	(.0000757)	(.0000345)
Before * D^2	-5.74e-08	3.94e-07***
	(6.06e-08)	(2.93e-08)
Between	.0123638	.0761099***
	(.029373)	(.019257)
Between * D	-.0001058	-.0002871***
	(.0001033)	(.00007)
Between * D^2	9.91e-08	2.50e-07***
	(8.40e-08)	(5.89e-08)
After	.0968688***	.0348838
	(.0366077)	(.036529)
After * D	-.0002531*	-.0002766**
	(.0001319)	(.0001219)
After * D^2	2.10e-07*	2.77e-07***
	(1.09e-07)	(9.83e-08)
Trend after	-.0774704***	-.0420033***
	(.0083385)	(.0118274)
Trend after * D	.0002568***	.0001303***
	(.0000343)	(.0000343)
Trend after * D^2	-1.87e-07***	-7.20e-08***
	(3.02e-08)	(2.54e-08)
Year fixed effects (12)	YES	YES
Structural characteristics (13)	YES	YES
Building period dummies (4)	YES	YES
Student housing complex characteristics (4)	YES	YES
Neighbourhood fixed effects (7)	YES	YES
Neighbourhood characteristics (7)	YES	YES
Observations	22,916	24,196
Adjusted R-squared	0.8573	0.8252

Note: Dependent variable is ln(transaction price). Robust standard errors are reported between parentheses
* $p < 0.10$
** $p < 0.05$
*** $p < 0.01$

6. Conclusions

In this paper the effect of student housing complexes on surrounding housing prices has been researched. In order to estimate the effect, a hedonic pricing model with a difference in difference specification is used. The findings of the analysis support the hypothesis (H_0) formulated in chapter 2. The (re)development of student housing complexes has an effect on the surrounding housing prices. Important in this study is whether the effect of the (re)development of student housing complexes is negative of positive in terms of surrounding housing prices. The preferred model gives insight in the question whether the (re)development has a negative or positive effect. Before the (re)development, the undeveloped plot or the vacant real estate object lowers the surrounding housing prices. Between the start and completion of the redevelopment surrounding housing prices rise. This implies that there exists a so called anticipation effect. Also after the (re)development the surrounding housing prices are higher around the newly developed student housing complex according to the analysis. This finding supports our second alternative hypothesis (H^2). Therefore, the main research question: *'Do the external effects of student housing (re)development have an impact on local residential property prices?'* is answered with the help of table 4, where the preferred model is analysed. The model gives insight in the positive price effect of housing surrounding a (re)development project of student housing. Therefore, it can be concluded that there exists a positive effect on surrounding housing prices of the (re)development of student housing complexes. The positive price effects, however, diminishes over time and distance.

In chapter 2, earlier research points out that the influx of students in a neighbourhood can cause a negative effect on housing prices. However, the influx of students in neighbourhoods as researched in earlier studies mainly focuses on students pushing out other groups of inhabitants. The focus of this research was on the (re)development of student housing complexes, and thus adding student population to the neighbourhood. Therefore, the results of this research are different from earlier research. A second conclusion that is mentioned in chapter 2 is that the local government plays a major role in studentification issues. In this study it has become clear that in Amsterdam, the influx of students has been encountered by building new student housing complexes on locations that were formerly desolate or vacant. As a result, the housing prices have gone up around the (re)development, and thus the role of the local government in guiding the influx of students has had a positive effect on the neighbourhoods.

This underpins the statement in earlier research that the local government does indeed play a major role in this matter.

To conclude, this study has pointed out that it is important to organize the influx of students in a neighbourhood by local governments in order to gain advantage in terms of rising residential property prices. The rise is however dependent on time and distance and will diminish over time and distance. From an investment perspective, it is good to know that property prices tend to grow directly after completion. From a governmental perspective, it is good to know that the influx of students does not always have negative effects on neighbourhoods and the housing prices within the neighbourhoods. According to the results the direction of the price effect is dependent on the characteristics of the development. Redevelopments and larger complexes have lower price stimulating effects than developments and smaller complexes.

In this paper the data received from the NVM is used. This data comprises 75 per cent of all housing transactions. It is questionable whether the other 25 per cent may have influenced the results of this study. Also, the city and municipality of Amsterdam is very dense. It is therefore questioned whether the treatment area of 1 km is not too big. In dense urban areas like Amsterdam 1 km is relative much in terms of amenities and inhabitants compared to less dense urban areas. Another limitation of this study is the number of building projects in Amsterdam. It is questionable that the effects found in this study are solely caused by the (re)development of student housing complexes. Namely, the (re)development projects of student housing complexes are in some cases part of larger urban renewal plans which also may affect the housing prices. In this study, distance is determined by drawing circles of 1 km around the properties. Taking for example walking time as a distance measurement could have resulted in other, more precise, outcomes. A last limitation in this study is the usage of years as time measurement. A more precise measurement like months or days could have resulted in different, or better, results.

In case of further research it is viable to gain access to more data than were available for this study. In the analysis of this study, anticipation effects are not accounted for since the data were not available. The analysis with only the (re)development projects where all the data were available did not result in the acceptance or rejection of relations between (re)developments of student housing complexes and surrounding housing price transactions. It is a shortcoming that this study does not incorporate the anticipation effects in the preferred model. Another shortcoming is the timing of this study since the municipality has planned more projects in the coming years. Doing the analysis again after the planned projects are completed may result in more viable results. Furthermore, within the Amsterdam metropolitan area there are plans to build student housing complexes outside the borders of the municipality of Amsterdam. Where the university complexes of Amsterdam are within the municipal borders, the plan is to develop student housing in cities like Almere, Zaandam and Purmerend. This means that students have to travel longer to the facilities of the universities in Amsterdam. In municipalities outside of Amsterdam, other effects of developing student housing complexes could occur. Further research in municipalities outside Amsterdam are interesting since it is unknown if the same effects on housing prices will occur in 'not traditional' student cities.

