The Redevelopment of Vacant Railway Heritage and the External Effect on House Prices

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Abstract. Roughly one fourth of all railway stations in The Netherlands is considered to be cultural heritage. Due to a loss of many traditional railway related functions, a lot of space within these stations became vacant over time. The redevelopment of the station buildings requires large investments and is therefore not always financially feasible. There are, however, policymakers that believe that the redevelopment of cultural heritage has a benefit for the surrounding living area. There are multiple scholars that tried to find the empirical evidence of this external effect. The redevelopment of railway heritage specifically is, however, not examined thus far. This thesis contains an empirical analysis, to explore the external effects of the redevelopment of vacant railway heritage, by analyzing surrounding house prices. With a hedonic regression and a difference-in-differences approach, the external effects of fourteen redevelopment projects of railway heritage are analyzed. Surrounding house prices are regressed before, between and after redevelopment took place. Results show that before redevelopment, railway heritage buildings were considered as a disamenity for the surrounding area. This effect disappeared after redevelopment started, indicating anticipation effects. After redevelopment, the railway heritage buildings seem to have a positive external effect on surrounding house prices. This external effect decreases when distance to the railway stations increases, indicating a linear distance decay effect. Lastly, a separate regression shows that the results of this study could be driven by the stations which are located in the largest municipalities. The findings of this study add evidence to theories on externalities and historic amenities.

Keywords – railway heritage, redevelopment, externalities, hedonic regression

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Preface

In front of you lies my master thesis: ‘’The Redevelopment of Vacant Railway Heritage and the External Effect on House Prices’’. This thesis is the final part of my academic career at the University of Groningen. I had a great time during my time as a student, as I had the opportunity to do two masters, be a member of the board of the Real Estate Club and organize the Career Day of the Faculty of Spatial Sciences.

This thesis was written during my internship at NS Stations. During this internship I have received great and professional guidance from Lenneke Wester and other colleagues. I would therefore really like to thank NS Stations and especially Lenneke Wester, for the opportunity to write my thesis at such a wonderful organization. In addition, I also have received helpful advice from my boyfriend Dennis de Jong and my fellow board member Marnix Uri. I really appreciate their support. Lastly, I want to thank my supervisor Xiaolong Liu, who has provided me with helpful feedback which improved my thesis extensively.

I hope you will enjoy reading my master thesis.

Sophie Louise Procé
Utrecht, June 16, 2018

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1. Introduction

There are more than 400 railway stations in the Netherlands. These railway stations are primarily developed and managed by NS Stations (NS Stations, 2017a). A considerable amount of the station buildings is of cultural-historical value, as one fourth is cultural heritage and is listed with a monumental status (NS Stations, 2017b). In the past, these stations facilitated a wide variety of functions, in addition to processing passenger flows. These functions included customs functions, tickets and services, office functions and station managerial homes. However, due to technological developments and a change in travel behavior, these traditional railway-related functions became obsolete over time (Spoorbeeld, 2017). As a result, a considerable amount of space within railway heritage buildings became vacant. Of all railway heritage buildings, around 30 percent deals with high vacancy levels. Furthermore, there exists around 30,000 square meters of vacancy within railway heritage buildings.

While railway related functions became obsolete, solutions were sought to redevelop the station buildings. However, there are multiple difficulties that occur with the redevelopment of railway heritage buildings, which makes their redevelopment complex to realize. Firstly, due to their status as cultural heritage, large investments are needed to redevelop and prepare the station buildings for new functions. These investments include high material and reconstruction costs and studies concerning architecture and design. Secondly, the direct benefits of redevelopment do not always compensate for the large investments and high redevelopment costs, even though public grants are sometimes provided (Bazelmans et al., 2013). In addition, it is particularly difficult to find new functions that provide direct benefits for the station buildings in peripheral areas. As a consequence, redevelopment projects concerning railway heritage do not always have a desirable rate of return, especially in peripheral areas (Bazelmans et al., 2013). Thirdly, selling (parts of) the station buildings or letting external parties redevelop the station buildings is, in many cases, not an option. This is due to the fact that NS Stations and Prorail, in most cases, retain ownership of the railway stations, since these stations still process passenger flows. As a consequence, redevelopment of railway heritage can not always be realized and a considerable amount of space within the station buildings remains vacant.

The complexities that occur with the redevelopment of railway heritage are comparable to the challenges that many cultural heritage sites currently face. Due to the high redevelopment costs and a complex system of policy frameworks that apply to the redevelopment of cultural heritage, vacancy is becoming a general problem for many owners of cultural heritage sites (Bazelmans et al., 2013). As a consequence, the assessment of the benefits of cultural heritage sites is becoming a critical component for the realization of many redevelopment projects (Rizzo & Throsby, 2006).

There are many policymakers that believe that the redevelopment of cultural heritage sites has benefits for the surrounding living area. Furthermore, they believe that the redevelopment of heritage sites can be used as a tool to upgrade neighborhoods (Van Duijn et al. 2016).

There are multiple scholars that tried to find empirical evidence of these external benefits (Van Duijn et al. 2016; Koster & Rouwendal 2017. In multiple studies, the house prices of houses in

proximity of heritage sites are analyzed. The results of these studies show that the redevelopment of cultural heritage sites can have a positive external effect on surrounding house prices. These results are in line with the idea that the presence of amenities, and historic amenities especially, is positively reflected in surrounding house prices (Lazrak et al., 2014). Given these results, it is of interest to investigate if similar positive external effects occur with the redevelopment of railway heritage buildings specifically. Past studies that do concern the redevelopment of railway stations mainly focus on mobility improvements (Bertolini & Spit, 1998) and do not consider the heritage value of railway stations. This study adds to this research gap by analyzing redevelopment projects concerning heritage stations and surrounding house prices. The results of this study contribute to literature on the value of historic amenities (Brueckner, 1999; Ahfeldt et al. 2013) and the importance of reusing monumental buildings (Jacob's, 1961).

The main objective of this research is to gain insight into the redevelopment of railway heritage and the external effects that this may have on surrounding house prices. These external effects are analyzed by applying a hedonic regression to a dataset that contains data on house prices and housing characteristics, provided by the Dutch Association of Agents (NVM). House prices are analyzed before, between and after redevelopment occurred. The focus of interest is to find the magnitude and reach of the external effects. Finding the external effects of redeveloping railway heritage sites, by analyzing house prices, contributes to theories concerning externalities (Cheshire & Sheppard, 1995; Koster & Rouwendal, 2017).

The structure of this thesis is as follows. Section two regards the theoretical framework, which includes theories and literature on cultural heritage and the external effects of redevelopment. In addition, the hypotheses that are tested in the analyses can also be found in section two. Section three contains a description of the methodology that is used in the analysis and a description of the empirical model. A summary of the dataset and descriptive statistics of this study can be found in section four. Lastly, the results of the hedonic analysis are stated in section five, followed by a discussion and conclusion of these results in section six.

2. Literature overview and theoretical framework

2.1 The effect of railway stations on house prices

Urban economic theory on railway stations and house prices finds its origin in the Von Thunen model (1826), in which the relation between location and land value is analyzed. The Von Thunen model predicts that there is a negative land-rent gradient. Land prices fall when the distance to the central market increases, in order to compensate for higher transportation costs. The Von Thunen model is based upon the three assumptions of Ricardo (1821). Firstly, Ricardo (1821) assumes that land prices must be treated as residual, as they dependent upon the height of transportation costs and non-land inputs. Secondly, land is allocated to its most profitable use or the highest bidder at that location. Lastly, Ricardo assumes that the supply of land at any location is fixed, as land supply is perfectly inelastic. If transportation rates fall, the Von Thunen model predicts that the distance limit to the central market increases and that the maximum land price increases. The bid-rent rent model builds upon the theory of the Von Thunen model (Alonso, 1964; Alonso, 1971; Evans 1973). In the bid-rent model, land prices also fall as distance to the central market increases, but at a diminishing rate. This is due to the fact that the bid-rent model includes factor substitution. The model predicts that when moving further away from the central market, firms and households will substitute in favour of land. For that reason, close to the central market, firms and households will consume relatively little land and more non-land inputs. As within the Von Thunen model, in the bid-rent model, the value of land reflects the utility derived from accessibility opportunities, which are caused by decreasing commuting costs.

In line with these important spatial economic theories, there has long been interest in transportation developments and the effect that these developments may have on surrounding house prices. The first survey which analyzed the effects of railway station developments was conducted in 1846 (Kilpatrick, 2007). This study showed that the London's rail lines had a positive effect of 10 to 25 percent on rents of surrounding houses, as a result of accessibility improvements. Although the methodology has changed considerably over time, the purpose of this research has remained the same over the years. As a result, numerous studies show a positive relation between proximity to railway stations and adjacent house prices (Voith, 1993; Armstrong, 1994; Garett, 2004; Baum-Snow & Kahn, 2001; Gibbons & Machin, 2005). Voith (1993), studied the effect of railway stations in Philadelphia and found that surrounding house prices had a price premium of 6.4 percent. In addition, Armstrong (1994) found a premium of 6.7 percent for houses in Boston which were located in proximity of railway stations. These results expose the economic benefits of accessibility and show a positive relation between accessibility opportunities and house prices. Moreover, according to the study of McDonald and Osuji (1995) even three years before its construction, Chicago's Midway Line increased house price within a 1 km radius with 17 percent.

However, there are several scholars that suggest that the presence of railway stations may also cause negative externalities such as noise, pollution and crime (Kilpatrick, 2007). With this in mind, Forest et al. (2016) studied the effect of (Metrolink) stations in Manchester on house prices. They found

significant decreases in house prices of houses located within 3 kilometers of these stations. Furthermore, there are studies that have been more specific in the way in which railway stations have an influence house prices. In their study, Gatzlaff and Smith (1999) find that lower income areas do often not experience the benefits of railway stations, while higher income areas do. In addition, Bowes and Ihlanfeldt (2001) found that increases in house prices due to railway station developments, are higher further away from the central market. At the same time, they also find evidence that the existence of a parking lot significantly decreases the prices of houses that are located within the immediate vicinity of railway stations. All in all, multiple studies suggest that while proximity to accessibility opportunities, such as railway stations, can have a positive influence on house prices, close proximity to the line or station itself could have a negative influence on surrounding houses (Kilpatrick, 2007).

2.2 The effect of the redevelopment of railway heritage on house prices

Roughly one fourth of all railway stations in the Netherlands is considered cultural heritage. This includes stations that are listed with a monumental status[1], such as municipal-, provincial- and national monuments. In addition, a number of other railway stations without a listed status is also treated as cultural heritage by NS Stations and Prorail, because of their iconic value. For those reasons, railway heritage includes a wide range of stations, such as Valkenburg (1853), Amsterdam Centraal (1881), Almere Centrum (1987) and Amersfoort (2004) (Spoorbeeld, 2017).

There are currently no studies that investigate the external effects that the redevelopment of railway heritage may have on surrounding house prices. There are, however, multiple studies that analyze the effect that cultural heritage sites, in general, have on surrounding house prices (Koster & Rouwendal, 2017; Van Duijn et al. 2016; Coulson & Lechenko 2001; Ruijgrok, 2006, Lazrak et al. 2014). These studies are built upon the theory that differences in (historic) amenities may cause substantial differences in house prices, as households are willing to pay a premium to be close to amenities that provide positive externalities (Roback, 1982). Cultural heritage sites are thus not only enjoyed by its users, but also by residents and firms close to them (Koster & Rouwendal, 2017).

In their study, Lazrak et al. (2014) analyzed house prices for 22 years in the Dutch city of Zaanstad. They found that, per additional monument within a 50-meter radius, houses were worth an extra 0.28 percent. Coulson and Lechenko (2001) studied the effect of historic designation on house prices in Texas. They found that historic designation provides positive externalities for surrounding houses.

In addition, there are multiple scholars that studied the external effects of investments in cultural heritage sites (Koster & Rouwendal, 2017; Van Duijn et al., 2016). Koster and Rouwendal (2017) analyzed data on investments in cultural heritage and house prices with the use of a repeat sales model.

[1] A list with all railway stations that have got a monumental status and their most recent redevelopment can be found in appendix A.

They constructed an instrument based on yearly fluctuations in the size of national subsidy programs concerning the maintenance of cultural heritage. Their results show that a one million euro per square kilometer increase in investments in cultural heritage leads to a price increase of 1.5 to 3 percent for surrounding houses.

Van Duijn et al. (2016) analyzed the external effects of the redevelopment of 36 abandoned cultural heritage sites in The Netherlands, with the use of a hedonic pricing model. They investigated these external effects by analyzing surrounding house prices. Surrounding house prices were regressed before, between and after redevelopment took place. In the model of Van Duijn et al. (2016), it is assumed that houses are effected by the redeveloped of industrial heritage, if they are located within a certain distance from the heritage sites (target area). The results show that before redevelopment took place, the industrial heritage sites seem to have a negative external effect on surrounding house prices. However, if a negative effect was present, it disappeared at the start of the redevelopment project. This implies that the redevelopment of industrial heritage has a positive external effect on the surrounding area.

