Out of business:

A quantitative approach to determine the effect on residential property prices when business areas disappear within their vicinity.

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June 21, 2019

Abstract. Residential properties prices are influenced by many different factors. One of them is the vicinity of business areas. It is known that business areas often negatively influence nearby residential property prices, although the availability of employment (partly) compensates this negative effect. However for now, the effect of their disappearance on nearby residential property prices is unknown. Therefore, this research investigates the effects on residential property prices when business areas disappear within their vicinity. This research data came from three organizations: the IBIS, NVM and CBS. It contained the years 2006 and 2017 and applies to the whole of the Netherlands. The datasets were combined and the distances of the residential properties were measured. This created a large variety of control variables to measure the price effect of the disappearance of business areas. The measurement was applied with a basic hedonic price model and multiple difference-in-difference models. The target and treatment areas were between 0 and 1750 meter from the (former) business area and reference and control areas were between 1750 and 2500 meter. Residential property prices were positively influenced by the presence of business areas in 2006, but this effect disappeared in 2017. However, it appears this effect is only caused in the Near Randstad and Randstad areas, as no changes or effects appeared in the Rest of the Netherlands area. This concludes, that lower residential property values are expected up to a distance of 1750 meter in the Randstad and near Randstad areas when business areas disappear within their vicinity.

Keyword: business areas, residential property prices, hedonic price model, difference-in-difference.

University of Groningen

Faculty of Spatial Sciences

MSc Real Estate Studies

Master Thesis

COLOPHON

Document	Master Thesis Real Estate Studies
Title	Out of business: A quantitative approach to determine the effect on residential property prices when business areas disappear within their vicinity.
Version	Final
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Date	21 June 2019
Word count	18301

University of Groningen
Faculty of Spatial Sciences
MSc Real Estate Studies

Preface

The report in front of you is the final result of the master thesis required to finish the Master Real Estate Studies on the University of Groningen. The past 11 months, I have been studying the effect on residential property prices when business areas disappear within their vicinity in the Netherlands.

This thesis could not have been made without help of other individuals and organizations and with this preface, I personally want to thank those. At first, I want to thank Dr. Mark van Duijn for supervising and helping me with my thesis. Furthermore, I want to thank the NVM for giving me access to their database and the CBS and IBIS for their public availability of their databases. And finally, I want to thank family and friends who supported me through this process, which led to this final result.

I hope you enjoy reading my thesis and that it will give new insights to your knowledge about business areas and its effect on residential property prices,

Rowan van Houwelingen
Groningen, 21 June 2019.

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1. Introduction

Business areas are of major importance to the Dutch economy: nearly 30 percent of the working population have their employment in these areas (LISA, 2012). This number is likely to be higher in the future as in recent years business areas have significantly grown is size. Between 1996 and 2012, their size increased from 649 to 814 square kilometer, a growth of almost 30 percent. In comparison, the size of residential areas only increased by 12 percent in the same period (CBS, 2016). The growth of business areas is mainly driven by two positive externalities: they bring local employment opportunities and they benefit the local economy (BNNVARA Vroege Vogels, 2019; Bardoel, 2019). However, business areas have quite some downsides for nearby residents. There are several negative externalities that could affect residential areas. Some examples are; pollution, traffic disturbance, odor nuisance and industrial noise (Dagblad van het Noorden, 2016; De Limburger, 2016; RTV Noord, 2018). Due to these negative externalities, municipalities in the Netherlands had plans to restructure 15 percent of the business areas by 2009. Most of these business areas were near or surrounded by residential areas. According to these plans, one-third of the business areas should be revitalized into a more modern business area. The other remaining two-third are considered to become a mixed zone, a residential area or completely remediated. When a business area is restructured into residential area, local inhabitants experience a higher quality of the nearby urban environment. The higher quality of the urban environment should lead to higher residential property prices in those areas (Renes et al., 2009).

However, what is exactly a business area? The terminology regarding industrial properties varies in the literature. Industrial areas, brownfields and business areas are terms which are strongly interwoven. Concerning this issue, Ball & Pratt (2018, p.20) stated that "*the definitions around industrial properties tell more about the definer, or the purpose of the definition than the objects they define.*" However, to asses an appropriate terminology for this research, it is chosen to work with the term of business areas used in the research of De Vor & De Groot. De Vor & De Groot (2010, p.17) stated that "*Business areas are in principle designed to accommodate, mostly large-scale, economic activities which harm the environmental housing conditions by, amongst others, noise nuisance, air pollution and traffic inconvenience.*" This means that industrial and distribution areas are included in this comprehensive term and for example merely office locations are excluded, as they generally do not harm the environmental housing conditions.