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Appendix

A. Map of included (re)development projects in Amsterdam

B. Full estimation results of the baseline model (model 4 is the preferred model)

	Model 1	Model 2	Model 3	Model 4
TARGET1000BEFORE	-.1418708***	-.0240326***	-.0275657***	-.0182131***
	.0168338	.0084782	.0084681	.0068954
TARGET1000BEFOREDISTANCE	-.0005163***	-.0001778***	-.0001743***	-.000052**
	.0000631	.0000313	.0000313	.0000255
TARGET1000BEFOREDISTANCE2	6.08e-07***	2.14e-07***	2.11e-07***	7.94e-08***
	5.39e-08	2.66e-08	2.65e-08	2.19e-08
TARGET1000BETWEEN	-.0902838***	.0655694***	.0630992***	.0543911***
	.034676	.0161309	.0161051	.0130514
TARGET1000BETWEENDISTANCE	-.0002907**	-.0003246***	-.0003225***	-.0001735***
	.0001277	.0000609	.0000608	.0000495
TARGET1000BETWEENDISTANCE2	4.11e-07***	3.07e-07***	3.06e-07***	1.46e-07***
	1.07e-07	5.15e-08	5.15e-08	4.22e-08
TARGET1000AFTER	-.0827722*	.0339493	.0332276	.0335537*
	.0485116	.0218394	.0218203	.0192632
TARGET1000AFTERDISTANCE	-.0002459	-.0001314	-.0001322	-.0000963
	.0001808	.0000834	.0000833	.0000713
TARGET1000AFTERDISTANCE2	4.76e-07***	2.12e-07***	2.12e-07***	1.39e-07**
	1.53e-07	7.14e-08	7.14e-08	6.02e-08
TARGET1000TRENDAFTER	.0370824***	-.0258303***	-.0259351***	-.0228916***
	.0110958	.00498	.0049742	.0048971
TARGET1000TRENDAFTERDISTANCE	-.0000575***	.000063***	.0000628***	.0000705***
	.0000438	.0000204	.0000204	.0000189
TARGET1000TRENDAFTERDISTANCE2	3.20e-08***	-5.11e-08***	-5.10e-08***	-6.02e-08***
	3.77e-08	1.80e-08	1.80e-08	1.63e-08
2006bn.TRANSACTIONYEAR	.0525512***	.0576269***	.057648***	.0638466***
	.0085645	.0041555	.0041552	.0034666
2007.TRANSACTIONYEAR	.1506433***	.1593693***	.1593984***	.1673058***
	.0086304	.0040727	.0040716	.0033622

2008.TRANSACTIONYEAR	.1990815***	.2071789***	.207445***	.2173936***
	.0087608	.0041839	.0041823	.0034212
2009.TRANSACTIONYEAR	.1288677***	.1488568***	.1489796***	.1623948***
	.0088616	.0041787	.0041794	.0034994
2010.TRANSACTIONYEAR	.1374764***	.1528384***	.1528766***	.1594636***
	.008788	.0042076	.0042086	.0035199
2011.TRANSACTIONYEAR	.1198252***	.1416845***	.1417172***	.1513068***
	.0093184	.0044186	.0044172	.0036725
2012.TRANSACTIONYEAR	.0311885***	.0731566***	.0730625***	.087972***
	.0091471	.0043837	.0043851	.0037089
2013.TRANSACTIONYEAR	.0134778	.056897***	.0567122***	.0635038***
	.009415	.0045896	.0045884	.0038603
2014.TRANSACTIONYEAR	.076164***	.1284305***	.1280447***	.1389637***
	.0085393	.0041168	.0041178	.0034708
2015.TRANSACTIONYEAR	.1663156***	.2212182***	.2208191***	.242051***
	.0086253	.0042303	.0042297	.0035472
2016.TRANSACTIONYEAR	.3205209***	.3691149***	.3685361***	.3933267***
	.0087475	.004369	.0043669	.0036685
2017.TRANSACTIONYEAR	.4648919***	.4990086***	.4988422***	.5237544***
	.0089766	.0044834	.0044767	.0037991
FLOORSPACE	X	.0095024***	.0095067***	.0082664***
		.0000638	.000064	.0000881
NROOMS	X	.0122015***	.0122599***	.0202491***
		.0019449	.0019528	.0030953
2bn.HOUSINGTYPE	X	-.1114318.***	-.1087719***	-.0001044
		0047873	0048059	.0043837
3.HOUSINGTYPE	X	-.0529361***	-.0494172***	.0955879***
		.0125291	.0124966	.0104419
4.HOUSINGTYPE	X	-.1380889***	-.1329243***	.0131756*
		.007474	.0075261	.0063654
5.HOUSINGTYPE	X	.0419883***	.039580**	.2107453***
		.0188759	.0188599	.0158963
BALCONY	X	-.0025813	-.0025858	.0017948***
		.0019005	.0018984	.0016781
TERRACE	X	.0864943***	.0857256***	.0672885***
		.0028822	.0028807	.0024555
GARDEN	X	.0943511***	.0953436***	.0939898***
		.0037805	.003778	.0031153
MAINTENANCEINSIDE	X	.0848806***	.0850199***	.0761684***
		.0028016	.0027958	.0023274
MAINTENANCEOUTSIDE	X	.0244661***	.0242338***	.0144848***
		.0031947	.0031901	.0026852
CENTRALHEATING	X	.0770351***	.0771108***	.0775094***
		.0031305	.0031246	.0026568
PARKING	X	.0706307***	.0719305***	.0664216***
		.0036639	.0036742	.0029513
2bn.BUILDINGPERIOD	X	-.2750215***	-.2724432***	-.1434689***
		.0026968	.0027207	.0025013
3.BUILDINGPERIOD	X	-.1324581***	-.1328163***	-.0614674***
		.0025476	.002547	.0022627
4.BUILDINGPERIOD	X	-.1112049***	-.1135209***	-.0029783***
		.0040552	.004074	.0034603
NROOMSSTUDCOMP	X	-.0001529***	-.0001492***	-.0001322***
		4.90e-06	4.92e-06	4.50e-06
MULTIPURPOSE	X	.1950644***	.191897***	.0649295***
		.0020245	.0020482	.0018975
REDEVELOPMENT	X	-.1510621***	-.1514206***	-.0424038***
		.0019079	.0019084	.0017186
WKCODE	X	X	-.0000129***	-.0000362***
			1.25e-06	1.19e-06
PFOREIGNMIGRANTS	X	X	X	-.0035365***
				.0001079
POPULATIONDENSITY	X	X	X	4.01e-06***
				1.53e-07
lnDISTANCETRAIN	X	X	X	-.0678678***
				.0018387
AVGHOUSEHOLDSIZE	X	X	X	-.1145001***
				.0050257
PYOUNGPEOPLE	X	X	X	.0054611***
				.0002959
PELDERLYPEOPLE	X	X	X	-.0025197***
				.0002134
lnAVGINCOMEPERPERSON	X	X	X	.4680218***
				.0062779