2.3 Hypotheses

Although there are multiple theories that suggest that the redevelopment of railway heritage has a positive effect on house prices, these theories mainly focus on accessibility improvements. However, when the redevelopment of railway stations does not include accessibility improvements, but the preservation of the historic features of the station buildings, different external effects are expected. When heritage sites are abandoned or not maintained properly, multiple studies suggest that these sites could have a negative effect on the surrounding area. However, when heritage sites are maintained properly, theories on historical amenities and externalities suggest that heritage sites could have a positive effect on surrounding house prices. Furthermore, this positive effect can even be expected before the redevelopment is finished, indicating anticipation effects. Cultural heritage sites can in this way be seen as amenity by the surrounding area. The following hypotheses test these theories

(1) The presence of railway heritage causes a negative effect on house prices of nearby houses, before redevelopment.
(2) The presence of railway heritage causes a positive effect on house prices of nearby houses, after redevelopment has started.

3. Methodology

3.1 Hedonic analysis

Since externalities do not have observable market prices, their value can only be measured indirectly (Van Duijn et al. 2016). Methods that are used to analyze the external effects of cultural heritage can be classified into stated preference and revealed preference approaches. Stated preference methods include discrete choice modelling or contingent valuation methodology. These approaches involve asking people for their willingness to pay (WTP) for the benefits that they receive from the presence of cultural heritage, or their willingness to accept compensation for its loss (WTA). Revealed preference approaches include techniques that rely on the observation of market behavior. Hedonic price models are an example of such a technique (Rizzo & Throsby, 2006). In this study, the external effects of the redevelopment of railway heritage are explored with the help of a hedonic regression and data house prices and housing characteristics.

In hedonic price models, heterogeneous goods are treated as packages of characteristics. Hedonic regression provides the methodology for estimating the relative contribution of these characteristics on the heterogeneous good, which is the dependent variable. As a result, the hedonic price of each characteristic can be estimated (Rosen, 1974). A primary reason for implementing hedonic analysis to housing markets is to understand the demand for and the value of environmental amenities. Understanding this is essential for predicting the response to changes in amenities in the housing market and the costs and benefits associated with such changes (Sheppard, 1999). There are, however, some limitations for implementing hedonic analysis to housing markets, which must be taken into account. Lack of stochastic independence between observations and collinearity are two econometric problems that occur when estimating hedonic prices. Lack of stochastic independence between observations occurs when the error of an observation is correlated with observations that are nearby. In addition, collinearity occurs when the variance of the characteristics is limited, which decreases the precision of the estimated parameters. This econometric problem can be addressed by including more information in the analysis (Sheppard, 1999).

To analyse the effect of redevelopment, house prices that are assumed to be affected by redevelopment (target group) are compared to house prices in a control group. In order to measure the difference between those two groups, a difference-in-differences approach has been applied to the hedonic regression. A simple pre- and post estimation might be biased, due to the fact that unobserved factors may change along with treatment and affect outcomes. A difference-in-differences approach removes this bias and isolates the treatment effect. The use of difference-in-differences methods has become widespread since the work of Ashenfelter and Card (1985). In this approach, the outcomes of the regression can be observed for two groups for two time periods.In this way, the effect of the redevelopment of railway heritage can be found. A detailed description of the target- and control group of this study can be found in the following two sections.

3.2 Target group

In this study, the target group contains houses that are expected to have received treatment from the redevelopment of railway heritage sites. In line with the study of Van Duijn et al. (2016) it is expected that a house receives treatment if it is located near one of the selected railway heritage sites and has been sold after completion of the redevelopment project. In this study, houses that are located within 1 kilometer of the selected railway stations are considered to be located in the treatment radius.

To measure the effect that railway heritage buildings have on surrounding houses, before redevelopment took place, a variable called ‘’Before’’ is included in the regression. In addition, theory suggests that households anticipate to changes in their neighborhood, if information and forecasting is assumed. For this reason, we include a variable called ‘’Between’’ in the regression, which captures the external effect of redevelopment, after redevelopment started and before it is finished. It would be expected that the coefficient of the ‘’Between’’ variable is not significantly different from the ‘’After’’ variable (Van Duijn et al., 2016). The ‘’After’’ variable captures the external effect of railway heritage after redevelopment has finished. The ‘’After’’ variable tells us if redevelopment of railway heritage has a positive influence on surrounding house prices. To check for robustness, the treatment radius is separated in different distance rings to measure the reach of the external effect in section 3.4.

3.3 Control group

The control group contains houses that are expected not to be influenced by the redevelopment of the selected railway heritage sites and were therefore sold outside the treatment radius. According to academic literature, the use of outer rings as control areas is standard practice (Van Duijn et al., 2016; Schwartz et al., 2006; Ahfeldt et al., 2013) Houses located in this ring are expected to be similar to the houses in the target group, as they are located in close proximity to houses in the target group. In addition, in order to control for neighborhood characteristics neighborhood characteristics are also added to the regression. In this study, houses that are located between 1 and 2 kilometers from the selected railway heritage sites are considered to be located in the control area. The most important assumed difference between the control- and target group is that the target group is expected to be influenced by the redevelopment of railway heritage sites.

3.4 Defining the empirical model

In this study, house prices are regressed on a number of structural characteristics, temporal characteristics, locational characteristics and a variable that reflects the external effect of railway heritage. The first category includes structural characteristics such as housing type, floor area and maintenance condition. The second category refers to the temporal market conditions of the moment in which the house was sold, which is approximated with the use of transaction year dummies. This category corrects for economic conditions, such as inflation. The third category includes locational characteristics which are approximated with the use of neighborhood dummies and neighborhood characteristics. The last variable indicates the presence of an externality, which in this study is the effect of the redevelopment of a railway heritage site located nearby. The empirical model that is used for this study is closely related to the model specification of Van Duijn et al. (2016).

The empirical model is defined as follows:

$$\ln(P_{ijt}) = b_0 + \sum_{k=1}^{K} \alpha_k S_{itk} + \theta_t y_t + \pi_j N_j + \sum_{s=1}^{S} \beta_s R_{itrs} + \varepsilon_t \quad (1)$$

The first variable P_{ijt} is the transaction price of property *i* that is located in neighborhood *j* at transaction year *t*. The second variable S_{itk} contains the structural characteristics *k* of property *i* sold in year *t*. The third variable y_t is a vector of dummy variables taking one for year *t* and zero otherwise. The fourth variable N_j is also a vector of dummy variables taking one for neighborhood *j* and zero otherwise. The fifth variable R_{itrs} is a vector of ring variables *s*, that depend on the location of the property *i*, the year of transaction *t* and the treatment radius *r*. The last variable ε_t is the error term. The parameters to be estimated in this model are α, θ, π and β.

Three different ring variables R_{itrs} are specified, which capture the external effect of the redevelopment of railway heritage. Firstly, a distance ring dummy (s = Before) is included if the location of the property *i* falls within the treatment radius r. The coefficient of this variable can be interpreted as the external effect of railway heritage before redevelopment took place, which is expected to be negative. Secondly, a distance ring dummy (s = Between) is included if the location of the property falls within the treatment radius r and the transaction year is between the start and the end of the redevelopment project. Lastly, a distance ring dummy (s = After) is included if the location of the property *i* falls within the treatment radius r and the transaction year is after the redevelopment project ended. The coefficient of this variable can be interpreted as the external effect of railway heritage after redevelopment took place, which is expected to be positive.

To measure the reach of the external effect, an alternative model is defined. This model is in line with the model in the study of Van Duijn et al. (2016). The alternative model cutes the target group in separate distance rings, which are used to measure the reach of the external effect. Since the amount of observations does not allow the use of smaller distance rings, radius rings of 250 meters are drawn to measure the reach of the external effect.

The alternative model is defined as follows:

$$\ln(P_{ijt}) = b_0 + \sum_{k=1}^{K} \alpha_k S_{itk} + \theta_t y_t + \pi_j N_j + \sum_{r=d_1-d_2}^{r_{max}} \sum_{s=1}^{S} \beta_{rs} R_{itrs} + \varepsilon_t \quad (2)$$

In the alternative model, the coefficients β of the different distance rings (0-250m, 250-500m, 500-750m and 750-1000m) are estimated separately. In line with the model of Van Duijn et al. (2016) the alternative model addresses to problem of homogeneity within the treatment radius. The other variables are similar to the variables in the empirical model, which control for structural characteristics, temporal characteristics and locational characteristics.

4. Data and descriptive statistics

4.1 Selection of the redeveloped vacant railway heritage stations

In the Netherlands, there are roughly one hundred railway stations that are considered cultural heritage. The names of all of these stations, their monumental status, their most recent redevelopment (excluding accessibility improvements) and the selection criteria can be found in appendix A. In this study we analyze a selection of railway heritage stations that have been redeveloped. The fourteen monumental railway stations that are selected have met the following selection criteria. In table 1 a summary of the selection criteria is set out. Firstly, there needs to be public information on the selected heritage stations and their redevelopment (1). NS Stations has got cultural historical reports on a number of railway heritage stations. These reports provide extensive information on these heritage stations and form the basis for the selection. Secondly, all of the selected stations need to have undergone a redevelopment which focused on preserving the heritage value of the station building (2). The focus of these redevelopments must be on the reuse of the station building or on the restoration of the historic features of these buildings, or both. Thirdly, the selected stations need to be redeveloped in the time frame in which data on house prices is available, which is after 1996 and before 2016 (3). This means that the selection is constrained by the availability of data. Fourthly, the station buildings need to vacant for a number of years, before they were redeveloped (4). This ensures us that there is a considerable difference between the use of the stations before and after redevelopment took place. Furthermore, this is in line with the study of Van Duijn et al. (2016), who studied the external effects of vacant industrial heritage sites, before, between and after redevelopment. Due to this selection criteria, the selected stations are located in peripheral areas. This is due to the fact that stations in peripheral areas are less easy to redevelop after they lost their original function. It is often more difficult to find new functions for these station buildings. As a consequence, heritage stations in peripheral areas are often vacant for a number of years before they got redeveloped, especially in comparison with heritage stations in the Randstad area. Lastly, the selected stations did not experience any accessibility improvements during the period in which they were redeveloped (5). These accessibility improvements include major changes in train timetables or tracks (NS Stations, 2018). All in all, there were fourteen railway heritage stations which met the criteria stated above and were therefore selected for the analysis. Table 2 includes information on the selected railway stations and their location, in addition to their monumental status and a description of their redevelopment. A more detailed description of the selected stations and their redevelopment can be found in appendix B.

Table 1. Selection criteria

Selection criteria monumental railway stations
1. There is public information available on the stations and their redevelopment
2. The stations have undergone a redevelopment which was focused on preserving their heritage value
3. The stations are redeveloped between after 1996 and before 2016
4. The station buildings need to be vacant for a number of years before redevelopment took place
5. The stations did experience accessibility improvements in the period in which they were redeveloped

Table 2. Overview selected railway stations

Station	Monumental status	Redevelopment period	Redevelopment description
Boxmeer Boxmeer Noord-Brabant	national	2014	The station building became vacant in 2011. In 2014 the interior and exterior were renovated and a new tenant reused the building
Groningen Groningen Groningen	national	1998-2000	The station building was brought back to its original design in the period 1998-2000 and the vacant areas became filled with commercial functions
Harlingen Harlingen Friesland	national	2009	After 12 years of vacancy, the station building was renovated and reused by new tenants in 2009
Horst-Sevenum Horst Limburg	national	2013	After a loss of function, the station building was redeveloped and reused in 2013 as a restaurant and bed and breakfast
Klimmen-Ransdaal Voerendaal Limburg	national	2003-2005	After 15 years of vacancy, the station building was redeveloped in the period 2003-2005 and is reused as a catering location
Landgraaf Landgraaf Limburg	national	2002-2003	After a loss of function, the station building was redeveloped in the period 2002-2003 and is reused as a restaurant
Oisterwijk Oisterwijk Noord-Brabant	national	2001-2005	After a loss of function, the station building was redeveloped in the period 2001-2005 and is reused as a restaurant
Roosendaal Roosendaal Noord-Brabant	national	2007-2013	After losing its function as an international train station, the main building was renovated and reconstructed in the period 2007-2013

Tiel Tiel Gelderland	municipal	2001-2007	The building was renovated and reconstructed in the period 2001-2007 and is reused as a restaurant
Vught Vught Noord-Brabant	national	2011	The station lost its function in 2003. In 2011 the building was redeveloped and reused as an office space.
Winschoten Oldambt Groningen	national	2012	In 2012 the station building was redeveloped and was brought back to the original design of 1904
Wolfheze Renkum Gelderland	municipal	2006	In 2006 a large restoration of the station building took place, afterwards the station was reopened and listed with a monumental status
Wolvega Westellingwerf Friesland	national	2015	After a loss of function, the station building was redeveloped and reused by new tenants in 2015
Zevenbergen Moerdijk Noord-Brabant	national	2012	The service counter closed in 1997. In 2012 the building was redeveloped and is reused as a restaurant

Source: Cultuurhistorische waardestellingen (Spoorbeeld, 2017)

4.2 The dataset

The dataset that is used in the hedonic analysis includes house prices and housing characteristics and is provided by the Dutch Association of Real Estate Agents (NVM). The complete NVM dataset contains between 60 and 75% of all owner-occupied house transactions in the Netherlands between 1985 and 2016. In addition, the dataset includes an extensive amount of information on each transaction.