There are several studies that have investigated the effects of business areas or industrial properties on nearby residential property prices. Beekmans & Beckers (2014) used a hedonic price analysis to determine the value of properties on business areas. They found that mixed-used sites have the lowest average property values and that specialization of business sites had a significant positive influence on the property values. Although they measured the prices of houses in the mixed-use zones, they did not measure the effects on nearby residential areas property values. De Vor & De Groot (2011) investigated the effects of business areas on nearby residential property prices. They concluded that business areas had a negative effect on residential property prices. As a result, they expected that residential property values would increase after business areas would disappear within their vicinity. Yet, no further research on this topic was undertaken to obtain the exact magnitude of this effect. Another research closely related to the effects of business areas on residential property prices is Van Duijn et al. (2016) on the redevelopment of 36 industrial heritage sites in the Netherlands. They found that the negative effects on residential property prices disappeared when the redevelopment started of industrial areas with heritage value. In the larger cities, there were even higher nearby residential property prices after redevelopment had taken place. However, the relatively small number of business areas and the emphasis on industrial heritage, makes generalization not suitable for the overall effect on residential property prices when business areas disappear within their vicinity.

To increase the knowledge and give new insights on residential property values after business areas leave their vicinity, the main research question will be: What is the general effect on residential property prices when business areas disappear within their vicinity? This research is therefore an attempt to measure the general effect on residential property prices when business areas disappear within their vicinity. It will add to literature that it measures to which extend there is an effect on residential property prices when business areas disappear within their vicinity. Also, it will reveal a general effect on residential property prices caused by the large number of disappeared business areas, without a connection to their type of redevelopment.

There are 3 sub questions which supports the main research question. The first sub question is: *Which factors determine residential property prices and what are the expected price effects when business areas disappear within their vicinity?* This question will be answered with a literature research in the theoretical framework. The focus is on the externalities of business areas and control variables for residential property prices. The outcomes will lead to the hypotheses in the end of chapter 2. The second sub question is: *To what distance are residential property prices effected when business areas disappear within their vicinity?* The methodology and data chapters will answer this question. Comparable studies will be consulted for their measurement distances for the appropriate control and treatment areas. Data from the IBIS, NVM and CBS will be collected and edited. With the combination of this data, testing between different distances of the treatment and control areas becomes possible. Than the distance where the disappearance of business areas had an effect on residential property prices can be determined. The final sub question is: *What is the effect on residential property prices caused by the vicinity of business areas?* The answer on this question helps to determine the magnitude of a possible effect on residential property prices before business disappear within their vicinity. This magnitude will be measured with a hedonic price model with the same areas and data before business areas had been disappeared. The model will have the same variables as a difference-in-difference model to answer the main question.

This research paper is organized in the following order: Chapter 2 is the theoretical framework. Here, the different theories regarding residential property price determinants and the externalities of business areas are discussed. At last, the hypotheses of the research will finalize this chapter. Chapter 3 will contain the research method. The different methods used in the research will be explained. The formulas of the regression models will be shown as for the variables included in the models. Chapter 4 contains the data and descriptive statistics. Here, the used datasets and data selection is described, followed by an overview of the statistics of the included variables in the regression models. Chapter 5 is where the results are represented. The outcomes from the different regression models are shown in individual regression tables. And finally, chapter 6 will be the conclusion and discussion of the research.

2. Theoretical framework

In this chapter, the underlying literature of the research will be discussed. At first, the principles of value creation of residential properties will be explained. The second part of this chapter is the used terminology of business areas. Then, the third part is about business areas and their externalities on residential areas. This is followed by the fourth part about other property price determinants. The fifth and final part of the chapter contains the research hypotheses.