_cons	12.35537	11.38891	11.8603	8.32461
	.0063839	.0052626	.0456115	.0887713
R^2	0.1233	0.7938	0.7941	0.8648
N	73,112	73,112	73,112	73,112
* p<0.10; ** p<0.05, *** p<0.01				

C. Chow-Test

	Error sum of squares
	AVGINCOMEPERPERSON
POOLED	1535.09919
AVGINCOMEPERPERSON>29000	847.28747
AVGINCOMEPERPERSON<22500	562.006583
No. of regressor	51
F(51,47060)	7149.13***
Note: ***p<0.01, **p<0.05, *p<0.10	

D. Do-File Stata

Note: the analysis is not performed with the original dataset. The dataset is pre-cleaned with the help of excel. Furthermore, the do-file is cleaned by deleting parts that were not important to this study.

```
drop if TRANSACTIONPRICE>2000000
gen lnTRANSACTIONPRICE=ln(TRANSACTIONPRICE)
gen logTRANSACTIONPRICE=log(TRANSACTIONPRICE)
gen lnTRANSACTIONPRICE=ln(TRANSACTIONPRICE)
drop if FLOORSPACE>300
gen lnFLOORSPACE=ln(FLOORSPACE)
gen PRICEM2=(TRANSACTIONPRICE/FLOORSPACE)
drop if PRICEM2>10000
qui tab HOUSINGTYPE, gen(HOUSINGTYPE)
qui tab BUILDINGPERIOD, gen(BUILDINGPERIOD)
rename HOUSINGTYPE1 HOUSTYPE_APP
rename HOUSINGTYPE2 HOUSTYPE_TERRACED
rename HOUSINGTYPE3 HOUSTYPE_SEMI
rename HOUSINGTYPE4 HOUSTYPE_CORNER
rename HOUSINGTYPE5 HOUSTYPE_DETACHED
rename BUILDINGPERIOD1 BP_1945
rename BUILDINGPERIOD2 BP1946_1980
rename BUILDINGPERIOD3 BP1981_2000
rename BUILDINGPERIOD4 BP2000_
summarize TRANSACTIONPRICE FLOORSPACE NROOMS HOUSTYPE_APP HOUSTYPE_TERRACED HOUSTYPE_SEMI
HOUSTYPE_CORNER HOUSTYPE_DETACHED BALCONY TERRACE GARDEN PARKING MAINTENANCEINSIDE
MAINTENANCEOUTSIDE CENTRALHEATING BP_1945 BP1946_1980 BP1981_2000 BP2000_
DISTANCESTUDENTHOUSINGCOMPLEX YEAROFOPENING AH MULTIPURPOSE REDEVELOPMENT URBANITY
PYOUNGPEOPLE PELDERLYPEOPLE POPULATIONDENSITY AVGHOUSEHOLDSIZE PFOREIGNMIGRANTS WOZ
AVGINCOMEPERPERSON rename AH NROOMSSTUDCOMP
histogram DISTANCESTUDENTHOUSINGCOMPLEX
mean PRICEM2
summarize TRANSACTIONPRICE FLOORSPACE NROOMS HOUSTYPE_APP HOUSTYPE_TERRACED HOUSTYPE_SEMI
HOUSTYPE_CORNER HOUSTYPE_DETACHED BALCONY TERRACE GARDEN PARKING MAINTENANCEINSIDE
MAINTENANCEOUTSIDE CENTRALHEATING BP_1945 BP1946_1980 BP1981_2000 BP2000_
DISTANCESTUDENTHOUSINGCOMPLEX YEAROFOPENING NROOMSSTUDCOMP NROOMSSTUDCOMP MULTIPURPOSE
REDEVELOPMENT URBANITY PYOUNGPEOPLE PELDERLYPEOPLE POPULATIONDENSITY AVGHOUSEHOLDSIZE
PFOREIGNMIGRANTS WOZ AVGINCOMEPERPERSON DISTANCETRAIN PRICEM2
gen lnDISTANCETRAIN=ln(DISTANCETRAIN)
gen lnAVGINCOMEPERPERSON=ln(AVGINCOMEPERPERSON)
gen lnPOPULATIONDENSITY=ln(POPULATIONDENSITY)
mvencode _all, mv(0) override
destring FLOORSPACE, replace
use "/Users/Evert/Documents/Masterthesis/STATA DATA NIEUW 06:08.dta"
drop if DISTANCESTUDENTHOUSINGCOMPLEX > 2000
drop if NEARSTUDENTCOMPLEX == 6
gen STARTBUILDING = 2011 if NEARSTUDENTCOMPLEX == 5
replace STARTBUILDING = 2007 if NEARSTUDENTCOMPLEX == 1
replace STARTBUILDING = 2013 if NEARSTUDENTCOMPLEX == 2
```

```
replace STARTBUILDING = 2015 if NEARSTUDENTCOMPLEX == 3
replace STARTBUILDING = 2015 if NEARSTUDENTCOMPLEX == 4
replace STARTBUILDING = 2011 if NEARSTUDENTCOMPLEX == 5
replace STARTBUILDING = 2016 if NEARSTUDENTCOMPLEX == 7
replace STARTBUILDING = 2009 if NEARSTUDENTCOMPLEX == 8
replace STARTBUILDING = 2013 if NEARSTUDENTCOMPLEX == 9
replace STARTBUILDING = 2013 if NEARSTUDENTCOMPLEX == 10
replace STARTBUILDING = 2015 if NEARSTUDENTCOMPLEX == 11
replace STARTBUILDING = 2015 if NEARSTUDENTCOMPLEX == 11
replace STARTBUILDING = 2016 if NEARSTUDENTCOMPLEX == 12
replace STARTBUILDING = 2015 if NEARSTUDENTCOMPLEX == 13
replace STARTBUILDING = 2015 if NEARSTUDENTCOMPLEX == 14
replace STARTBUILDING = 2015 if NEARSTUDENTCOMPLEX == 15