For the analysis, a selection of the NVM dataset was distributed. The subset contains data on transactions within 14 municipalities in the Netherlands, between January 1st 1996 and December 31st 2016. The selection of municipalities was made on the basis of the presence of one of the selected railway heritage sites. The subset contains 69 variables on locational and housing characteristics. A selection of the housing characteristics is used in the hedonic analysis. This selection is based on the studies of Van Duijn et al. (2016) and Daams et al. (2016) and can be found in table 3. In addition, the dataset was prepared for the analysis by the removal of outliers and log transformation. The details of the data preparation can be found in Appendix E. By applying log transformation on the dependent variable (transaction prices), coefficients can be interpreted as percentage changes.

Table 3. Housing characteristics

Variable	Description
Transaction price	Logarithm of the transaction price
Building period	Dummy variable for each building period
Number of rooms	Number of rooms in the house
Living area	Logarithm of the corrected useable living area in m^2
Maintenance inside	Dummy maintenance inside (1 = good)
Maintenance outside	Dummy maintenance outside (1 = good)
Central heating	Dummy central heating (1 = yes)
Garden	Dummy garden (1 = yes)
Balcony	Dummy balcony (1 = yes)
Parking	Dummy parking (1 = yes)
Listed built monument	Dummy listed built monument (1 = yes)
Standard house	Dummy standard house (1 = yes)
Detached house	Dummy detached house (1 = yes)
Semi-detached house	Dummy semi-detached house (1 = yes)
Corner house	Dummy corner house (1 = yes)
Apartment	Dummy apartment (1 = yes)

To separate the target and control group and measure the external effect of the redevelopment of railway heritage, a variable including the distance from each house to the nearest railway heritage building is added to the NVM dataset.

The distance between each house and the nearest selected railway station was measured with the use of location coordinates (Rijksdriehoekscoördinaten). In the Netherlands, these location coordinates are widely used for georeferencing. The location coordinates were merged with the NVM

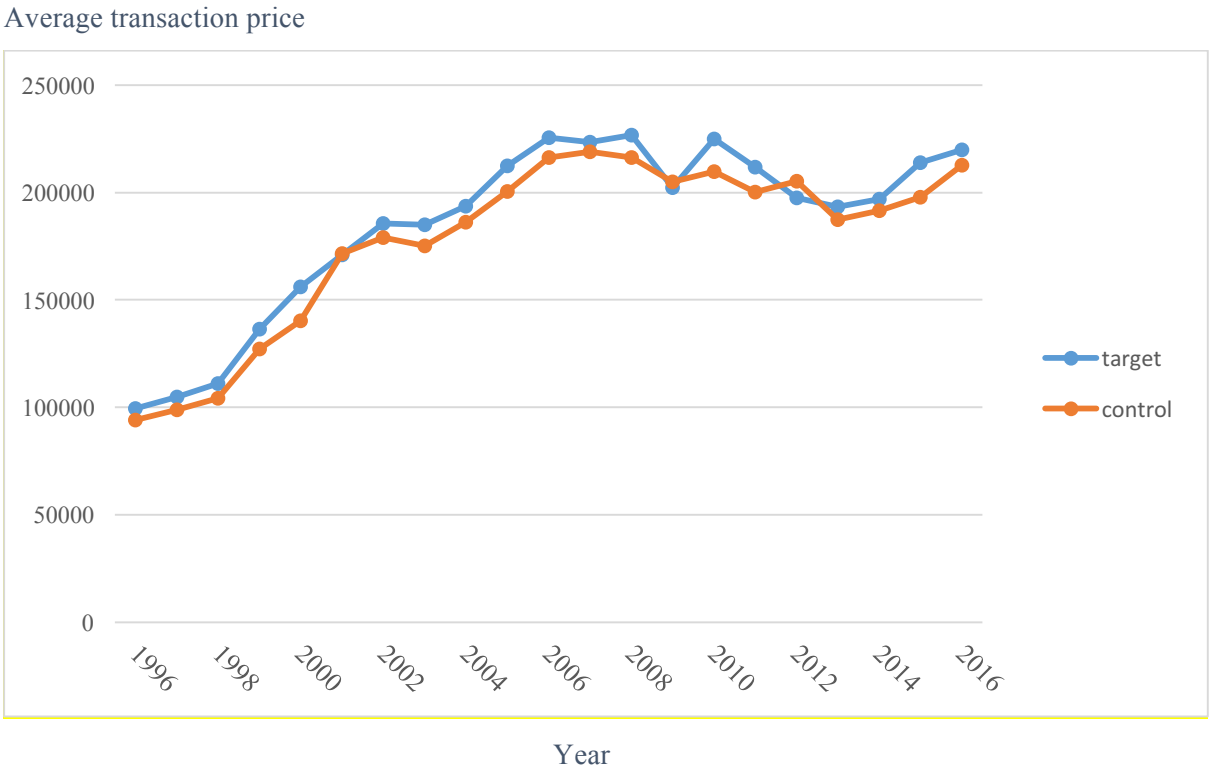
dataset based on a variable including a zipcode and house number. This variable provides a unique locational code, which is important for applying a correct merge. Besides the location coordinates of the houses, the location coordinates of the selected railway stations were also added to the dataset[2]. The distance between the location coordinates of each house and the location coordinates of the nearest selected railway station is calculated with the help of Pythagorean theorem. With the creation of a distance variable, the target and control group are separated.

Lastly, a CBS dataset including neighborhood characteristics was merged with the NVM dataset. With this data, house prices can be regressed on neighborhood characteristics. In line with the study of Van Duijn et al. (2016), these characteristics include population density (#/km^2), share of foreign migrants (%), average household size (#), share of young people (%) and share of elderly people (%).

4.3 Descriptive statistics

The average transaction prices of houses in the target and control group are plotted, separately, in figure 1. In figure 1, the differences between the transaction prices of the target- and control group are made insightful for every transaction year. In this way, we can control for large differences between the target and control group. Both plots show an upward trend in house prices since the mid-nineties and a decrease in house prices after the economic recession started in 2008, which is in line with the study of Van Duijn et al. (2016). The differences between the transaction prices in the target- and control group are modest. The largest difference between these groups occurs in 2011. This might indicate that there could have been an event that positively influenced houses prices in the target group in 2011.

[2] The location coordinates and a map of the selected railway stations can be found in appendix C



Source: NVM (1996-2016), own calculations

Figure 1. Average transaction prices of target- and control group

The descriptive statistics of the target-, control- and total group are, separately, stated in table 4. The descriptive statistics are stated separately in order to illustrate the differences between the groups. The standard deviations of the variables are only included if the variable is not transformed into a dummy.

The descriptive statistics show that the difference between the number of observations in the target- and control group is modest, as as 47 (63) percent of all observations fall in the target group (control group). The mean transaction price in the target group lies more than 20.000 euros lower than the mean transaction price in the control group. It can, however, not be stated that the difference in the transaction prices is due to the presence of a railway heritage station. This is due to the fact that there are multiple differences between the housing- and location characteristics of the target- and control group. When looking into the housing characteristics of both groups, there exists a difference between the building periods of these groups, which could have an influence on the transaction prices. Surprisingly, the mean living area (m2) of the target group is higher than the mean living area (m2) of the control group. This can be due to the fact that there are more detached- and semi-detached houses and less apartments in the target group. When looking into the neighborhood characteristics of both groups, the population density of the target group is lower than the population density of the control group, which could have a negative influence on mean house prices in the target group. In addition, this finding implies that the railway stations are located in less populated areas.

Table 4. Summary of the descriptive statistics for the target- control- and total group

	Target group: 0-1000m	Control group: 1000-2000m	Total 0-2000m
Housing characteristics			
	Mean (St. Dev.)	Mean (St. Dev.)	Mean (St. Dev.)
Transaction price (in euros)	186 419 (920)	207 945 (28 531)	198 919 (16 572)
Building period 1500-1905	0.11	0.06	0.08
Building period 1906-1930	0.21	0.18	0.19
Building period 1931-1944	0.19	0.11	0.15
Building period 1945-1959	0.09	0.08	0.08
Building period 1960-1970	0,15	0.19	0.18
Building period 1971-1980	0.10	0.14	0.12
Building period 1981-1990	0.08	0.10	0.09
Building period 1991-2000	0.04	0.10	0.08
Building period >2001	0.03	0.04	0.04
Living area (in m2)	109.2 (0.36)	106.61 (0.30)	107.71 (0.23)
Number of rooms	4.19 (0.002)	4.12 (0.001)	4.15 (0.01)
Maintenance inside	0.88	0.91	0.90
Maintenance outside	0.90	0.93	0.92
Central heating	0.85	0.86	0.86
Garden	0.52	0.51	0.51
Balcony	0.30	0.31	0.31
Parking	0.27	0.27	0.27
Listed built monument	0.02	0.01	0.01
Standard house	0.23	0.26	0.25
Detached house	0.10	0.08	0.09
Semi-detached house	0.15	0.12	0.13
Corner house	0.11	0.09	0.10
Apartment	0.41	0.45	0.43
Neighborhood characteristics			
Distance to nearest railway station (in meters)	646.80 (1.75)	1480.55 (1.90)	1130.83 (2.42)
Foreign migrants (%)	28.65	29.67	29.25
Population density	5392	6170	5844
Average household size (#)	1.98	1.98	1.95
Young people (%)	27.99	30.60	29.50
Elderly people (%)	18.70	17.81	18.18
Number of observations	17.233	29.369	42.060

5. Results

5.1 Empirical results

In this section the estimation results of the hedonic pricing model are presented. Table 5 reports the key coefficients and the standard errors of the empirical model. Due to the fact that the transaction price is transformed into a natural logarithm, the coefficients can be interpreted as percentage changes. The adjusted R-squared of the last column (4) indicates that the empirical model fits the data properly. The external effects of redevelopment are captured in the Before, Between and After variables. In addition, the coefficients of the other variables are to be found in appendix D.

Column (1) reports the results of the naïve hedonic regression, which only includes the Before, Between and After variables and transaction year dummies. The adjusted R-squared of this regression is relatively low and the results of the After variable are not in line with the expected positive effect of redevelopment, as the coefficient is negative. Colum (2) reports the results of the naïve hedonic regression with the inclusion of structural characteristics and building period dummies. As expected, the adjusted R-squared of this regression is substantially higher. The coefficient of the Before variable implies a negative effect of railway heritage before redevelopment started. On the other hand, the coefficients of the Between and After variables imply a positive external effect after the redevelopment of the selected railway stations started. In column (3) neighborhood dummies are added to the regression. The coefficients of the Between and After variables are similar to the coefficients in column (2), but slightly lower.

Lastly, in column (4) the neighborhood characteristics are added to the regression, which represents the empirical model as stated in section 3. The coefficient of the Before variable is negative and significantly different from zero. Houses that are located in the treatment area (1000 meters) were sold for 4,57 % (=(exp$^{(-.0457)}$-1)*100) less than houses that are located in the control area. This indicates that the selected monumental stations were a disamenity for the surrounding area, before redevelopment started. The coefficient that captures the anticipation effects, the Between variable, is also significantly different from zero but is found to be positive. Houses that are located in the treatment area (1000 meters) were sold for 8,89 % (=(exp$^{(.0889)}$-1)*100) more than houses that are located in the control area. This indicates that the negative external effects of the railway heritage disappeared after the start of the redevelopment. The coefficient of the After variable is also significantly different from zero and is positive. Houses that are located in the treatment area (1000 meters) were sold for 4.73 % (=(exp$^{(-.0473)}$-1)*100) more than houses that are located in the control area. This indicates that the railway heritage sites were an amenity for the surrounding area after the redevelopment had been completed.

Table 5. Regression results for the empirical model

	(1)	**(2)**	**(3)**	**(4)**
Sample size	< 2000m	< 2000m	< 2000m	< 2000m
Treatment area	0-1000m	0-2000m	0-2000m	0-2000m
Control area	1000-2000m	1000-2000m	1000-2000m	1000-2000m
Before	-0.0057 (0.0095)	-0.0423 *** (0.00490)	-0.0450 *** (0.00529)	-0.0457 *** (0.00497)
Between	0.244 *** (0.0109)	0.101 *** (0.00564)	0.0898 *** (0.00532)	0.0889 *** (0.0049)
After	- 0.0434 *** (0.0106)	0.0527 *** (0.00548)	0.0449 *** (0.00494)	0.0473 *** (0.0046)
Structural characteristics	NO	YES	YES	YES
Building period dummies	NO	YES	YES	YES
Neighborhood dummies	NO	NO	YES	YES
Neighborhood characteristics	NO	NO	NO	YES
Transaction year dummies	YES	YES	YES	YES
Observations	42 000	41 197	41 197	40 289
Adjusted R-squared	0.264	0.805	0.874	0.875

Note: Dependent variable is logarithm of the transaction price. Robust standard errors are reported between parentheses *** p<0.01, ** p<0.05, * p<0.10

5.2 Results for the alternative model

In this section the estimation results of the alternative model are reported. This model investigates the robustness of the results and the distance decay effect of the external effect. This effect is allowed to be linear, concave or convex over distance to the railway heritage site. In order to measure the reach of the external effect, rings of 250 meters are drawn within the treatment radius (0-250m, 250-500m, 500-750m, 750-1000m). Separately, we estimate the coefficients of the different distance rings.