2.1. Principles of residential property values

The underlying principles that determine residential property values can be traced back to the 19th century. The first theories over residential property prices originated from theories over land values. Ricardo (1821) found, that the demand for land determines the amount of rent paid. In this research, land owners had no role other than trying to obtain the highest possible rent. In addition to this, Von Thunen (1826) found a pattern whereby agricultural land values were the highest near any major town where there was a market for their produce. The value of land rapidly declined with the increased distance from a market. This was due to the cost of transportation of the products. This principle of land values was later called the Bid Rent Theory. The same principles for land values and rents are still applicable for commuter distances and the value of residential properties (Evans, 2008). Later on, the neoclassical rent theory was developed, which conflicts the original idea of Ricardo. Jevons (1911) noted, that the value of land is determined by their rent, which in turn is determined by the use of the land to the most profitable alternative usage. The key differences in Jevons (1911), is that land could be used for multiple purposes, and thus, their value could be increased as it could be used in their most profitable form. However, Evans (2008) notes that in situations with planning restriction, the classical Ricardian theories are still applicable. Due to the lack of alternative uses of the available land, the price for residential usage could then be derived from the demand for its use. Next to the demand, there is the supply of residential space. Ricardo (1821) assumed, that there was a fixed supply of land. However, that argument can be altered due to planning regulations. When there are changes in the zoning regulations, more land could be supplied to the market. As a result, this increases the supply which should lead to lower prices. The opposite effect is also possible. New planning restrictions could lower the availability of residential properties, which leads to higher prices by the same demand (Evans, 2008).

Another important theory among residential property values is the Four-Quadrant Model from DiPasquale & Wheaton (1992). The Four-Quadrant Model exists out of two important equations (Lisi, 2015):

1. $D(R, P, U, X) = S$
2. $\Delta S = \Delta S_{t+1} - S_t = C(K, P) - \delta * S,$

The first formula is the demand for residential properties (D). It exists out the rent price of properties (R), the property price (P), cost of homeownership (U) and exogenous variables (X). This demand leads to a new supply of residential properties (S). The second formula is the change of supply of residential properties (ΔS). The formula goes as follows: the cost of new construction of properties (C) minus the depreciation rate of residential properties supply at the exogenous rate of (δ) times the number of new supplied residential properties (S). The cost of new construction exists of construction costs (K) and the price of residential properties (P). These equations lead to the model on the following page (Figure 1).

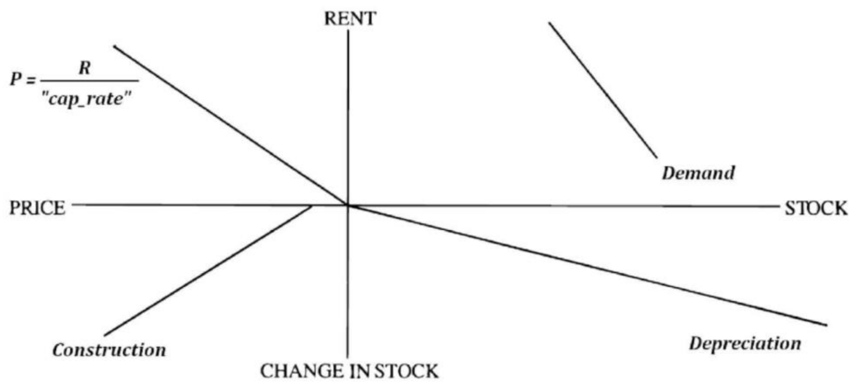

Figure 1. The Four-Quadrant model and its underlying variables (Lisi, 2015).

The model works in the following way: the preliminary amount of housing, is the demand for residential space that is equal to the amount of residential space supplied. This is because the rent is determined by the market. This meant the model is in the equilibrium position at the start. The demand exists out of the rent price and the economic conditions. When there is a positive shock in demand, rents will go up. When the capitalization rate stays equal, the higher rents leads to higher prices. The higher prices leads to more construction of residential property space, resulting in a positive change in stock. As consequence, there is a higher amount of depreciation, which results in a change in demand. This process will continue until there is a new equilibrium. When a negative shock appears, opposite will occur. The important aspect of this model, is that if there is a change in any of the variables, all the others will be affected as well.