replace STARTBUILDING = 2011 if NEARSTUDENTCOMPLEX == 16
replace STARTBUILDING = 2015 if NEARSTUDENTCOMPLEX == 17
replace STARTBUILDING = 2014 if NEARSTUDENTCOMPLEX == 18
replace STARTBUILDING = 2011 if NEARSTUDENTCOMPLEX == 19
replace STARTBUILDING = 2012 if NEARSTUDENTCOMPLEX == 20
replace STARTBUILDING = 2006 if NEARSTUDENTCOMPLEX == 21
replace STARTBUILDING = 2014 if NEARSTUDENTCOMPLEX == 22
* Created new variable with start year of construction
gen TARGET1000 = DISTANCESTUDENTHOUSINGCOMPLEX <=1000
gen CONTROL1000 = DISTANCESTUDENTHOUSINGCOMPLEX > 1000
gen AFTERNEW = TRANSACTIONYEAR > YEAROFOPENING
gen BETWEENNEW = TRANSACTIONYEAR >= STARTBUILDING & TRANSACTIONYEAR <= YEAROFOPENING
gen BEFORENEW = TRANSACTIONYEAR < STARTBUILDING
gen TRENDAFTERNEW = TRANSACTIONYEAR-YEAROFOPENING if AFTERNEW == 1
* CREATED NEW TARGET AND CONTROL AREAS AND VARIABLES
gen TARGET1000BEFORE = TARGET1000*BEFORENEW
gen TARGET1000BEFOREDISTANCE = TARGET1000BEFORE*DISTANCESTUDENTHOUSINGCOMPLEX
gen TARGET1000BEFOREDISTANCE2 = TARGET1000BEFORE*DISTANCESTUDENTHOUSINGCOMPLEX^2
gen TARGET1000BETWEEN = TARGET1000*BETWEENNEW
gen TARGET1000BETWEENDISTANCE = TARGET1000BETWEEN*DISTANCESTUDENTHOUSINGCOMPLEX
gen TARGET1000BETWEENDISTANCE2 = TARGET1000BETWEEN*DISTANCESTUDENTHOUSINGCOMPLEX^2
gen TARGET1000AFTER = TARGET1000*AFTERNEW
gen TARGET1000AFTERDISTANCE = TARGET1000AFTER*DISTANCESTUDENTHOUSINGCOMPLEX
gen TARGET1000AFTERDISTANCE2 = TARGET1000AFTER*DISTANCESTUDENTHOUSINGCOMPLEX^2
gen TARGET1000TRENDAFTER = TARGET1000*TRENDAFTERNEW
gen TARGET1000TRENDAFTERDISTANCE = TARGET1000TRENDAFTER*DISTANCESTUDENTHOUSINGCOMPLEX
gen TARGET1000TRENDAFTERDISTANCE2 = TARGET1000TRENDAFTER*DISTANCESTUDENTHOUSINGCOMPLEX^2
mvencode _all, mv(0) override
sum TRANSACTIONPRICE DISTANCESTUDENTHOUSINGCOMPLEX FLOORSPACE NROOMS BALCONY TERRACE PARKING
GARDEN MAINTENANCEINSIDE MAINTENANCEOUTSIDE CENTRALHEATING HOUSTYPE_APP HOUSTYPE_TERRACED
HOUSTYPE_SEMI HOUSTYPE_CORNER HOUSTYPE_DETACHED BP_1945 BP1946_1980 BP1981_2000 BP2000_
NROOMSSTUDCOMP MULTIPURPOSE REDEVELOPMENT POPULATIONDENSITY PFOREIGNMIGRANTS DISTANCETRAIN
AVGHOUSEHOLDSIZE PYOUNGPEOPLE PELDERLYPEOPLE AVGINCOMEPERPERSON
sum TRANSACTIONPRICE DISTANCESTUDENTHOUSINGCOMPLEX FLOORSPACE NROOMS BALCONY TERRACE PARKING
GARDEN MAINTENANCEINSIDE MAINTENANCEOUTSIDE CENTRALHEATING HOUSTYPE_APP HOUSTYPE_TERRACED
HOUSTYPE_SEMI HOUSTYPE_CORNER HOUSTYPE_DETACHED BP_1945 BP1946_1980 BP1981_2000 BP2000_
NROOMSSTUDCOMP MULTIPURPOSE REDEVELOPMENT POPULATIONDENSITY PFOREIGNMIGRANTS DISTANCETRAIN
AVGHOUSEHOLDSIZE PYOUNGPEOPLE PELDERLYPEOPLE AVGINCOMEPERPERSON if TARGET1000==1
sum TRANSACTIONPRICE DISTANCESTUDENTHOUSINGCOMPLEX FLOORSPACE NROOMS BALCONY TERRACE PARKING
GARDEN MAINTENANCEINSIDE MAINTENANCEOUTSIDE CENTRALHEATING HOUSTYPE_APP HOUSTYPE_TERRACED
HOUSTYPE_SEMI HOUSTYPE_CORNER HOUSTYPE_DETACHED BP_1945 BP1946_1980 BP1981_2000 BP2000_
NROOMSSTUDCOMP MULTIPURPOSE REDEVELOPMENT POPULATIONDENSITY PFOREIGNMIGRANTS DISTANCETRAIN
AVGHOUSEHOLDSIZE PYOUNGPEOPLE PELDERLYPEOPLE AVGINCOMEPERPERSON if CONTROL1000==1
*MODEL 1
reg lnTRANSACTIONPRICE TARGET1000BEFORE TARGET1000BEFOREDISTANCE TARGET1000BEFOREDISTANCE2
TARGET1000BETWEEN TARGET1000BETWEENDISTANCE TARGET1000BETWEENDISTANCE2 TARGET1000AFTER
TARGET1000AFTERDISTANCE TARGET1000AFTERDISTANCE2 TARGET1000TRENDAFTER
TARGET1000TRENDAFTERDISTANCE TARGET1000TRENDAFTERDISTANCE2 i.TRANSACTIONYEAR, robust
* MODEL 2
reg lnTRANSACTIONPRICE TARGET1000BEFORE TARGET1000BEFOREDISTANCE TARGET1000BEFOREDISTANCE2
TARGET1000BETWEEN TARGET1000BETWEENDISTANCE TARGET1000BETWEENDISTANCE2 TARGET1000AFTER