Table 6 reports the coefficients and the standard errors for the alternative model. The coefficients of the last three distance rings of the Before variable are significantly different from zero at a 1%. The coefficients are all negative and became larger when distance to the railway station increases. This indicates that the external effect of railway heritage is not linear when the distance to the station increases. The last three coefficients of the Between variable are significantly different from zero at a 1% level. The coefficients are all negative, but do not become smaller as the distance to the station increases. :Lastly, the last three coefficients of the After variable are significantly different from

zero at a 1% level. These coefficients are positive, indicating that the stations are regarded as an amenity. The coefficients become smaller when distance to the railway station increases. This indicates a distance decade effect of railway heritage, after redevelopment took place.

Table 6. Regression results for the alternative model

	(5)
Sample size	< 2000m
Treatment area	0-1000m
Control area	1000-2000m
Before 0-250m	- 0.0091 (0.0088)
Before 250-500m	- 0.0271*** (0.00643)
Before 500-750m	- 0.0455 *** (0.00567)
Before 750-1000m	- 0.0479 *** (0.0051)
Between 0-250m	0.0124 (0.0275)
Between 250-500m	- 0.0539 *** (0.0119)
Between 500-750m	- 0.0524 *** (0.0101)
Between 750-1000m	- 0.0595 *** (0.0089)
After 0-250m	0.0201 (0.0125)
After 250-500m	0.0690 *** (0.0062)
After 500-750m	0.0433 *** (0.0055)
After 750-1000m	0.0415 *** (0.0102)
Structural characteristics	YES
Building period dummies	YES
Neighborhood dummies	YES
Neighborhood characteristics	YES
Transaction year dummies	YES
Observations	40 289
Adjusted R-squared	0.876

Note: Dependent variable is logarithm of the transaction price. Robust standard errors are reported between parentheses *** p<0.01, ** p<0.05, * p<0.10

5.3 Are the results driven by the largest municipalities?

It is likely that redevelopment projects in larger cities have higher external effects, since they often get more media attention (Van Duijn et al., 2016). In addition, the railway stations in larger cities are often larger station buildings and process more passengers, in comparison with stations in smaller cities or villages. This selection problem could drive up the coefficients of this study. For this reason, we separate the selected stations into two groups. Houses that are located in municipalities with more than 40.000 residents, which are the houses near the stations of Tiel, Horst-Sevenum, Roosendaal and Groningen, are separated from the rest of the dataset. We separately run the regressions of these two groups. A Chow test allows us to see if there are significant differences between these two groups, while the null hypothesis of this test is that the intercepts and slopes are identical between separated groups. Table 7 reports the coefficients of the empirical model after the separation of the two groups. The coefficients of the stations in the smaller municipalities show no significant results, except for the after variable, which is positive. This result is in line with what is expected, but smaller than the result of the After variable in the empirical model. The coefficients of the stations in the four largest municipalities show significant results, at a 5% and 1% level, respectively. The coefficients are in line with what is expected, as the Before variable is negative and the Between and After variables are positive. The results of this study are in line with the results of the study of Van Duijn et al. (2016). In their paper, the external effects of redevelopment were driven by the redevelopment projects in the G4 cities. It could therefore be argued that the results in this study could be driven by the stations within the largest municipalities. Furthermore, the Chow F-statistic (47.57) is significantly different from zero at the 1% level. This means that the null hypothesis is rejected and that the intercepts and slopes are not identical between the separated groups.

Table 7. Regression results after splitting dataset

	(6) Excluding largest 4	**(7)** Largest 4 municipalities
Sample size	< 2000m	< 2000m
Treatment area	0-1000m	0-2000m
Control area	1000-2000m	1000-2000m
Before	-0.0208 (0.0132)	-0.0134 ** (0.0054)
Between	-0.0190 (0.0119)	0.101 *** (0.0059)
After	0.0276 ** (0.0132)	0.0256 *** (0.0048)
Structural characteristics	YES	YES
Building period dummies	YES	YES
Neighborhood dummies	YES	YES
Neighborhood characteristics	YES	YES
Transaction year dummies	YES	YES
Observations	12 050	28 130
Adjusted R-squared	0.861	0.874

Note: Dependent variable is logarithm of the transaction price. Robust standard errors are reported between parentheses *** p<0.01, ** p<0.05, * p<0.10

6. Conclusions

In this study, the external effects of the redevelopment of vacant railway heritage stations on nearby house prices have been explored. These external effects were analyzed before, between and after redevelopment took place. Fourteen monumental railway stations were chosen for the empirical analysis. All of these railway stations lost part of their original function and had been vacant for a considerable period before they were redeveloped. These redevelopments include reusing the station building and/or the restoration of its historic features.

A hedonic pricing model with a difference-in-differences approach has been used to compare house prices in a predefined treatment area with house prices in the control area. The hedonic model was applied to a dataset, provided by the NVM, of housing transactions that occurred between 1996 and 2016. The treatment area is defined as houses that are sold within one kilometer of the redeveloped railway heritage stations, while the control area is defined as houses that are sold in the outer ring area. House prices are regressed on a number of structural characteristics, temporal characteristics, neighborhood characteristics and a variable that reflects the presence of the external effects. After running the hedonic regression with a treatment area of one kilometer, a fifth regression is used to measure the distance decay effect of the redevelopment. This regression splits the treatment area in distance rings of 250 meters. A sixth and seventh regression are then used to see whether the external effects are driven by the stations which are located within the four largest municipalities. The conclusions of this study are as follows.

Firstly, the results of the regressions with a one kilometer radius show that there exists a negative external effect of railway heritage on surrounding house prices, before redevelopment occurred. This confirms the first hypothesis, which states that railway heritage has a negative effect on nearby house prices, before redevelopment started. The effects are, however, relatively small in comparison with other studies on the redevelopment of cultural heritage (Van Duijn et al., 2016). Furthermore, the negative external effects of railway heritage seem to disappear at the start of the redevelopment projects, indicating anticipation effects. After the completion of the redevelopment projects, the regressions show that railway heritage has a positive effect on surrounding house prices. This confirms the second hypothesis, which states that railway heritage has a positive effect on house prices nearby after redevelopment has started. These findings are in line with theories on historic amenities and house prices (Cheshire & Sheppard, 1995; Brueckner et al., 1999). The positive effect after redevelopment is , however, smaller than the assumed anticipation effects.

Secondly, the fifth regression shows that there is a clear linear distance decay effect of railway heritage, but only after redevelopment is finalized. The regression shows that the coefficient of the key variable ‘After’ becomes smaller when distance to the railway stations increases.

Thirdly, the sixth and seventh regressions show that, when separating the stations in the four largest municipalities from the rest, the regression results could be driven by the stations in the largest municipalities. This result is in line with the results in the study of Van Duijn et al. (2016).

As with any academic research, there are several limitations to this study. Firstly, the selection of stations is influenced by the amount of public information that is available on monumental railway stations and by the availability of data on housing transactions. Although there is extensive information available about a number of monumental railway stations, this information only covers a part of all stations that are cultural heritage. As a consequence, the selection of stations of this study depends heavily on information that is publicly available and the selection is therefore not representative for all monumental railway stations that are redeveloped. Furthermore, there is no public information available on the magnitude of the investments that were made for the selected redevelopments. This implies that we cannot compare the redevelopments based on their investment value. In addition, data on house price transactions is available for the time period 1996-2016. There are, however, many heritage stations that have been redeveloped before this time period, which limits the amount of heritage stations that could be included.

Secondly, it could be very well possible that neighborhoods are in the target group because of the neighborhood characteristics. Consequently, being assigned to the target group could be not entirely random and house prices might actually be driven by neighborhood characteristics. This would then yield biased estimated with respect to treatment. To account for this, an often used procedure is the matching procedure. Van Duijn et al. (2016) use propensity score matching as a matching technique[3]. The propensity score can be defined as

$$\mathbb{P}[T = 1|X]$$

Where T denotes the variable for treated and X is a set containing neighborhood characteristics previously used in the regressions. By the use of propensity score matching, a new control area is defined, based on comparable neighborhood characteristics. In order to account for robustness of the results, it is recommended to add a matching procedure to a similar study.

[3] Since we follow Van Duijn et al. (2016), and since the same neighbourhood characteristics are used, we implicitly assume that the assumptions of unconfoundedness and overlap are satisfied.

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Appendices

Appendix A. List with all monumental railway stations

Name of the station	Monumental status	Selection criteria (1) Public information	Other selection criteria (2,3,4 & 5) Most recent redevelopment
Aalten	Municipal	NO	
Alkmaar	Municipal	NO	
Almelo	National	YES	A small redevelopment took place in 2001, as former warehouse that lost its original function is tranformed into a busstation (YES: criteria 3&4) *source: spoorbeeld.nl/stations/station-almelo*
Almelo de Riet	National	YES	In the late eighties the station building lost its tickets and services function. A small internal redevelopment took place in 2001, with the arrival of a new tenant (YES: criteria 3,4 &5) *source: spoorbeeld.nl/stations/station-almeloderiet*
Amsterdam Amstel	National	YES	No large redevelopments took place which focused on preserving the heritage value of the station building *source:spoorbeeld.nl/stations/station-amsterdamamstel*
Amsterdam Centraal	National	YES	Due to an increasing amount of passengers and the implementation of the OV chipcard, a masterplan called 'Reizigersmachine' was implemented in 2004-2017, which focused on proccessing more passengers at the station of Amsterdam Centraal (YES: criteria 3) *source: spoorbeeld.nl/stations/station-amsterdamcentraal*
Amsterdam Muiderpoort	National	NO	
Apeldoorn	Municipal	NO	
Arkel	Municipal	NO	
Arnemuiden	National	NO	
Arnhem Velperpoort	Muncipal	YES	No large redevelopments took place which focused on preserving the heritage value of the station building *source:spoorbeeld/stations/stationarnhemvelperpoort*
Baarn	National	NO	
Bilthoven	Municipal	NO	
Boxmeer	National	YES	The waiting area of the station building became vacant in 2000. The building was renovated and reused by a new tenant in 2014. In addition, a new station hall was created (YES: criteria 2,3,4 &5) *source: spoorbeeld.nl/stations/station-boxmeer*
Cuijk	Municipal	NO	

Dalfsen	Municipal	YES	No large redevelopements took place which focused on preserving the heritage value of the station building *source:spoorbeeld/stations/station-dalfsen*
Delden	Municipal	YES	The station building was redeveloped in 1985-1989. The station lost part of its original function and the station building was split up. One part of the building was let to external parties (2,3 &5) *source:spoorbeeld.nl/stations/station-delden*
Delft	National	YES	The station building has been sold in 2016[4] (YES: criteria 2,3,4 &5) *source:spoorbeeld.nl/stations/station-delft*
Delfzijl	National	YES	The interior of the station building was redeveloped in the 1960's. In the 1980's a lot the station functions became obsolete, due to technological developments (YES: criteria 2, 4&5) *spoorbeeld.nl/stations/station-delfzijl*
Den Dolder	National	YES	In 2003, the tickets and service function of the station became obsolete. The interior of the station building was redeveloped in 2016, as new tenants made use of the station building (YES: criteria 2,4 &5) *source: spoorbeeld/nl/stations/station-dendolder*
Den Haag HS	National	YES	The interior of the station building was renovated in 1989. The layout, however, remained unchanged (YES: criteria, 2, 4 &5) *source:spoorbeeld.nl/stations/station-denhaaghs*
Deventer	National	YES	In 2011 a masterplan was created, which focused on the redevelopment of the whole station area. In this master plan, the cultural historic value of the station area is of high importance. The masterplan is, however, not implemented yet (YES: criteria 2, 4 &5) *spoorbeeld.nl/stations/station-deventer*
Dieren	Municipal	NO	
Dordrecht	National	YES	Redevelopment of the exterior of the station building in the 1960's. The orginal features of the station building were redeveloped(YES: criteria 2,4 &5) *source : spoorbeeld.nl/stations/station-dordrecht*
Driebergen-Zeist	Municipal	NO	
Echt	National	NO	
Ede Centrum	National	YES	The station building was tranformed into a museum in 1973, at the station lost its original function (YES: criteria 2, 4 &5) *source: spoorbeeld.nl/stations/station-edecentrum*
Eindhoven	National	YES	The station building is redeveloped and reopenend in 2018 (YES: criteria, 2, 4 &5) *spoorbeeld.nl/stations/station-eindhoven*
Enkhuizen	National	YES	The station building was redeveloped in 1980, as the use of the station building changed. Freight transportation became obsolete and the ferry moved