2.2. Externalities of business areas

Next to the theories about the principles of residential property values, there are several theories over how residential property values are influenced through the externalities of business areas. Verhoef & Nijkamp (2002) investigated business areas and its externalities in a hypothetical model of a monocentric city. In this model, there was a spatial equilibrium where they measure the externalities of industrial centers on rents of residential areas. These externalities were split in two effects: The positive externality is the agglomeration effects of business areas and the negative externality is the pollution caused by business areas. The agglomeration externality was expressed as the commuting time for employment and pollution was measured as a decrease in environmental quality. This meant, as earlier noticed by Evans (2008), that when the distances to business areas increases, the longer commuting time leads to lower rents. This distance decay function is reversed for the externality of environmental quality, whereby greater distances leads to higher rents. As they run the spatial equilibrium model, they concluded that over an extended period of time, the externalities from business areas lead to an inverted U-shaped rent gradient. This meant lower rents near and far from the business areas, and higher rents in the intermediate distance (Verhoef & Nijkamp, 2002).

The notion that business areas decrease property rents, and thus their values, is further strengthened by Farber (1998). He found, that hazardous manufacturing facilities reduce the residential property values in their immediate vicinity. De Vor & De Groot (2011) and Visser & Van Dam (2006) found, that business areas have negative an effect on nearby residential property values. Visser & Van Dam (2006) found a negative correlation between the percentages of business areas in a neighborhood with residential property prices. Like Verhoef & Nijkamp (2002), De Vor & De Groot (2011) also concluded, that the impact of negative externalities of industrial properties affected the perception on the spatial quality of nearby residential properties. In Xie & Li (2010), two other examples of externalities caused by business areas are found. These are the risk of negatively influence public health and wide scale pollution. This is strengthened by Smolen et al. (1991). They found, that pollution greatly affects the residential property value. Severe pollution could cause up to a 25 percent decrease in residential property value. Martin et al. (2006) found, that homeowners are willing to pay for lower nearby noise disturbance and air pollution. This is supported by Beekmans et al. (2014) and De Vor & De Groot (2011). They concluded, that traffic nuisance had a negative effect on residential property values. However, according to Greenberg et al. (2001), negative externalities do not necessary disappear when business areas leave within the vicinity of a residential area. Former business areas are often polluted, have high risk of fires, contain abandoned hazardous materials and pose (drink)water threats. These aforementioned effects would only disappear after soil remediation and redevelopment have taken place. An important aspect by determining the total effect of externalities around business areas is found in the research of Sweeney & Feser (2004). They conclude, that externalities do not always operate in a uniform manner. This is due to the variation among industrial and metropolitan areas, the urban form and institutional structures. This greatly complicates the measurement of their externalities.

Despite for the negative externalities on residential housing, there are also positive externalities caused by business areas. The most important factors are the short commuting time and nearby employment opportunities. Oswald (1999) concluded, that longer commuting distances through the loss of local employment reduces the gain from a job. This is the process where the net wage becomes lower in value due to the increased cost and length in commuting time. This effect is confirmed in the research of So et al. (2001). They found the connection between the length of transportation, wages and residential property prices in the United States. Gallin (2006) and Genesove & Mayer (1994) found a strong relationship between employment, local economies and residential property prices. They concluded, that the loss of local employment will result in a worse local economic situation, which in turn decreased residential property prices. This is supported by Himmelberg et al. (2005) and Case & Mayer (1996). Both studies found, that residential property prices are negatively affected after the disappearance of local industry. According to De Souca (2005), a good example of this effect can be found in the United States. The tendency of manufacturing enterprises to leave urban areas, and therefore the loss of local employment, has led to a depressed real estate market in many cities. In contrast, DeFusco et al. (2016) found, that residential property prices rose enormous in the Silicon Valley, due to the increased scale of the nearby tech industry.

However, Himmelberg et al. (2005) noted, that the growth rate in residential property values does not always follow the changes in industrial concentrations. This may be due to another important aspect, namely the elasticity of the local residential property market (Zietz et al., 2007). The study of Enrico (2011) strengthen this notion. There was found, that a shock to a local labor market is partially capitalized into local residential property prices. Also, this research found, that the total effect of the loss of employment is mainly determined by the elasticity of the local housing market, which differs from city to city.

2.3. Residential property prices determinants

As residential properties are heterogeneous goods, they are all different from each other (Dunse & Jones 1998). There are many different determinants that could affect the residential property prices, and therefore, they need to be included in this research. These determinants can be divided in individual, physical surrounding, social surrounding and market factors.