TARGET1000AFTERDISTANCE TARGET1000AFTERDISTANCE2 TARGET1000TRENDAFTER
TARGET1000TRENDAFTERDISTANCE TARGET1000TRENDAFTERDISTANCE2 i.TRANSACTIONYEAR FLOORSPACE
NROOMS i.HOUSINGTYPE BALCONY TERRACE GARDEN MAINTENANCEINSIDE MAINTENANCEOUTSIDE
CENTRALHEATING PARKING i.BUILDINGPERIOD NROOMSSTUDCOMP MULTIPURPOSE REDEVELOPMENT, robust
* MODEL 3
replace WK_CODE = subinstr(WK_CODE, "WK", " ",.)
rename WK_CODE WKCODE
destring WKCODE, replace
reg lnTRANSACTIONPRICE TARGET1000BEFORE TARGET1000BEFOREDISTANCE TARGET1000BEFOREDISTANCE2
TARGET1000BETWEEN TARGET1000BETWEENDISTANCE TARGET1000BETWEENDISTANCE2 TARGET1000AFTER
TARGET1000AFTERDISTANCE TARGET1000AFTERDISTANCE2 TARGET1000TRENDAFTER
TARGET1000TRENDAFTERDISTANCE TARGET1000TRENDAFTERDISTANCE2 i.TRANSACTIONYEAR FLOORSPACE
```

```
NROOMS i.HOUSINGTYPE BALCONY TERRACE GARDEN MAINTENANCEINSIDE MAINTENANCEOUTSIDE
CENTRALHEATING PARKING i.BUILDINGPERIOD NROOMSSTUDCOMP MULTIPURPOSE REDEVELOPMENT WKCODE,
robust
* MODEL 4
gen lnDISTANCETRAIN = ln(DISTANCETRAIN)
gen lnAVGINCOMEPERPERSON = ln(AVGINCOMEPERPERSON)
reg lnTRANSACTIONPRICE TARGET1000BEFORE TARGET1000BEFOREDISTANCE TARGET1000BEFOREDISTANCE2
TARGET1000BETWEEN TARGET1000BETWEENDISTANCE TARGET1000BETWEENDISTANCE2 TARGET1000AFTER
TARGET1000AFTERDISTANCE TARGET1000AFTERDISTANCE2 TARGET1000TRENDAFTER
TARGET1000TRENDAFTERDISTANCE TARGET1000TRENDAFTERDISTANCE2 i.TRANSACTIONYEAR FLOORSPACE
NROOMS i.HOUSINGTYPE BALCONY TERRACE GARDEN MAINTENANCEINSIDE MAINTENANCEOUTSIDE
CENTRALHEATING PARKING i.BUILDINGPERIOD NROOMSSTUDCOMP MULTIPURPOSE REDEVELOPMENT WKCODE
PFOREIGNMIGRANTS POPULATIONDENSITY lnDISTANCETRAIN AVGHOUSEHOLDSIZE PYOUNGPEOPLE
PELDERLYPEOPLE lnAVGINCOMEPERPERSON, robust
save "/Users/Evert/Desktop/STATA DATA NIEUW 08:08 2.dta"

use "/Users/Evert/Desktop/STATA DATA NIEUW 08:08 2.dta"
** DESCRIPTIVES CONTROL
sum TRANSACTIONPRICE DISTANCESTUDENTHOUSINGCOMPLEX FLOORSPACE NROOMS BALCONY TERRACE PARKING
GARDEN MAINTENANCEINSIDE MAINTENANCEOUTSIDE CENTRALHEATING HOUSTYPE_APP HOUSTYPE_TERRACED
HOUSTYPE_SEMI HOUSTYPE_CORNER HOUSTYPE_DETACHED BP_1945 BP1946_1980 BP1981_2000 BP2000_
NROOMSSTUDCOMP MULTIPURPOSE REDEVELOPMENT POPULATIONDENSITY PFOREIGNMIGRANTS DISTANCETRAIN
AVGHOUSEHOLDSIZE PYOUNGPEOPLE PELDERLYPEOPLE AVGINCOMEPERPERSON if CONTROL1000==1
** DESCRIPTIVES TARGET
sum TRANSACTIONPRICE DISTANCESTUDENTHOUSINGCOMPLEX FLOORSPACE NROOMS BALCONY TERRACE PARKING
GARDEN MAINTENANCEINSIDE MAINTENANCEOUTSIDE CENTRALHEATING HOUSTYPE_APP HOUSTYPE_TERRACED
HOUSTYPE_SEMI HOUSTYPE_CORNER HOUSTYPE_DETACHED BP_1945 BP1946_1980 BP1981_2000 BP2000_
NROOMSSTUDCOMP MULTIPURPOSE REDEVELOPMENT POPULATIONDENSITY PFOREIGNMIGRANTS DISTANCETRAIN
AVGHOUSEHOLDSIZE PYOUNGPEOPLE PELDERLYPEOPLE AVGINCOMEPERPERSON if TARGET1000==1
** DESCRIPTIVES TOTAL
sum TRANSACTIONPRICE DISTANCESTUDENTHOUSINGCOMPLEX FLOORSPACE NROOMS BALCONY TERRACE PARKING
GARDEN MAINTENANCEINSIDE MAINTENANCEOUTSIDE CENTRALHEATING HOUSTYPE_APP HOUSTYPE_TERRACED
HOUSTYPE_SEMI HOUSTYPE_CORNER HOUSTYPE_DETACHED BP_1945 BP1946_1980 BP1981_2000 BP2000_
NROOMSSTUDCOMP MULTIPURPOSE REDEVELOPMENT POPULATIONDENSITY PFOREIGNMIGRANTS DISTANCETRAIN
AVGHOUSEHOLDSIZE PYOUNGPEOPLE PELDERLYPEOPLE AVGINCOMEPERPERSON
reg lnTRANSACTIONPRICE TARGET1000BEFORE TARGET1000BEFOREDISTANCE TARGET1000BEFOREDISTANCE2
TARGET1000BETWEEN TARGET1000BETWEENDISTANCE TARGET1000BETWEENDISTANCE2 TARGET1000AFTER
TARGET1000AFTERDISTANCE TARGET1000AFTERDISTANCE2 TARGET1000TRENDAFTER
TARGET1000TRENDAFTERDISTANCE TARGET1000TRENDAFTERDISTANCE2 i.TRANSACTIONYEAR, robust
reg lnTRANSACTIONPRICE TARGET1000BEFORE TARGET1000BEFOREDISTANCE TARGET1000BEFOREDISTANCE2