[4] No stations are selected that have been sold or are owned by other parties than NS Stations

			away from the station building (YES: criteria, 2, 4 &5) *spoorbeeld.nl/stations-station-enkhuizen*
Enschede	Municipal	YES	The station building was redeveloped in the 1980's, as several new functions were added to the station of Enschede, including office space and money exchange offices (YES: critera, 2, 4 &5) *spoorbeeld.nl/stations/station-enschede*
Ermelo	Municipal	NO	
Geldermalsen	National	YES	The station building is currently under construction (YES: 2, 4 &5) source: spoorbeeld.nl/stations/station-geldermalsen
Geldrop	National	NO	
Gilze-Rijen	Municipal	NO	
Goor	Municipal	NO	
Groningen	National	YES	In 1995, a lot of original functions of the station building became obsolete. For this reason, part of the station building was redeveloped and reused in 1998-2000. The vacant areas were used by new commercial tenants (YES: criteria: 2, 3, 4 &5) *source:spoorbeeld.nl/stations/station-groningen*
Haarlem	National	YES	Implementation of a masterplan for the entire station area in 2003, developed by the muncipality (YES: criteria 2 &3) *source: spoorbeeld.nl/stations/station-haarlem*
Hardenberg	Municipal	NO	
Harlingen	National	YES	The NS serviceshop closed in 1999, due to technological developments. A redevelopment and reuse of the station building was done in 2009 (YES: criteria 2, 3, 4 &5) *source: spoorbeeld.nl/stations/station-harlingen*
Heino	Municipal	NO	
Hengelo	National	NO	
Holten	Municipal	NO	
Hoorn	National	YES	Redevelopment of the interior of the station building in 1973 (YES: criteria 2 &5) *source: spoorbeeld.nl/stations/station-hoorn*
Horst-Sevenum	National	YES	The station building lost its original function in 1999. The station building was renovated and reused in 2013 as a lunch room and bed &breakfast (YES: criteria 2, 3, 4 &5) *source: spoorbeeld.nl/stations/station-horst-sevenum*
Kampen	National	NO	
Kapelle-Biezelinge	Municipal	NO	
Kesteren	National	NO	
Klimmen-Ransdaal	National	YES	The station building lost its original function in late 1980's. The station building was redeveloped in 2003-2005 and transformed into a restaurant (YES: criteria 2, 3, 4 &5) *source: spoorbeeld.nl/stations/station-klimmen-ransdaal*

Kropswolde	Municipal	NO	
Landgraaf	National	YES	The station building was redeveloped 2002-2003 and was transformed into a restaurant, after loosing its original function (YES: criteria 2, 3, 4 &5) *source: spoorbeeld.nl/stations/station-landgraaf*
Leeuwarden	National	YES	The station building was modernized in 1986. In 1994=2000, a new shopping area was developed, as the station lost its function as a waiting area and service counter (YES: criteria 2 &5) *source: spoorbeeld.nl/stations/station-leeuwarden*
Lochem	Municipal	NO	
Lunteren	National	NO	
Maastricht	National	YES	The station building will be reused in a couple of years, after loosing parts of its original function (YES 2, 4 &5) *source: spoorbeeld.nl/stations/station-maastricht*
Marienberg	Municipal	NO	
Meppel	National	YES	In the 1980's the station building was almost demolished. However, it was decided that the station building needed to be renovated, because of its historical value (YES: criteria 2, 4 &5) *source: spoorbeeld.nl/stations/station-meppel*
Middelburg	National	YES	The station building was partly redeveloped in the 1990's (YES: criteria 2, 4 &5) *source:spoorbeeld.nl/stations/station-middelburg*
Naarden-Bussum	Provincial	YES	The station building was partly redeveloped in 2011 (YES: criteria 3, 4 &5) *source: spoorbeeld.nl/stations/station-naarden-bussum*
Nijkerk	Municipal	YES	No large redevelopements took place which focused on preserving the heritage value of the station building *source:spoorbeeld.nl/stations/station-nijkerk*
Nunspeet	Municipal	YES	No large redevelopements took place which focused on preserving the heritage value value of the station building *source: spoorbeeld.nl/stations/station-nunspeet*
Obdam	Provincial	NO	
Oisterwijk	National	YES	The building was redeveloped in 2001-2005 and was reused as a restaurant, after loosing its original function (YES: criteria 2, 3, 4 &5) *source: stationsweb.nl/stations/station-oisterwijk*
Oudenbosch	National	NO	
Overveen	Municipal	YES	The station building was reused in 2009, by the arrival of a new tenant (YES: criteria 3, 4 &5) *source:spoorbeeld.nl/stations/station-overveen*
Reuver	Municipal	NO	
Roosendaal	National	YES	The station lost its original function as a border station in the 1960's. The station building was restored in 2007=2013 (YES: criteria 2, 3, 4 &5) *source: spoorbeeld.nl/stations/station-roosendaal*

Rotterdam Noord	Municipal	YES	No large redevelopements took place which focused on preserving the heritage value of the station building *source: spoorbeeld.nl/stations/station-rotterdamnoord*
Santpoort Zuid	Municipal	NO	
Scheemda	National	NO	
Schin op Geul	National	NO	
Sneek	National	YES	After the station lost many of its original functions, a redevelopment of the exterior of the station building took place in the 1970's (YES: criteria 2 &5) *source: spoorbeeld.nl/stations/station-sneek*
Soest	National	YES	The station was redeveloped and reused in 1989, after loosing its original function (YES: criteria 2 &5) *source: spoorbeeld.nl/stations/station-soest*
Soestdijk	National	YES	The interior of the station building was redeveloped in 2012 (YES: criteria 3, 4 &5) *source: spoorbeeld.nl/stations/station-soestdijk*
Soestduinen	Municipal	NO	
Swalmen	Municipal	NO	
Tiel	Municipal	YES	The station building was redeveloped and reused in 2001-2007, as the main building was transformed into a restaurant (YES: criteria 2, 3, 4 &5) *source:spoorbeeld/stations/station-tiel*
Tilburg	National	YES	After large redevelopments took place in the 1960's and the 1970's, the station building was partly redeveloped in 2002 (YES: criteria 3, 4 &5) *source: spoorbeeld.nl/stations/station-tilburg*
Utrecht Maliebaan	National	NO	
Valkenburg	National	YES	The station building was redeveloped and let to an external party in 2005 (YES: criteria 2, 3, 4 & 5)[5] *source: spoorbeeld.nl/stations-station-valkenburg*
Vleuten	Municipal	NO	
Vlissingen	National	YES	The station building was redeveloped in 1949-1950 (YES: criteria 2 &5) *source:spoorbeeld.nl/stations/station-vlissingen*
Voerendaal	National	YES	The station building had a small redevelopment in 2008, with the arrival of a new tenant (YES: criteria 3, 4 &5) *source: spoorbeeld.nl/stations/station-voerendaal*
Vorden	Municipal	NO	
Vught	National	YES	The station building was renovated and reused in 2011, after is lost its original function (YES: critera 2, 3, 4 &5) *source: spoorbeeld.nl/stations/station-vught*
Weert	National	NO	

[5] No stations are selected that have been sold or are owned by other parties than NS Stations

Winschoten	National	YES	No large redevelopements took place which focused on preserving the heritage value of the station building *source:spoorbeeld.nl/stations/station-winschoten*
Winterswijk	Municipal	YES	The station building was redeveloped into a restaurant in 2010, which closed in 2012 (YES: criteria, 2, 4 &5) *source:spoorbeeld.nl/stations/station-winterswijk*
Woerden	Municipal	NO	
Wolfheze	Municipal	YES	The station building was restored and reopened in 2006, after being vacant for a number of years. The station building is currently used for commercial and residential functions (YES: criteria 2, 3, 4 &5) *source: spoorbeeld.nl/stations/station-wolfheze*
Wolvega	Municipal	YES	In 2011, ticket and service functions were placed outside the station building.The station building was redeveloped in 2015(YES: criteria 2, 3, 4 &5) *source: www.spoorbeeld.nl/stations/station-wolvega*
Zandvoort aan Zee	National	YES	The station building mostly remained unchanged. A redevelopment of the interior took place in 1952, as the waiting areas were transformed into housing (YES: criteria 2, 4 &5) *source: spoorbeeld.nl/stations/station-zandvoortaanzee*
Zetten-Andelst	Municipal	NO	
Zevenbergen	National	YES	The service counter closed in 1997. The station building was renovated and reused as a restaurant in 2012 (YES: criteria 2, 3, 4 &5) *source: spoorbeeld.nl/stations/station-zevenbergen*
Zutphen	National	YES	The station lost parts of its original function in 1980's. The station square was redeveloped in 2006 (YES: criteria 3 &5) *source: spoorbeeld.nl/stations/station-zutphen*
Zwolle	National	YES	Redevelopment of the main building in the 1990's, as the functions of the building moved towards the passenger tunnel (YES: criteria 2, 4 &5) *source: spoorbeeld.nl/stations/station-zwolle*

(source: https://www.spoorbeeld.nl/labels/cultuurhistorisch-onderzoek)

Appendix B. Detailed description selected railway stations and redevelopment

Station Boxmeer (Boxmeer)

The railway station of Boxmeer was built in 1882. The station is part of the series of stations called 'Hemmen' and was, in all likelihood, designed by railway architect W.A. van Wadenoyen. The station of Boxmeer is one of the two stations of the 'Hemmen' type which is still owned by NS Stations. The station is part of the Nijmegen-Venlo railway line. In 1975, the station building was designated as a national monument. The station's waiting area became obsolete in 2000, when the ticket machines were placed outside the station building. Additionally, the office space of the station manager also lost its function and therefore became vacant. In 2014, a renovation of the interior and exterior of the building took place, due to the arrival of a new tenant. The biggest change was the creation of a new station hall.

Source: Cultuurhistorische waardestelling Boxmeer https://www.spoorbeeld.nl/stations/station-boxmeer

Groningen (Groningen)

The railway station of Groningen was built in 1896 and was designed by the architect Isaac Gosschalk. The station is part of the five standard station types and is classified as a 1st class station. The station building is designated a national monument and the platform caps are protected as municipal monuments. Around 1995, several spaces in the station building were vacant due to a loss of traditional staff facilities. In addition to this, adjustments caused a loss of historical material and structures until the end of the 1990s. In 1998, an assessment was made to potentially fill up the vacant spaces of the station building. It was decided that the monumental status of the building should be seen as a benefit and could be used for commerce. In the period 1998-2000 the origin structure of the building was restored and the restoration was honored with the "Europa Nostra Medal of Honor'' in 2000. Meanwhile almost all areas on the ground floor are used for commercial purposes.

Source: Cultuurhistorische waardestelling Groningen https://www.spoorbeeld.nl/stations/station-groningen

Harlingen (Harlingen)

The railway station of Harlingen was built in 1863 and was designed by the engineer J.W. Witsen. The station is part of the five standard station types and is classified as a 3th class station. The station building is designated as a national monument. The station of Harlingen is part of the Harlingen-Leeuwarden railway line. The station building lost its original function in 1999, when the NS Service shop and coffee shop were closed. In 2009, the station building was brought back to use. After being

vacant for a long time, the station restoration was honorably restored. In addition to this, the ground floor is reused as a furniture shop and passengers can use the building for travel information.

Source: Cultuurhistorische waardestelling Standaardstations Vooroorlogs
https://www.spoorbeeld.nl/stations/station-harlingen &
http://www.stationsweb.nl/station.asp?station=harlingen

Horst-Sevenum (Horst)

The railway station of Horst-Sevenum was built in 1864 and was designed by engineer K. H. Brederode. The station is part of the five standard station types and is classified as a 5th class station. The station building is designated as a national monument. The station of Horst-Sevenum is part of the Eindhoven-Roermond railway line. Five years after the station was built, the size of the building was already too small and the building was extended. In the first decade of the twentieth century, the station lost its original and the station building became vacant. In 2013, the building was redevelopment and reused as a lunchroom and bed & breakfast.

Source: Cultuurhistorische waardestelling Horst-Sevenum https://www.spoorbeeld.nl/stations/station-horst-sevenum

Klimmen-Ransdaal (Voerendaal)

The railway station of Klimmen-Ransdaal was built in 1913. The station building was designed by G.W. van Heukelom as a unique example in his series of three stations along the Schin op Geul-Heerlen railway line. In 1997, the station building was designated as a national monument. In the late 1980's, the service counters closed and the building was withdrawn from its function as a station. Afterwards, the station was vacant for approximately fifteen years. In 2003, the station rooms were offered for rent. The station building was redeveloped in the period 2003-2005 and is reused as a restaurant by Brasserie D'r Blauwe Engel.

Source: Cultuurhistorische waardestelling Klimmen-Ransdaal
https://www.spoorbeeld.nl/stations/station-klimmen-ransdaal

Landgraaf (Landgraaf)

The railway station of Landgraaf was built in 1893. The station is designated as a national monument. The station of Landgraaf is the last remaining station building along the Sittard-Heerlen-Herzogenrath mine railway line. Due to the demolition of the other stations along the former mine railway line, the station has a high cultural historical value. After losing its original function, the station is redeveloped

in the period 2002-2003 and is reused as a restaurant. Ristorante Pizzeria Santa Maria, including a new service counter, opened in 2003.