Probably the most important aspect of individual characteristics is the amount of m^2 floor space. There are many different researches that point out that an increase in size of a residential property led to a higher value (Zietz et al., 2008; Van Duijn et al., 2016; De Vor & De Groot, 2011). In different researches, the number of rooms is found as a positive determinant for property values (Van Duijn et al., 2016; Paterson & Boyle, 2002). However, according to Zietz et al. (2008) this is often correlated with the amount of m^2 and therefore, not always significant for the property value. Other individual determinants are the type of the property (Van Duijn et al., 2016; De Vor & De Groot, 2011), age of the property (Zietz et al., 2008; Bartolomew & Ewing, 2011; Paterson & Boyle, 2002; De Vor & De Groot, 2011), monumental status (Van Duijn et al., 2016), the availability of a balcony (Bartolomew & Ewing, 2011), garage (Paterson & Boyle, 2002; De Vor & De Groot, 2011; Zietz et al., 2008) and a fireplace (Paterson & Boyle, 2002).

Physical surrounding determinants that influence the residential property value mainly concern the built environment. The degree of urbanity can influence the local property values (Beekmans et al., 2014). According to Paterson & Boyle (2002), this effect can be seen in rural areas, whereby property values are higher than elsewhere. However, according to Andersson, Shyr & Fu (2010), the same higher values occur within properties in residential areas. Areas close to city centers have higher property values according to Van Duijn et al. (2016) and Van Dam & Visser (2006). Furthermore, geographical features can have effect on residential property values. Property values tend to be higher with public green, forest, water or an open view (Van Duijn et al., 2016; Van Dam & Visser, 2006; Bartolomew & Ewing, 2011; Paterson & Boyle, 2002).

Social surrounding values also have an effect on residential property values. A high amount of non-western immigrants has a negative influence on local property values (Van Duijn et al., 2016; De Vor & De Groot, 2011). Higher population densities have negative effects on residential property values (Van Duijn et al., 2016; De Vor & De Groot, 2011; Van Dam & Visser). At last, a high level of residents that are unemployed in the neighborhood negatively influence residential property values (Bartolomew & Ewing, 2011).

For market factors, the location in the Netherlands is important for residential property prices. De Vor & De Groot (2011) found, that residential property prices in and near the Randstad are more expensive than in the rest of the Netherlands. This is due to the larger employment opportunities in this region. Also, between neighborhoods within a city, there could be undisclosed differences in residential prices (Van Duijn et al., 2016). Tax systems, market demand and other macro-economic factors are other important variables for residential property prices (Van den Noord, 2005).

2.4. Hypotheses

As exemplified in the previous paragraph, there are many different externalities caused by business areas on residential properties. There are positive and negative effects that influence residential property values. Because of the conflicting effects, it is questionable to state that when local business areas disappear within the vicinity of residential areas, the values would rise or decrease. The studies of De Vor & De Groot (2011) and Verhoef & Nijkamp (2002) both concluded that on short distances, the negative externalities of business areas outweigh their positive externalities. Therefore, residential property values should increase when business areas disappear within their vicinity. Enrico (2011) found, that there are differences in the effects of employment loss on residential property prices between cities due to the differences in urban structure. In the Netherlands, the Randstad greatly differ from the rest of the country. In the Randstad, there are more employment opportunities for local residents, thus lowering the effect of nearby employment loss. One can therefore expect there is a more positive effect on residential property prices in the Randstad than in the rest of the Netherlands when business areas disappear within their vicinity. Therefore, the following hypotheses for this research are:

1. Business areas have a negative effect on nearby residential property values.

2. Residential property values increase when business areas disappear within their vicinity.

3. There is a more positive effect on residential property values in the Randstad than in the other areas in the Netherlands when business areas disappear within their vicinity.

3. Methodology

In the coming chapter, the research method will be explained and the justification for its use. The used models will be clarified, as for the included variables. A standard hedonic price model will be explained, which is intended to measure the effect of business areas on nearby residential property prices. Then, the difference-in-difference models are discussed. These are models that measures the effect on residential property prices when business areas disappear within their vicinity. The same effects are measured when the model is split into different areas of the Netherlands.