TARGET1000BETWEEN TARGET1000BETWEENDISTANCE TARGET1000BETWEENDISTANCE2 TARGET1000AFTER
TARGET1000AFTERDISTANCE TARGET1000AFTERDISTANCE2 TARGET1000TRENDAFTER
TARGET1000TRENDAFTERDISTANCE TARGET1000TRENDAFTERDISTANCE2 i.TRANSACTIONYEAR FLOORSPACE
NROOMS i.HOUSINGTYPE BALCONY TERRACE GARDEN MAINTENANCEINSIDE MAINTENANCEOUTSIDE
CENTRALHEATING PARKING i.BUILDINGPERIOD NROOMSSTUDCOMP MULTIPURPOSE REDEVELOPMENT, robust
reg lnTRANSACTIONPRICE TARGET1000BEFORE TARGET1000BEFOREDISTANCE TARGET1000BEFOREDISTANCE2
TARGET1000BETWEEN TARGET1000BETWEENDISTANCE TARGET1000BETWEENDISTANCE2 TARGET1000AFTER
TARGET1000AFTERDISTANCE TARGET1000AFTERDISTANCE2 TARGET1000TRENDAFTER
TARGET1000TRENDAFTERDISTANCE TARGET1000TRENDAFTERDISTANCE2 i.TRANSACTIONYEAR FLOORSPACE
NROOMS i.HOUSINGTYPE BALCONY TERRACE GARDEN MAINTENANCEINSIDE MAINTENANCEOUTSIDE
CENTRALHEATING PARKING i.BUILDINGPERIOD NROOMSSTUDCOMP MULTIPURPOSE REDEVELOPMENT WKCODE,
robust
reg lnTRANSACTIONPRICE TARGET1000BEFORE TARGET1000BEFOREDISTANCE TARGET1000BEFOREDISTANCE2
TARGET1000BETWEEN TARGET1000BETWEENDISTANCE TARGET1000BETWEENDISTANCE2 TARGET1000AFTER
TARGET1000AFTERDISTANCE TARGET1000AFTERDISTANCE2 TARGET1000TRENDAFTER
TARGET1000TRENDAFTERDISTANCE TARGET1000TRENDAFTERDISTANCE2 i.TRANSACTIONYEAR FLOORSPACE
NROOMS i.HOUSINGTYPE BALCONY TERRACE GARDEN MAINTENANCEINSIDE MAINTENANCEOUTSIDE
CENTRALHEATING PARKING i.BUILDINGPERIOD NROOMSSTUDCOMP MULTIPURPOSE REDEVELOPMENT WKCODE
PFOREIGNMIGRANTS POPULATIONDENSITY lnDISTANCETRAIN AVGHOUSEHOLDSIZE PYOUNGPEOPLE
PELDERLYPEOPLE lnAVGINCOMEPERPERSON, robust
gen TARGET0500 = DISTANCESTUDENTHOUSINGCOMPLEX <=500
gen CONTROL0500 = DISTANCESTUDENTHOUSINGCOMPLEX > 500
gen TARGET0500BEFORE = TARGET0500*BEFORENEW
gen TARGET0500BEFOREDISTANCE = TARGET0500BEFORE*DISTANCESTUDENTHOUSINGCOMPLEX
gen TARGET0500BEFOREDISTANCE2 = TARGET0500BEFORE*DISTANCESTUDENTHOUSINGCOMPLEX^2
gen TARGET0500BETWEEN = TARGET0500*BETWEENNEW
gen TARGET0500BETWEENDISTANCE = TARGET0500BETWEEN*DISTANCESTUDENTHOUSINGCOMPLEX
gen TARGET0500BETWEENDISTANCE2 = TARGET0500BETWEEN*DISTANCESTUDENTHOUSINGCOMPLEX^2
gen TARGET0500AFTER = TARGET0500*AFTERNEW
gen TARGET0500AFTERDISTANCE = TARGET0500AFTER*DISTANCESTUDENTHOUSINGCOMPLEX
gen TARGET0500AFTERDISTANCE2 = TARGET0500AFTER*DISTANCESTUDENTHOUSINGCOMPLEX^2
gen TARGET0500TRENDAFTER = TARGET0500*TRENDAFTERNEW
gen TARGET0500TRENDAFTERDISTANCE = TARGET0500TRENDAFTER*DISTANCESTUDENTHOUSINGCOMPLEX
gen TARGET0500TRENDAFTERDISTANCE2 = TARGET0500TRENDAFTER*DISTANCESTUDENTHOUSINGCOMPLEX^2
**REGRESSION MODEL 5
```

```
reg lnTRANSACTIONPRICE TARGET0500BEFORE TARGET0500BEFOREDISTANCE TARGET0500BEFOREDISTANCE2
TARGET0500BETWEEN TARGET0500BETWEENDISTANCE TARGET0500BETWEENDISTANCE2 TARGET0500AFTER
TARGET0500AFTERDISTANCE TARGET0500AFTERDISTANCE2 TARGET0500TRENDAFTER
TARGET0500TRENDAFTERDISTANCE TARGET0500TRENDAFTERDISTANCE2 i.TRANSACTIONYEAR FLOORSPACE
NROOMS i.HOUSINGTYPE BALCONY TERRACE GARDEN MAINTENANCEINSIDE MAINTENANCEOUTSIDE
CENTRALHEATING PARKING i.BUILDINGPERIOD NROOMSSTUDCOMP MULTIPURPOSE REDEVELOPMENT WKCODE
PFOREIGNMIGRANTS POPULATIONDENSITY lnDISTANCETRAIN AVGHOUSEHOLDSIZE PYOUNGPEOPLE
PELDERLYPEOPLE lnAVGINCOMEPERPERSON, robust
gen TARGET1500 = DISTANCESTUDENTHOUSINGCOMPLEX <=1500
gen CONTROL1500 = DISTANCESTUDENTHOUSINGCOMPLEX > 1500
gen TARGET1500BEFORE = TARGET1500*BEFORENEW
gen TARGET1500BEFOREDISTANCE = TARGET1500BEFORE*DISTANCESTUDENTHOUSINGCOMPLEX
gen TARGET1500BEFOREDISTANCE2 = TARGET1500BEFORE*DISTANCESTUDENTHOUSINGCOMPLEX^2
gen TARGET1500BETWEEN = TARGET1500*BETWEENNEW