Source: Stationsweb http://stationsweb.nl/station.asp?station=landgraaf&vraag=landgraaf

Oisterwijk (Oisterwijk)

The railway station of Oisterwijk was built in 1864 and was designed by the architect K. H. Van Brederode. The station is part of the five standard station types and is classified as a 4th class station. The station building is designated as a national monument. The station of Oisterwijk is part of the Tilburg-Eindhoven railway line. After the station lost its original function, the building was redeveloped in the period 2001-2005 and is reused as a restaurant called 'T Stationneke'.

Source: Cultuurhistorische waardestelling Standaardstations Vooroorlogs
https://www.spoorbeeld.nl/stations/station-oisterwijk

Roosendaal (Roosendaal)

The railway station of Roosendaal was built in 1907 and was designed by the architect Van Ravesteyn. The size of the station building is directly related to the original function as a border station. In the 1960's there was a decline in the amount of passengers that used the station, due to rise of private car ownership and increasing air traffic. As a consequence, the border controls at station Roosendaal disappeared. Due to its historical value, the station building became designated as national monument in 2001. The station square was redeveloped in 2007. In the period 2009-2013 the station building was completely restored and reconstructed by the design of the architects Rusland + Partners.

Source: Cultuurhistorische waardestelling Roosendaal https://www.spoorbeeld.nl/stations/station-roosendaal

Tiel (Tiel)

The railway station of Tiel was built in 1883 and was, in all likelihood, designed by architect Van Wadenoijen.. The station is part of the five standard station types and is classified as a 3th class station. The station building is a municipal monument. In addition to the station of Tiel, Sneek and Delfzijl are the only stations in the same category that still exist. All three of these stations do not have a station function anymore. In 2001, the station building of Tiel was renovated and part of the extension of the building was removed. In 2003 a new tenant uses the side wings of the building for catering functions. In 2007, the main building is redeveloped and is reused a restaurant called 'BuitenSporig'.

Source: Cultuurhistorische waardestelling Tiel https://www.spoorbeeld.nl/stations/station-tiel

Vught (Vught)

The railway station of Vught was built in 1868 and was designed by G. van Diesen. The station is part of the five standard station types and is classified as a new 5th class station. The station building is designated as a national monument. The station is part of the Utrecht-Boxtel railway line. The station lost its original function in 2003. In 2011 the building was redeveloped and reused as an office space.

Source: Cultuurhistorische waardestelling Vught https://www.spoorbeeld.nl/stations/station-vught

Winschoten (Oldambt)

The railway station of Winschoten was built in 1862 and was designed by architect K.H. van Brederode. The station is part of the five standard station types and is classified as a 3th class station. The stations of Harlingen and Winschoten are the only station buildings of this type that have been redeveloped and do not have a function as a station building anymore. The station building of Winschoten is designated as a national monument. The station is part of the Groningen-Bad Nieuweschans railway line. In 2012 the station building was restored and was brought back to the design of 1904.

Source: Cultuurhistorische waardestelling Winschoten https://www.spoorbeeld.nl/stations/station-winschoten

Wolfheze (Renkum)

The railway station of Wolfheze was built in 1899. The design of the station building of Wolfheze has been applied to six other stations. The station building of Wolfheze is, however, the only station that is still remained. The station is part of the Amsterdam-Arnhem railway line. The building was restored in 2006 and was designated as a municipal monument in the same year. The station is currently used for commercial and residential functions.

Source: Cultuurhistorische waardestelling Wolfheze https://www.spoorbeeld.nl/stations/station-wolfheze

Wolvega (Westellingwerf)

The railway station of Wolvega was built in 1865 and was designed by engineer K.P. van Brederode. The station is part of the five standard station types and is classified as a 4th class station. In 1998, the station building was designated as a national monument. The station of Wolvega is part of the Zwolle-Leeuwarden railway line. In 2011, ticket sales were placed outside the station building and the station building lost its function. Although the station of Wolvega was threatened with demolition, the municipality and NS Stations decided to renovate the station building, partly because the station is the

most well-preserved station of the 4th class. The exterior was brought back to its original design and the interior was modernized in 2015. The first floor has been converted into office space and the ground floor combines a waiting area with a flower shop.

Source: Cultuurhistorische waardestelling Wolvega https://www.spoorbeeld.nl/stations/station-wolvega

Zevenbergen (Moerdijk)

The railway station of Zevenbergen was built in 1864, commissioned by the 'Société Anonyme des Chemins de Fers d'Anvers à Rotterdam'. The station building is designated as a national monument. The station of Zevenbergen is part of the Rotterdam-Antwerpen railway line. The service counter closed in 1997. After being vacant for several years, the station building was redeveloped in 2012. The station was given a new function as a restaurant called ‘T Peronneke’ reused the station building.

Source: Stationsweb http://www.stationsweb.nl/station./station-station-zevenbergen

Appendix C. Location coordinates and map of the selected railway stations

Station	X	Y
Boxmeer	193234	406316
Groningen	233585	581111
Harlingen	157530	575984
Horst-Sevenum	200488	382206
Klimmen-Ransdaal	190424	319575
Landgraaf	199552	323066
Oisterwijk	141567	399238
Roosendaal	90609	394994
Tiel	157536	433403
Vught	148423	407426
Winschoten	196583	543811
Wolfheze	182964	446467
Wolvega	196583	543811
Zevenbergen	101194	406125

Appendix D. Regression results

Regression results model 1,2,3 and 4

Variables	(1) Model (1)	(2) Model (2)	(3) Model (3)	(4) Model(4)
Before	-0.00566	-0.0423***	-0.0450***	-0.0457***
	(0.00952)	(0.00490)	(0.00529)	(0.00497)
Between	0.244***	0.101***	0.0898***	0.0889***
	(0.0109)	(0.00564)	(0.00532)	(0.00493)
After	-0.0434***	0.0527***	0.0449***	0.0473***
	(0.0106)	(0.00548)	(0.00494)	(0.00462)
logm2		0.735***	0.636***	0.631***
		(0.00523)	(0.00581)	(0.00441)
obj_hid_NKAMERS		0.0156***	0.0193***	0.0194***
		(0.00114)	(0.00141)	(0.000929)
garden		0.0133***	0.0206***	0.0209***
		(0.00330)	(0.00296)	(0.00273)
insidemain		0.115***	0.111***	0.112***
		(0.00519)	(0.00445)	(0.00422)
outsidemain		0.0827***	0.0680***	0.0681***
		(0.00576)	(0.00519)	(0.00469)
centralheating		0.0947***	0.0895***	0.0880***
		(0.00353)	(0.00308)	(0.00289)
officialmonumentstatus		0.0995***	0.129***	0.123***
		(0.0103)	(0.0115)	(0.00871)
parking		0.128***	0.117***	0.116***
		(0.00339)	(0.00317)	(0.00282)
balcony		0.0226***	0.00762***	0.00846***
		(0.00310)	(0.00276)	(0.00257)
cornerhouse		-0.000598	0.0185***	0.0197***
		(0.00437)	(0.00333)	(0.00355)
detachedhouse		0.256***	0.279***	0.283***
		(0.00516)	(0.00578)	(0.00458)
semidetachedhouse		0.0661***	0.101***	0.103***
		(0.00435)	(0.00390)	(0.00371)
apartment		-0.0520***	-0.0716***	-0.0725***
		(0.00390)	(0.00379)	(0.00355)
constructionyear1		0.115**	0.0373	0.0355
		(0.0467)	(0.0362)	(0.0375)
constructionyear2		0.0503	-0.00490	-0.00401
		(0.0466)	(0.0361)	(0.0374)
constructionyear3		0.0535	0.0124	0.0128
		(0.0466)	(0.0361)	(0.0374)
constructionyear4		0.00252	-0.0384	-0.0377
		(0.0467)	(0.0361)	(0.0374)
constructionyear5		-0.0941**	-0.0639*	-0.0625*
		(0.0466)	(0.0361)	(0.0374)
constructionyear6		-0.0342	-0.0295	-0.0279
		(0.0466)	(0.0361)	(0.0374)

constructionyear7		0.0504	0.0346	0.0365
		(0.0467)	(0.0361)	(0.0375)
constructionyear8		0.151***	0.148***	0.150***
		(0.0467)	(0.0362)	(0.0375)
constructionyear9		0.208***	0.232***	0.236***
		(0.0469)	(0.0364)	(0.0377)
afmeldingyear1996	-0.924***	-0.785***	-0.790***	-0.784***
	(0.0136)	(0.00749)	(0.00655)	(0.00619)
afmeldingyear1997	-0.856***	-0.716***	-0.721***	-0.717***
	(0.0129)	(0.00709)	(0.00607)	(0.00588)
afmeldingyear1998	-0.775***	-0.648***	-0.658***	-0.653***
	(0.0126)	(0.00687)	(0.00599)	(0.00564)
afmeldingyear1999	-0.601***	-0.504***	-0.514***	-0.509***
	(0.0124)	(0.00645)	(0.00592)	(0.00529)
afmeldingyear2000	-0.469***	-0.370***	-0.378***	-0.373***
	(0.0125)	(0.00645)	(0.00576)	(0.00529)
afmeldingyear2001	-0.295***	-0.249***	-0.262***	-0.259***
	(0.0120)	(0.00618)	(0.00533)	(0.00502)
afmeldingyear2002	-0.228***	-0.172***	-0.184***	-0.181***
	(0.0119)	(0.00614)	(0.00486)	(0.00498)
afmeldingyear2003	-0.208***	-0.139***	-0.152***	-0.148***
	(0.0119)	(0.00612)	(0.00479)	(0.00497)
afmeldingyear2004	-0.145***	-0.0746***	-0.0835***	-0.0817***
	(0.0117)	(0.00604)	(0.00479)	(0.00490)
afmeldingyear2006	0.00265	0.0460***	0.0356***	0.0374***
	(0.0116)	(0.00597)	(0.00450)	(0.00486)
afmeldingyear2005	-0.0596***	-0.00267	-0.0138***	-0.0128***
	(0.0116)	(0.00598)	(0.00451)	(0.00486)
afmeldingyear2007	0.0191*	0.0618***	0.0610***	0.0621***
	(0.0112)	(0.00577)	(0.00437)	(0.00469)
afmeldingyear2008	0.0114	0.0664***	0.0636***	0.0646***
	(0.0120)	(0.00614)	(0.00503)	(0.00498)
afmeldingyear2009	-0.0368***	0.0205***	0.0244***	0.0262***
	(0.0130)	(0.00664)	(0.00483)	(0.00539)
afmeldingyear2010	-0.00607	0.0431***	0.0413***	0.0353***
	(0.0131)	(0.00667)	(0.00566)	(0.00540)
afmeldingyear2011	-0.0364***	0.0191***	0.0205***	0.0208***
	(0.0135)	(0.00690)	(0.00578)	(0.00559)
afmeldingyear2012	-0.0575***	-0.0387***	-0.0456***	-0.0462***
	(0.0136)	(0.00695)	(0.00609)	(0.00563)
afmeldingyear2013	-0.0997***	-0.0767***	-0.0851***	-0.0853***
	(0.0136)	(0.00693)	(0.00577)	(0.00561)
afmeldingyear2014	-0.0776***	-0.0529***	-0.0596***	-0.0590***
	(0.0121)	(0.00615)	(0.00517)	(0.00496)
elderlypeople				-0.0345***
				(0.0023)
householdsize				0.130***
				(0.204)
youngpeople				0.232***
				(0.0143)

foreignmigrants				-0.0138***
				(0.104)
populationdensity				1.40e-05***
				(1.30e-05)
Constant	12.16***	8.290***	8.791***	8.383***
	(0.00679)	(0.0515)	(0.0428)	(0.469)
Observations	42,000	41,197	41,197	40,289
R-squared	0.264	0.805	0.874	0.875

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Regression results model 5

Variables	(5) Model(5a)
Before250	-0.00910
	(0.00882)
Before500	-0.0271***
	(0.00643)
Before750	-0.0455***
	(0.00567)
Before1000	-0.0479***
	(0.00508)
Between	0.0884***
	(0.00493)
After	0.0476***
	(0.00461)
logm2	0.631***
	(0.00441)
obj_hid_NKAMERS	0.0195***
	(0.000929)
garden	0.0209***
	(0.00273)
insidemain	0.112***
	(0.00422)
outsidemain	0.0680***
	(0.00468)
centralheating	0.0878***
	(0.00288)
officialmonumentstatus	0.124***
	(0.00871)
parking	0.116***
	(0.00282)
balcony	0.00819***
	(0.00257)
cornerhouse	0.0198***