3.1 Standard hedonic price model

As read in the previous chapter, residential property prices can be derived from the approach of a monocentric model. Prices are assumed to be a function of the distance to a business area or another employment area. However, according to Chau & Chin (2002), the hedonic price model is another approach to determine the underlying residential property prices. The hedonic price model fits the residential property market better, because properties have characteristics of durability, are spatial fixed and are heterogeneous goods. Properties prices are the sum of all its marginal or implicit prices, which are estimated through a regression analysis. Another important aspect in a hedonic price model, is that it can measure the willingness-to-pay. Willingness-to-pay is defined as the amount of money that consumers are prepared to pay on average for a certain property characteristic. This is not only limited to property itself; various surrounding variables and amenities can also be measured in this manner (Kuminoff et al., 2010). Next to willingness-to-pay, there is the willingness-to-accept. Willingness-to-accept is the compensation size needed for consumers to accept something negative that affects them. A hedonic price model measures the equilibrium on which buyers and sellers are willing to trade. Thus, it is the price that connects the supply and demand in a hedonic price model. It provides an exact measure of the marginal willingness to pay and willingness to accept for equilibrium transactions in a market (Heckman et al., 2010). With this equilibrium, the externalities of business areas can be measured. The research of De Vor & De Groot (2011) strengthened this notion and clarified that hedonic price models are appropriate to measure the magnitude of the externalities of business areas on residential property values.

The first model in this research is a hedonic price model based on the work of De Vor & De Groot (2011). The model will measure to what extent business areas had effect on residential property values in 2006. A comparison can be made between the effect of industrial properties on residential property prices measured in the research of De Vor & De Groot (2011), and the effects of business areas in this research. In this hedonic price model, there are several variables included and some are excluded in comparison with the research of De Vor & De Groot (2011). Floor area, type of house, year of construction, garage, ethnic composition, population density and distance to business areas are included variables in both studies. However, volume, heating, garden, size of business area, a heavy industry area dummy and distance to highway and railway are not included. Additional included variables are the number of rooms, the availability of a balcony and extra factors over the nearby physical built environment. The additional variables came from the theoretical framework. In the theoretical framework there were indications that those variables had effect on residential property values. Including those variables should give a more precise estimation of the effect of business areas**,** see appendix D. An important value that is excluded in this research in comparison with De Vor & De Groot (2011) is the volume of a property (m^3). This is due to the high correlation between m^3 and m^2 of a property. Transaction price and the amount of useable m^2 will be measured in a logarithmic scale. Due to this, the variance will more constant, which helps to overcome common statistical problems. Also, positive skewed distributions will be closer to a normal distributions (Brooks & Tsolacos, 2010). To obtain unbiased standard errors of the errors of the OLS coefficients, and thus preventing the problems of heteroscedasticity, there will be worked with robust standard errors. As a result, the different variables in the hedonic price model lead to the formula on the next page.

$$Ln(P_{ij}) = \alpha + \sum_{k=1}^{k}\beta_k S_{ik} + \sum_{g=1}^{g}\theta_g N_{ig} + \sum_{s=1}^{s}\gamma_{sr} BR_{irs} + \pi_z R_{zi} + \varepsilon_i$$

The first variable ($Ln(P_{ij})$) is the logarithmic *Ln* of the transaction price of property *i* that is located in the district *j*. Due to the transaction price is transformed into a natural logarithm, the coefficients can be interpreted as a precentral change with the formula $(\exp^{(coefficient)}-1)*100$. The α stands for the constant of the model. Followed up with ($\sum\beta_k S_{ik}$) which contains all the structural characteristics *k* of property *i*. The fourth variable ($\sum\theta_g N_{ig}$) are all the neighborhood characteristics of property *i.* The fifth variable ($\sum\gamma_s BR_{irs}$) is a ring variable *s* that depends on the location of the address *i* with the treatment radius *r*. The sixth variable ($\pi_z R_{zi}$) is a dummy variable for if the Randstad, Near Randstad or the Rest of the Netherlands. The final variable (ε_i) is the robust error term. The parameters that are estimated in this model are β, θ, γ and π. The rings used in this model are 250 meter each up to the distance of 1750 meter from business areas. The reference area is between 1750 and 2500 meter.