gen TARGET1500BETWEENDISTANCE = TARGET1500BETWEEN*DISTANCESTUDENTHOUSINGCOMPLEX
gen TARGET1500BETWEENDISTANCE2 = TARGET1500BETWEEN*DISTANCESTUDENTHOUSINGCOMPLEX^2
gen TARGET1500AFTER = TARGET1500*AFTERNEW
gen TARGET1500AFTERDISTANCE = TARGET1500AFTER*DISTANCESTUDENTHOUSINGCOMPLEX
gen TARGET1500AFTERDISTANCE2 = TARGET1500AFTER*DISTANCESTUDENTHOUSINGCOMPLEX^2
gen TARGET1500TRENDAFTER = TARGET1500*TRENDAFTERNEW
gen TARGET1500TRENDAFTERDISTANCE = TARGET1500TRENDAFTER*DISTANCESTUDENTHOUSINGCOMPLEX
gen TARGET1500TRENDAFTERDISTANCE2 = TARGET1500TRENDAFTER*DISTANCESTUDENTHOUSINGCOMPLEX^2
**REGRESSION MODEL 6
reg lnTRANSACTIONPRICE TARGET1500BEFORE TARGET1500BEFOREDISTANCE TARGET1500BEFOREDISTANCE2
TARGET1500BETWEEN TARGET1500BETWEENDISTANCE TARGET1500BETWEENDISTANCE2 TARGET1500AFTER
TARGET1500AFTERDISTANCE TARGET1500AFTERDISTANCE2 TARGET1500TRENDAFTER
TARGET1500TRENDAFTERDISTANCE TARGET1500TRENDAFTERDISTANCE2 i.TRANSACTIONYEAR FLOORSPACE
NROOMS i.HOUSINGTYPE BALCONY TERRACE GARDEN MAINTENANCEINSIDE MAINTENANCEOUTSIDE
CENTRALHEATING PARKING i.BUILDINGPERIOD NROOMSSTUDCOMP MULTIPURPOSE REDEVELOPMENT WKCODE
PFOREIGNMIGRANTS POPULATIONDENSITY lnDISTANCETRAIN AVGHOUSEHOLDSIZE PYOUNGPEOPLE
PELDERLYPEOPLE lnAVGINCOMEPERPERSON, robust
save "/Users/Evert/Desktop/STATA DATA NIEUW 22:08 .dta"
sum AVGINCOMEPERPERSON
histogram AVGINCOMEPERPERSON
sum AVGINCOMEPERPERSON, detail
sum if AVGINCOMEPERPERSON>30000
sum if AVGINCOMEPERPERSON<20000
sum if AVGINCOMEPERPERSON<22000
sum if AVGINCOMEPERPERSON<22500
sum if AVGINCOMEPERPERSON>27500
sum if AVGINCOMEPERPERSON<28500
sum if AVGINCOMEPERPERSON>28500
sum if AVGINCOMEPERPERSON>29500
sum if AVGINCOMEPERPERSON>29000
reg lnTRANSACTIONPRICE TARGET1000BEFORE TARGET1000BEFOREDISTANCE TARGET1000BEFOREDISTANCE2
TARGET1000BETWEEN TARGET1000BETWEENDISTANCE TARGET1000BETWEENDISTANCE2 TARGET1000AFTER
TARGET1000AFTERDISTANCE TARGET1000AFTERDISTANCE2 TARGET1000TRENDAFTER
TARGET1000TRENDAFTERDISTANCE TARGET1000TRENDAFTERDISTANCE2 i.TRANSACTIONYEAR FLOORSPACE
NROOMS i.HOUSINGTYPE BALCONY TERRACE GARDEN MAINTENANCEINSIDE MAINTENANCEOUTSIDE
CENTRALHEATING PARKING i.BUILDINGPERIOD NROOMSSTUDCOMP MULTIPURPOSE REDEVELOPMENT WKCODE
PFOREIGNMIGRANTS POPULATIONDENSITY lnDISTANCETRAIN AVGHOUSEHOLDSIZE PYOUNGPEOPLE
PELDERLYPEOPLE lnAVGINCOMEPERPERSON, robust, if AVGINCOMEPERPERSON>29000
reg lnTRANSACTIONPRICE TARGET1000BEFORE TARGET1000BEFOREDISTANCE TARGET1000BEFOREDISTANCE2
TARGET1000BETWEEN TARGET1000BETWEENDISTANCE TARGET1000BETWEENDISTANCE2 TARGET1000AFTER
TARGET1000AFTERDISTANCE TARGET1000AFTERDISTANCE2 TARGET1000TRENDAFTER
TARGET1000TRENDAFTERDISTANCE TARGET1000TRENDAFTERDISTANCE2 i.TRANSACTIONYEAR FLOORSPACE
NROOMS i.HOUSINGTYPE BALCONY TERRACE GARDEN MAINTENANCEINSIDE MAINTENANCEOUTSIDE
CENTRALHEATING PARKING i.BUILDINGPERIOD NROOMSSTUDCOMP MULTIPURPOSE REDEVELOPMENT WKCODE
PFOREIGNMIGRANTS POPULATIONDENSITY lnDISTANCETRAIN AVGHOUSEHOLDSIZE PYOUNGPEOPLE
PELDERLYPEOPLE lnAVGINCOMEPERPERSON, robust, if AVGINCOMEPERPERSON<22500
save "/Users/Evert/Desktop/STATA DATA NIEUW 25:08 .dta"
summarize AVGINCOMEPERPERSON
gen AVGINCsub = 0
replace AVGINCsub=1 if AVGINCOMEPERPERSON>29000
replace AVGINCsub=2 if AVGINCOMEPERPERSON<22500
reg lnTRANSACTIONPRICE TARGET1000BEFORE TARGET1000BEFOREDISTANCE TARGET1000BEFOREDISTANCE2
TARGET1000BETWEEN TARGET1000BETWEENDISTANCE TARGET1000BETWEENDISTANCE2 TARGET1000AFTER
TARGET1000AFTERDISTANCE TARGET1000AFTERDISTANCE2 TARGET1000TRENDAFTER
TARGET1000TRENDAFTERDISTANCE TARGET1000TRENDAFTERDISTANCE2 i.TRANSACTIONYEAR FLOORSPACE
NROOMS i.HOUSINGTYPE BALCONY TERRACE GARDEN MAINTENANCEINSIDE MAINTENANCEOUTSIDE