	(0.00355)
detachedhouse	0.282***
	(0.00458)
semidetachedhouse	0.103***
	(0.00371)
apartment	-0.0726***
	(0.00355)
constructionyear1	0.0288
	(0.0375)
constructionyear2	-0.0110
	(0.0374)
constructionyear3	0.00514
	(0.0374)
constructionyear4	-0.0433
	(0.0374)
constructionyear5	-0.0669*
	(0.0374)
constructionyear6	-0.0325
	(0.0374)
constructionyear7	0.0297
	(0.0375)
constructionyear8	0.143***
	(0.0375)
constructionyear9	0.229***
	(0.0377)
afmeldingyear1996	-0.784***
	(0.00619)
afmeldingyear1997	-0.717***
	(0.00588)
afmeldingyear1998	-0.653***
	(0.00564)
afmeldingyear1999	-0.509***
	(0.00529)
afmeldingyear2000	-0.373***
	(0.00529)
afmeldingyear2001	-0.259***
	(0.00502)
afmeldingyear2002	-0.181***
	(0.00498)
afmeldingyear2003	-0.148***
	(0.00497)
afmeldingyear2004	-0.0816***
	(0.00490)
afmeldingyear2006	0.0375***
	(0.00486)
afmeldingyear2005	-0.0128***
	(0.00485)
afmeldingyear2007	0.0624***
	(0.00469)
afmeldingyear2008	0.0646***

	(0.00498)
afmeldingyear2009	0.0264***
	(0.00538)
afmeldingyear2010	0.0352***
	(0.00540)
afmeldingyear2011	0.0209***
	(0.00558)
afmeldingyear2012	-0.0462***
	(0.00563)
afmeldingyear2013	-0.0851***
	(0.00560)
afmeldingyear2014	-0.0589***
	(0.00496)
elderlypeople	-0.0234***
	(0.0145)
householdsize	0.128***
	(0.204)
youngpeople	0.0343***
	(0.0034)
foreignmigrants	-0.0157***
	(0.104)
populationdensity	1.41e-05***
	(1.30e-05)
Constant	8.393***
	(0.469)
Observations	40,289
R-squared	0.876

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Variables	(5) Model(5b)
Before	0.0204***
	(0.00401)
Between250	0.0124
	(0.0275)
Between500	-0.0539***
	(0.0119)
Between750	-0.0524***
	(0.0101)
Between1000	-0.0595***
	(0.00890)
After	-0.0125***
	(0.00394)
logm2	0.631***
	(0.00442)
obj_hid_NKAMERS	0.0193***

	(0.000932)
garden	0.0201***
	(0.00274)
insidemain	0.112***
	(0.00423)
outsidemain	0.0679***
	(0.00470)
centralheating	0.0888***
	(0.00289)
officialmonumentstatus	0.123***
	(0.00874)
parking	0.117***
	(0.00283)
balcony	0.00811***
	(0.00258)
cornerhouse	0.0197***
	(0.00357)
detachedhouse	0.281***
	(0.00459)
semidetachedhouse	0.102***
	(0.00373)
apartment	-0.0728***
	(0.00356)
constructionyear1	0.0428
	(0.0376)
constructionyear2	0.00322
	(0.0375)
constructionyear3	0.0200
	(0.0375)
constructionyear4	-0.0303
	(0.0376)
constructionyear5	-0.0554
	(0.0375)
constructionyear6	-0.0209
	(0.0375)
constructionyear7	0.0449
	(0.0376)
constructionyear8	0.157***
	(0.0376)
constructionyear9	0.243***
	(0.0378)
afmeldingyear1996	-0.770***
	(0.00615)
afmeldingyear1997	-0.703***
	(0.00583)
afmeldingyear1998	-0.656***
	(0.00569)
afmeldingyear1999	-0.501***
	(0.00533)
afmeldingyear2000	-0.376***

	(0.00533)
afmeldingyear2001	-0.258***
	(0.00505)
afmeldingyear2002	-0.176***
	(0.00500)
afmeldingyear2003	-0.144***
	(0.00498)
afmeldingyear2004	-0.0770***
	(0.00491)
afmeldingyear2006	0.0420***
	(0.00488)
afmeldingyear2005	-0.00820*
	(0.00487)
afmeldingyear2007	0.0615***
	(0.00471)
afmeldingyear2008	0.0695***
	(0.00499)
afmeldingyear2009	0.0278***
	(0.00540)
afmeldingyear2010	0.0393***
	(0.00542)
afmeldingyear2011	0.0215***
	(0.00560)
afmeldingyear2012	-0.0459***
	(0.00565)
afmeldingyear2013	-0.0852***
	(0.00562)
afmeldingyear2014	-0.0591***
	(0.00498)
elderlypeople	-0.0345***
	(0.125)
householdsize	0.129***
	(0.204)
youngpeople	0.0235***
	(0.0241)
foreignmigrants	-0.0162***
	(0.104)
populationdensity	1.38e-05***
	(1.31e-05)
Constant	8.376***
	(0.470)
Observations	40,289
R-squared	0.875

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Variables	(5) Model(5c)

Before	-0.0435***
	(0.00501)
Between	0.0881***
	(0.00494)
After250	0.0201
	(0.0125)
After500	0.0690***
	(0.00616)
After750	0.0433***
	(0.00550)
After1000	0.0415***
	(0.00534)
logm2	0.631***
	(0.00441)
obj_hid_NKAMERS	0.0195***
	(0.000929)
garden	0.0208***
	(0.00273)
insidemain	0.112***
	(0.00422)
outsidemain	0.0681***
	(0.00468)
centralheating	0.0880***
	(0.00288)
officialmonumentstatus	0.124***
	(0.00871)
parking	0.116***
	(0.00282)
balcony	0.00849***
	(0.00257)
cornerhouse	0.0197***
	(0.00355)
detachedhouse	0.283***
	(0.00458)
semidetachedhouse	0.103***
	(0.00371)
apartment	-0.0726***
	(0.00355)
constructionyear1	0.0336
	(0.0375)
constructionyear2	-0.00613
	(0.0374)
constructionyear3	0.0104
	(0.0374)
constructionyear4	-0.0386
	(0.0374)
constructionyear5	-0.0622*
	(0.0374)
constructionyear6	-0.0289

	(0.0374)
constructionyear7	0.0348
	(0.0375)
constructionyear8	0.148***
	(0.0375)
constructionyear9	0.234***
	(0.0377)
afmeldingyear1996	-0.784***
	(0.00619)
afmeldingyear1997	-0.716***
	(0.00588)
afmeldingyear1998	-0.653***
	(0.00564)
afmeldingyear1999	-0.509***
	(0.00529)
afmeldingyear2000	-0.373***
	(0.00529)
afmeldingyear2001	-0.259***
	(0.00502)
afmeldingyear2002	-0.181***
	(0.00498)
afmeldingyear2003	-0.149***
	(0.00497)
afmeldingyear2004	-0.0817***
	(0.00490)
afmeldingyear2006	0.0372***
	(0.00486)
afmeldingyear2005	-0.0130***
	(0.00485)
afmeldingyear2007	0.0620***
	(0.00469)
afmeldingyear2008	0.0644***
	(0.00498)
afmeldingyear2009	0.0261***
	(0.00539)
afmeldingyear2010	0.0349***
	(0.00540)
afmeldingyear2011	0.0207***
	(0.00559)
afmeldingyear2012	-0.0463***
	(0.00563)
afmeldingyear2013	-0.0852***
	(0.00561)
afmeldingyear2014	-0.0589***
	(0.00496)
elderlypeople	-0.0456***
	(0.00345)
householdsize	0.129***
	(0.204)
youngpeople	0.0204***

	(0.0543)
foreignmigrants	-0.0157***
	(0.104)
populationdensity	1.41e-05***
	(1.30e-05)
Constant	8.386***
	(0.469)
Observations	40,289
R-squared	0.876

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Regression results model 6 and 7

Variables	(6) Model (6)	(7) Model (7)
Before	-0.0208	-0.0134**
	(0.0132)	(0.00536)
Between	0.0190	0.101***
	(0.0129)	(0.00593)
After	0.0276**	0.0256***
	(0.0132)	(0.00479)
logm2	0.621***	0.634***
	(0.00891)	(0.00499)
obj_hid_NKAMERS	0.0226***	0.0201***
	(0.00151)	(0.00115)
garden	-0.0354***	0.0513***
	(0.00588)	(0.00299)
insidemain	0.119***	0.109***
	(0.00915)	(0.00453)
outsidemain	0.0396***	0.0801***
	(0.00978)	(0.00512)
centralheating	0.0466***	0.0831***
	(0.00711)	(0.00300)
officialmonumentstatus	0.0968***	0.129***
	(0.0188)	(0.00930)
parking	0.0902***	0.128***
	(0.00441)	(0.00362)
balcony	0.0369***	0.00508*
	(0.00579)	(0.00276)
cornerhouse	0.0364***	0.0161***
	(0.00586)	(0.00433)
detachedhouse	0.313***	0.249***
	(0.00700)	(0.00646)
semidetachedhouse	0.136***	0.0855***
	(0.00564)	(0.00511)
apartment	-0.0549***	-0.0633***

	(0.00951)	(0.00369)
constructionyear1	0.0297	-0.0474
	(0.0474)	(0.0654)
constructionyear2	-0.00232	-0.0857
	(0.0468)	(0.0653)
constructionyear3	0.101**	-0.0808
	(0.0470)	(0.0653)
constructionyear4	-0.00423	-0.120*
	(0.0468)	(0.0654)
constructionyear5	-0.0219	-0.149**
	(0.0466)	(0.0654)
constructionyear6	0.00474	-0.119*
	(0.0465)	(0.0654)
constructionyear7	0.0595	-0.0405
	(0.0466)	(0.0655)
constructionyear8	0.183***	0.0530
	(0.0468)	(0.0654)
constructionyear9	0.266***	0.139**
	(0.0474)	(0.0655)
afmeldingyear1996	-0.669***	-0.847***
	(0.0119)	(0.00708)
afmeldingyear1997	-0.566***	-0.787***
	(0.0117)	(0.00660)
afmeldingyear1998	-0.502***	-0.718***
	(0.0117)	(0.00616)
afmeldingyear1999	-0.308***	-0.593***
	(0.0107)	(0.00581)
afmeldingyear2000	-0.197***	-0.448***
	(0.0106)	(0.00583)
afmeldingyear2001	-0.124***	-0.312***
	(0.0101)	(0.00554)
afmeldingyear2002	-0.0538***	-0.231***
	(0.0102)	(0.00546)
afmeldingyear2003	-0.0229**	-0.197***
	(0.0101)	(0.00546)
afmeldingyear2004	0.0273***	-0.125***
	(0.00974)	(0.00543)
afmeldingyear2006	0.106***	0.00902*
	(0.00962)	(0.00540)
afmeldingyear2005	0.0499***	-0.0375***
	(0.00957)	(0.00541)
afmeldingyear2007	0.0996***	0.0489***
	(0.00922)	(0.00524)
afmeldingyear2008	0.105***	0.0515***
	(0.00989)	(0.00555)
afmeldingyear2009	0.0795***	0.00324
	(0.0107)	(0.00600)
afmeldingyear2010	0.0850***	0.0185***
	(0.0103)	(0.00608)
afmeldingyear2011	0.0558***	0.00457

	(0.0107)	(0.00628)
afmeldingyear2012	-0.0275***	-0.0535***
	(0.0104)	(0.00640)
afmeldingyear2013	-0.0723***	-0.0897***
	(0.0104)	(0.00638)
afmeldingyear2014	-0.0535***	-0.0611***
	(0.00920)	(0.00563)
elderlypeople	-0.0345***	-0.0432***
	(0.0245)	(0.0356)
householdsize	0.317**	0.205***
	(0.143)	(0.0699)
youngpeople	0.242***	0.357***
	(0.0356)	(0.0234)
foreignmigrants	-0.0326***	-0.0234***
	(0.0394)	(0.0643)
populationdensity	5.75e-05***	1.17e-05***
	(1.99e-05)	(1.55e-06)
Constant	7.857***	8.858***
	(0.232)	(0.0909)
Observations	12,050	28,130
R-squared	0.861	0.874

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Appendix E. Data preparation

Description	Stata command
Merges	
Merge location coordinates with NVM dataset	merge m:1 zipcode+housenumber using ‘’BAG01012013_XY.dta’’
Merge CBS data with NVM dataset	merge m:1 obj_buut_ID using ‘’Neighborhood.dta’’
Generate CBS variables	
Generate household variable	gen household = 0 replace household = 1.2 if h==1 replace household = 1.3 if h==2 replace household = 1.4 if h==3 replace household = 1.5 if h==4 replace household = 1.6 if h==5 replace household = 1.7 if h==6 replace household = 1.8 if h==7 replace household = 1.9 if h==8 replace household = 2.0 if h==9 replace household = 2.1 if h==10 replace household 2.2 if h==11 replace household 2.3 if h==12 replace household 2.4 if h==13 replace household 2.5 if h==14 replace household 2.6 if h==15 replace household 2.7 if h==16 replace household 2.8 if h==17 replace household 2.9 if h==18 replace household 3.0 if h==19
Generate young variable	gen youngtot = bevolkingleeftijdsgroepen0tot15j + bevolkingsleeftijdgroepen15tot25
Generate foreign variable	gen foreigntot = bevolkingallochtonenwesterstotaa + bevolkingallochtonennietwestern /// + bevolkingallochtonennietwestersm + v13 + bevokingallochtonennietwesterss + /// bevolkingallochtonennietwesterst + bevolkingallochtonennietwestereso
Generate old variable	gen old = oldtot/bevolkingaantalinwonersaantal
Generate distance variable	
Insert x en y coordinates of the selected stations	import excel spreadsheet ‘’stationsx+y’’