3.2 Difference-in-difference approach

The basic hedonic price model has different limitations. The main limitation is that it cannot calculate shocks in the real estate market. Thus, it is not suitable to measure before and after situations. In this case, business areas that disappeared from nearby residential areas. Therefore, another method is used to overcome this problem, namely the Difference-in-Difference Method. First used by Ashenfelter (1978), this method is nowadays widely spread in empirical economics. For this method there are at least two groups needed with at least two measure points. The first group is exposed to a treatment after the first measure point; the target group. The other group should not be exposed to the same treatment as the target group: the control group. Then, at the second measure point, the average gain from the control group should be subtracted from the gain of the target group over the same time period. This should lead to a measurable result which is caused by the treatment in the target area (Imbens & Wooldridge, 2009; Zhou, Taber, Arcona & Li, 2016). The double differencing removes any biases at the second measurement point between both groups. This could have been caused by permanent differences among the groups. Biases in the target group that are the result of time trends not related to the treatment are also removed in this manner (Imbens & Wooldridge, 2009).

The first model, “basic”, will be with a two-group two-time-points difference-in-difference model. The second model, “extended”, will be a multiple-group two-time-points difference-in-difference model. In the basic model, the target area will be the residential properties within 1750 meter from the disappeared business areas. The control area will be between 1750 and 2500 meter. This distance is chosen due to testing with the effects of business areas on nearby residential property prices. The effect of business areas tends to affect residential properties up to 1750 meter, with a stable control area between 1750 and 2500 meter, see appendix A. When this is applied to an econometric model, the following formula is composed:

$$Ln(P_{ijt}) = \alpha + \sum_{k=1}^{k}\beta_k S_{itk} + \sum_{g=1}^{g}\theta_g N_{itg} + \sum_{s=1}^{s}\gamma_{sr} BR_{itrs} + \pi_z R_{zit} + \phi_t Y_{it} + \varepsilon_t$$

The first variable ($Ln(P_{ijt})$) is the logarithmic *Ln* of the transaction price of property *i* that is located in the district *j* in the year of transaction *t*. The α stands for the constant of the model. Followed up with ($\sum\beta_k S_{itk}$), which contains all the structural characteristics *k* of property *i* in transaction year *t*. The fourth variable ($\sum\theta_g N_{itg}$) are all the neighborhood characteristics *g* of property *i* in transaction year *t.* The fifth variable ($\sum\gamma_s BR_{itrs}$), is a ring variable *s* that is depend of the location of the property *i*, in the year of transaction *t* with the treatment radius *r*. The sixth variable ($\pi_z R_{zit}$) is a dummy variable whereby property *i* is located in the Randstad, Near Randstad or the Rest of the Netherlands *z* in year *t*. The seventh variable ($\phi_t Y_{it}$) is a dummy variable for year *t*. The final variable (ε_t) is the error term, which will be used in its robust form. The parameters that are estimated in this model are β, θ, γ, π and ϕ. In this formula by ($\sum\gamma_s BR_{itrs}$) there are 2 distance dummies; (s=before) if the location of the property falls within the treatment area *r*. The second dummy (s=after) is if the criteria of the s=before dummy is met and the year of the property transaction is after business areas have disappeared from the vicinity of residential areas (Van Duijn et al. 2014).

The formula for the extended model differs slightly from the basic model. The main difference lies in the distance dummies. Now, they follow the 250 meter steps as earlier used by the basic hedonic price model. This leads to the following formula:

$$Ln(P_{ijt}) = \alpha + \sum_{k=1}^{k}\beta_k S_{itk} + \sum_{g=1}^{g}\theta_g N_{itg} + \sum_{r=d1-d2}^{rmax}\sum_{s=1}^{s}\gamma_{sr} BR_{itrs} + \pi_z R_{zit} + \phi_t Y_{it} + \varepsilon_t$$

This is a model whereby the treatment area is not between 0 and 1750 meter, but is divided in rings of 250 meter each up to the distance of 1750 meter. The control area stays the same with the distance between 1750 and 2500 meter. The distance effect caused by the disappearing of business areas is measured with dummies, because it is a less restrictive form instead of employing the real of natural log of distance (Debrezion et al., 2005).