CENTRALHEATING PARKING i.BUILDINGPERIOD NROOMSSTUDCOMP MULTIPURPOSE REDEVELOPMENT WKCODE
PFOREIGNMIGRANTS POPULATIONDENSITY lnDISTANCETRAIN AVGHOUSEHOLDSIZE PYOUNGPEOPLE
PELDERLYPEOPLE lnAVGINCOMEPERPERSON, robust, if AVGINCsub==1
reg lnTRANSACTIONPRICE TARGET1000BEFORE TARGET1000BEFOREDISTANCE TARGET1000BEFOREDISTANCE2
TARGET1000BETWEEN TARGET1000BETWEENDISTANCE TARGET1000BETWEENDISTANCE2 TARGET1000AFTER
TARGET1000AFTERDISTANCE TARGET1000AFTERDISTANCE2 TARGET1000TRENDAFTER
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TARGET1000TRENDAFTERDISTANCE TARGET1000TRENDAFTERDISTANCE2 i.TRANSACTIONYEAR FLOORSPACE
NROOMS i.HOUSINGTYPE BALCONY TERRACE GARDEN MAINTENANCEINSIDE MAINTENANCEOUTSIDE
CENTRALHEATING PARKING i.BUILDINGPERIOD NROOMSSTUDCOMP MULTIPURPOSE REDEVELOPMENT WKCODE
PFOREIGNMIGRANTS POPULATIONDENSITY lnDISTANCETRAIN AVGHOUSEHOLDSIZE PYOUNGPEOPLE
PELDERLYPEOPLE lnAVGINCOMEPERPERSON, robust, if AVGINCsub==2
reg lnTRANSACTIONPRICE TARGET1000BEFORE TARGET1000BEFOREDISTANCE TARGET1000BEFOREDISTANCE2
TARGET1000BETWEEN TARGET1000BETWEENDISTANCE TARGET1000BETWEENDISTANCE2 TARGET1000AFTER
TARGET1000AFTERDISTANCE TARGET1000AFTERDISTANCE2 TARGET1000TRENDAFTER
TARGET1000TRENDAFTERDISTANCE TARGET1000TRENDAFTERDISTANCE2 i.TRANSACTIONYEAR FLOORSPACE
NROOMS i.HOUSINGTYPE BALCONY TERRACE GARDEN MAINTENANCEINSIDE MAINTENANCEOUTSIDE
CENTRALHEATING PARKING i.BUILDINGPERIOD NROOMSSTUDCOMP MULTIPURPOSE REDEVELOPMENT WKCODE
PFOREIGNMIGRANTS POPULATIONDENSITY lnDISTANCETRAIN AVGHOUSEHOLDSIZE PYOUNGPEOPLE
PELDERLYPEOPLE lnAVGINCOMEPERPERSON
reg lnTRANSACTIONPRICE TARGET1000BEFORE TARGET1000BEFOREDISTANCE TARGET1000BEFOREDISTANCE2
TARGET1000BETWEEN TARGET1000BETWEENDISTANCE TARGET1000BETWEENDISTANCE2 TARGET1000AFTER
TARGET1000AFTERDISTANCE TARGET1000AFTERDISTANCE2 TARGET1000TRENDAFTER
TARGET1000TRENDAFTERDISTANCE TARGET1000TRENDAFTERDISTANCE2 i.TRANSACTIONYEAR FLOORSPACE
NROOMS i.HOUSINGTYPE BALCONY TERRACE GARDEN MAINTENANCEINSIDE MAINTENANCEOUTSIDE
CENTRALHEATING PARKING i.BUILDINGPERIOD NROOMSSTUDCOMP MULTIPURPOSE REDEVELOPMENT WKCODE
PFOREIGNMIGRANTS POPULATIONDENSITY lnDISTANCETRAIN AVGHOUSEHOLDSIZE PYOUNGPEOPLE
PELDERLYPEOPLE lnAVGINCOMEPERPERSON if AVGINCsub==1
reg lnTRANSACTIONPRICE TARGET1000BEFORE TARGET1000BEFOREDISTANCE TARGET1000BEFOREDISTANCE2
TARGET1000BETWEEN TARGET1000BETWEENDISTANCE TARGET1000BETWEENDISTANCE2 TARGET1000AFTER
TARGET1000AFTERDISTANCE TARGET1000AFTERDISTANCE2 TARGET1000TRENDAFTER
TARGET1000TRENDAFTERDISTANCE TARGET1000TRENDAFTERDISTANCE2 i.TRANSACTIONYEAR FLOORSPACE
NROOMS i.HOUSINGTYPE BALCONY TERRACE GARDEN MAINTENANCEINSIDE MAINTENANCEOUTSIDE
CENTRALHEATING PARKING i.BUILDINGPERIOD NROOMSSTUDCOMP MULTIPURPOSE REDEVELOPMENT WKCODE
PFOREIGNMIGRANTS POPULATIONDENSITY lnDISTANCETRAIN AVGHOUSEHOLDSIZE PYOUNGPEOPLE
PELDERLYPEOPLE lnAVGINCOMEPERPERSON if AVGINCsub==2
reg lnTRANSACTIONPRICE TARGET1000BEFORE TARGET1000BEFOREDISTANCE TARGET1000BEFOREDISTANCE2
TARGET1000BETWEEN TARGET1000BETWEENDISTANCE TARGET1000BETWEENDISTANCE2 TARGET1000AFTER
TARGET1000AFTERDISTANCE TARGET1000AFTERDISTANCE2 TARGET1000TRENDAFTER
TARGET1000TRENDAFTERDISTANCE TARGET1000TRENDAFTERDISTANCE2 i.TRANSACTIONYEAR FLOORSPACE
NROOMS i.HOUSINGTYPE BALCONY TERRACE GARDEN MAINTENANCEINSIDE MAINTENANCEOUTSIDE
CENTRALHEATING PARKING i.BUILDINGPERIOD NROOMSSTUDCOMP MULTIPURPOSE REDEVELOPMENT WKCODE
PFOREIGNMIGRANTS POPULATIONDENSITY lnDISTANCETRAIN AVGHOUSEHOLDSIZE PYOUNGPEOPLE
PELDERLYPEOPLE lnAVGINCOMEPERPERSON if AVGINCsub>0
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