Generate distance variable from station to observations (in meters)	gen distance = sqrt ((X-stations)^2+(Y-stationsy)^2)
Generate transaction year variable	
Generate transactionyear variable	gen double afmelding = (obj_hid_DATUM_AFMELDING*1000) format afmelding %tc generate afmeldingyear = year (dofc(afmelding))
Log transformations	
Generate logarithm of transaction price	gen logprice = log (obj_hid_TRANSACTIEPRIJS)
Generate logarithm of living area	gen logm2 = log (obj_hid_m2)
Generate housing characteristics dummies	
Generate insidemaintaince dummy	gen insidemain = 0 replace insidemain =1 if inlist(obj_hid_ONBI, 6,7,8,9)
Generate outsidemaintenance dummy	gen outsidemain = 1 if inlist(obj_hid_ONBIJ, 6,7,8,9)
Generate centralheating dummy	gen centralheating = 0 replace centralheating = 1 if obj_hid_VERW == 2
Generate construction period dummy 1500 - 1905	gen constructionyear1 = 0 replace constructionyear1 = 1 if BWPER == 1
Generate construction period dummy 1906 - 1930	gen constructionyear2 = 0 replace constructionyear2 = 1 if BWPER == 2
Generate construction period dummy 1931 - 1944	gen constructionyear3 = 0 replace constructionyear3 = 1 if BWPER == 3
Generate construction period dummy 1945 - 1959	gen constructionyear4 = 0 replace constructionyear4 = 1 if BWPER == 4
Generate construction period dummy 1960 - 1970	gen constructionyear5 = 0 replace constructionyear5 = 1 if BWPER ==5
Generate construction period dummy 1971 - 1980	gen constructionyear6 = 0 replace constructionyear6 = 1 if BWPER == 6
Generate construction period dummy 1981 - 1990	gen constructionyear7 = 0 replace constructionyear7 = 1 if BWPER == 7
Generate construction period dummy 1991 - 2000	gen constructionyear8 = 0 replace constructionyear8 = 1 if BWPER == 8
Generate construction period dummy >2001	gen constructionyear9 = 0 replace constructionyear9 = 1 if BWPER == 9
Generate official monumentstatus dummy	gen officalmonumentstatus = 0 replace officialmonumentstatus = 1 if obj_hid_MONUMENT ==1
Generate standard house dummy	gen standardhouse = 0 replace standardhouse = 1 if obj_hid_TYPE == 1

Generate detached house dummy	gen detachedhouse = 0 replace detachedhouse = 1 if obj_hid_TYPE == 5
Generate semidetached house dummy	gen semidetachedhouse = 0 replace semidetachtedhouse = 1 if inlist obj_hid__TYPE == 4
Generate corner house dummy	gen cornerhouse = 0 replace cornerhouse = 1 if obj_hid_TYPE == 3
Generate apartment dummy	gen apartment = 0 replace apartment = 1 if == 2
Generate parking dummy	gen parking = 0 replace parking = 1 if inlist(obj_hid_PARKEER,2,3,4,6,8)
Generate balcony dummy	gen balcony = 0 replace balcony = 1 if inlist (obj_hid_NBALKON,1,2,3,4,5,6,7,8,9)
Generate garden dummy	gen garden = 0 replace garden = 1 if obj_hid_TUIN_OPP>0
Excluding outliers	
Drop cases that are further away than 2000 meters	drop if distance>2000
Drop cases with implausible transaction prices	drop if obj_hid_TRANSACTIEPRIJS<2500 obj_hid_TRANSACTIEPRIJS>2500000
Drop cases with implausible number of rooms	drop if obj_hid_NKAMERS<0
Drop if housetype is not regular home	drop if obj_hid_SOORTHUIS==1 drop if obj_hid_SOORTHUIS==2 drop if obj_hid_SOORTHUIS==3 drop if obj_hid_SOORTHUIS==4
Generate key variables	
Generate Before variable	gen Before = 0 replace Before = 1 if distance<1000
Generate Between variable	gen Between = 0 replace Between = 1 if distance<1000 & transactionyear>startredevelopment & transactionyear<endredevelopment gen After = 0
Generate After variable	replace After = 1 if distance<1000 & transactionyear>endredevelopment
Generate ring radius After 0-250m	gen after250=0

Generate ring radius After 250-500m	replace after250=1 if distance<250 & transactionyear>endredevelopment gen after500=0 replace after500=1 if distance>250 & distance<500 & transactionyear>endredevelopment
Generate ring radius After 500-750m	gen after750=0 replace after750=1 if distance>500 & distance<750 & transactionyear>endredevelopment
Generate ring radius After 750-1000m	gen after1000=0 replace after1000=1 if distance>750 & distance<750 & transactionyear>endredevelopment
Generate groups for Chow-Test	
Generate group excluding largest 4	
	gen group1=0 replace group1 = 1 if inlist (stationnaam, ‘’Vught’’ , ‘’Klimmen-Ransdaal’’ , ‘’Harlingen’’ , ‘’Zevenbergen’’, ‘’Wolfheze’’ , ‘’ Boxmeer’’ , ‘’Landgraaf’’ , ‘’Wolvega’’ , ‘’Oisterwijk’’ , ‘’Winschoten’’)
	gen group2= 0 replace group2 =1 if inlist (stationnaam, ‘’Horst-Sevenum’’, ‘’Tiel’’ , ‘’Roosendaal’’ , ‘’Groningen’’)
Regressions	
Regression without structural or neighborhood characteristics (1)	reg logprice BEFORE BETWEEN AFTER afmeldingyear1996 afmeldingyear1997 /// afmeldingyear1998 afmeldingyear1999 afmeldingyear2000 afmeldingyear2001 /// afmeldingyear2002 afmeldingyear2003 afmeldingyear2004 afmeldingyear2006 /// afmeldingyear2005 afmeldingyear2007 afmeldingyear2008 afmeldingyear2009 /// afmeldingyear2010 afmeldingyear2011 afmeldingyear2012 afmeldingyear2013 /// afmeldingyear2014
Regression with structural characteristics (2)	reg logprice BEFORE BETWEEN AFTER logm2 obj_hid_NKAMERS garden insidemain /// outsidemain centralheating officialmonumentstatus parking balcony /// cornerhouse detachedhouse semidetachedhouse apartment constructionyear1 /// constructionyear2 constructionyear3 constructionyear4 constructionyear5 /// constructionyear6 constructionyear7 constructionyear8 constructionyear9 ///afmeldingyear1996 afmeldingyear1997 afmeldingyear1998 afmeldingyear1999 /// afmeldingyear2000 afmeldingyear2001 afmeldingyear2002 afmeldingyear2003 /// afmeldingyear2004 afmeldingyear2006 afmeldingyear2005 afmeldingyear2007 ///

	afmeldingyear2008 afmeldingyear2009 afmeldingyear2010 afmeldingyear2011 /// afmeldingyear2012 afmeldingyear2013 afmeldingyear2014
Regression with structural characteristics and neighborhood dummy (3)	areg logprice BEFORE BETWEEN AFTER logm2 obj_hid_NKAMERS garden insidemain /// outsidemain centralheating officialmonumentstatus parking balcony /// cornerhouse detachedhouse semidetachedhouse apartment constructionyear1 /// constructionyear2 constructionyear3 constructionyear4 constructionyear5 /// constructionyear6 constructionyear7 constructionyear8 constructionyear9 ///afmeldingyear1996 afmeldingyear1997 afmeldingyear1998 afmeldingyear1999 /// afmeldingyear2000 afmeldingyear2001 afmeldingyear2002 afmeldingyear2003 /// afmeldingyear2004 afmeldingyear2006 afmeldingyear2005 afmeldingyear2007 /// afmeldingyear2008 afmeldingyear2009 afmeldingyear2010 afmeldingyear2011 /// afmeldingyear2012 afmeldingyear2013 afmeldingyear2014, robust absorb(obj_buurt_ID)
Regression containing structural and neighborhood characteristics (4)	areg logprice BEFORE BETWEEN AFTER logm2 obj_hid_NKAMERS garden insidemain /// outsidemain centralheating officialmonumentstatus parking balcony cornerhouse /// detachedhouse semidetachedhouse apartment constructionyear1 /// constructionyear2 constructionyear3 constructionyear4 constructionyear5 /// constructionyear6 constructionyear7 constructionyear8 constructionyear9 /// afmeldingyear1996 afmeldingyear1997 afmeldingyear1998 afmeldingyear1999 /// afmeldingyear2000 afmeldingyear2001 afmeldingyear2002 afmeldingyear2003 /// afmeldingyear2004 afmeldingyear2006 afmeldingyear2005 afmeldingyear2007 /// afmeldingyear2008 afmeldingyear2009 afmeldingyear2010 afmeldingyear2011 /// afmeldingyear2012 afmeldingyear2013 afmeldingyear2014 old household young /// foreign popdens, robust absorb (obj_buurt_ID)
Regression alternative model	areg logprice before250 before500 before750 before1000 between250 between500 between750 between1000 after250 after500 after750 after1000 logm2 obj_hid_NKAMERS garden insidemain /// outsidemain centralheating officialmonumentstatus parking balcony cornerhouse ///

	detachedhouse semidetachedhouse apartment constructionyear1 /// constructionyear2 constructionyear3 constructionyear4 constructionyear5 /// constructionyear6 constructionyear7 constructionyear8 constructionyear9 /// afmeldingyear1996 afmeldingyear1997 afmeldingyear1998 afmeldingyear1999 /// afmeldingyear2000 afmeldingyear2001 afmeldingyear2002 afmeldingyear2003 /// afmeldingyear2004 afmeldingyear2006 afmeldingyear2005 afmeldingyear2007 /// afmeldingyear2008 afmeldingyear2009 afmeldingyear2010 afmeldingyear2011 /// afmeldingyear2012 afmeldingyear2013 afmeldingyear2014 old household young /// foreign popdens, robust absorb (obj_buurt_ID)
Regression excluding largest 4	areg logprice BEFORE BETWEEN AFTER logm2 obj_hid_NKAMERS garden insidemain /// outsidemain centralheating officialmonumentstatus parking balcony cornerhouse /// detachedhouse semidetachedhouse apartment constructionyear1 /// constructionyear2 constructionyear3 constructionyear4 constructionyear5 /// constructionyear6 constructionyear7 constructionyear8 constructionyear9 /// afmeldingyear1996 afmeldingyear1997 afmeldingyear1998 afmeldingyear1999 /// afmeldingyear2000 afmeldingyear2001 afmeldingyear2002 afmeldingyear2003 /// afmeldingyear2004 afmeldingyear2006 afmeldingyear2005 afmeldingyear2007 /// afmeldingyear2008 afmeldingyear2009 afmeldingyear2010 afmeldingyear2011 /// afmeldingyear2012 afmeldingyear2013 afmeldingyear2014 old household young /// foreign popdens, robust absorb (obj_buurt_ID) if group1==1
Regression largest 4	areg logprice BEFORE BETWEEN AFTER logm2 obj_hid_NKAMERS garden insidemain /// outsidemain centralheating officialmonumentstatus parking balcony cornerhouse /// detachedhouse semidetachedhouse apartment constructionyear1 /// constructionyear2 constructionyear3 constructionyear4 constructionyear5 /// constructionyear6 constructionyear7 constructionyear8 constructionyear9 /// afmeldingyear1996 afmeldingyear1997 afmeldingyear1998 afmeldingyear1999 /// afmeldingyear2000 afmeldingyear2001 afmeldingyear2002 afmeldingyear2003 ///

	afmeldingyear2004 afmeldingyear2006 afmeldingyear2005 afmeldingyear2007 /// afmeldingyear2008 afmeldingyear2009 afmeldingyear2010 afmeldingyear2011 /// afmeldingyear2012 afmeldingyear2013 afmeldingyear2014 old household young /// foreign popdens, robust absorb (obj_buurt_ID) if group2==2
Regression group1 and group2	areg logprice BEFORE BETWEEN AFTER logm2 obj_hid_NKAMERS garden insidemain /// outsidemain centralheating officialmonumentstatus parking balcony cornerhouse /// detachedhouse semidetachedhouse apartment constructionyear1 /// constructionyear2 constructionyear3 constructionyear4 constructionyear5 /// constructionyear6 constructionyear7 constructionyear8 constructionyear9 /// afmeldingyear1996 afmeldingyear1997 afmeldingyear1998 afmeldingyear1999 /// afmeldingyear2000 afmeldingyear2001 afmeldingyear2002 afmeldingyear2003 /// afmeldingyear2004 afmeldingyear2006 afmeldingyear2005 afmeldingyear2007 /// afmeldingyear2008 afmeldingyear2009 afmeldingyear2010 afmeldingyear2011 /// afmeldingyear2012 afmeldingyear2013 afmeldingyear2014 old household young /// foreign popdens, robust absorb (obj_buurt_ID) group1 group2
Chow-Test	test _b[group1]=0, notest test _b[group2]=0, accum