The last models for this research will be fairly similar to the difference-in-difference extended model. The difference is that the regression of the extended model is split in three parts: The Randstad, Near Randstad and the Rest of the Netherlands. According to Renes et al. (2009), the higher demand for residential properties in the Randstad causes business areas to be more likely to be restructured into residential areas than in the peripheral areas of the Netherlands. Regeneration projects are expected to have a positive influence on nearby residential property prices. As result, there could be significant differences between areas in the Netherlands, and thus, separate measurement of the different areas should take place. There are no significant differences in the measurement method. As result, the formula is not significantly different compared with the extended difference-in-difference model.

4. Data and descriptive statistics

In this chapter, the used data and the descriptive statistics will be discussed. At first, there will be a section about the data in the research. The data selection and its processing will be explained in this part. The second part of this chapter contains the descriptive statistics. At the end of this chapter the table of all the descriptive statistics will be shown.

4.1 Data selection and processing

This research is based on a quantitative approach. Data will be collected to answer the main and sub-questions and test the hypotheses. In this research, data of property transactions in combination with data of business areas will be used to determine the effect on residential property prices when business areas dissapear within their vicinity. The used data came from 3 different organizations; IBIS, NVM and CBS. The data from the IBIS (integral of company- and informationsystems) contained GIS data of the locations of business areas in the Netherlands in the year 2006 and 2017. By combining the RIN (country identification number) of the business areas from both years, a selection could be made for which areas have disappeared in 2017 in comparison with 2006. Due to municipal divisions and the combining of multiple business areas, some RIN numbers have been lost without the actual disappearance of those business areas. Therefore, an extra selection has been made with GIS. Every business area from the 2006 layer that was overlapped by a business area from the 2017 layer was removed from the data base. This led to the assumption that 210 business areas in 110 different municipalities had been disappeared between 2006 and 2017. These former business areas and the municipalities located within 2500 meter from those areas have been used in this research. The municipalities were split in three groups: Randstad, Near Randstad and the Rest of the Netherlands. See figure 2 for the three municipalities groups and for a list of the individual municipalities in appendix B. The definition of the Randstad area is selected according to the research of Van Eck et al. (2006). The Randstad is the economic core area of the Netherlands. Most of the employment and business opportunities are located over there. Residential property prices are therefore expected to be higher (De Vor & De Groot, 2011). The group Randstad municipalities consisted of 35 municipalities. The municipalities in the group Near Randstad were selected by measuring the maximum distance of these to the municipalities of the Randstad group to be 30 kilometer. This group consisted of 26 municipalities. The rest of the municipalities are in the group Rest of the Netherlands, and contained of 46 municipalities.

Paterson & Boyle (2002) showed the possibilities to use GIS in combination with residential property data for a hedonic price model. This research will also use GIS for some parts of the research. With GIS, the distances between the transferred residential properties and the 210 disappeared business areas will be determined. The first step is to select all the addresses within 2500 meter from the disappeared business areas. These addresses came from a BAG (basic address information) of the Netherlands. The first 1750 meter of the 2500 meter is divided in groups of 250 meter each, to comply with the distance rings of the basic hedonic price model and the extended difference-in-difference models. See figure 3 for the result.

The second part of the data came from the NVM (Dutch Association of Brokers and Appraisers). The data contained the transaction information of sold residential properties from the earlier selected municipalities in 2006 and 2017. The NVM data contained various individual property characteristics that could help to explain the differences between the various transaction prices. Pagourtzi et al. (2003) discussed that the valuation of a property exists out of the best estimate of the trading price of a property. According to them, there are three possible ways to estimate the value of a property:

1. The price is the actual exchange price in the marketplace
2. The market value is an estimation of the price of the property when it is sold on the market
3. A calculation of worth to assess the inherent value to an individual or a group.

The data from the NVM are exchange prices. Therefore, they meet the first requirement and could be used to measure the underlying changes in residential properties values. This data will be combined with the addresses selected from the different distance rings. The 3,5 million addresses were too large in size to properly combine in GIS. The addresses were therefore split up in smaller groups. Then, they were combined with the NVM data in Excel based on the combination of postal code, street name and house number. All the leftover addresses where no transactions had taken place or were outside the 2500 meter zone were removed. For the difference-in-difference models, the distance groups of 250 meter rings are combined with the year of sale to create Before and After groups. The residential properties between 1750 and 2500 meter will be put into one group. For the basic hedonic model, this distance in the 2006 data will be the reference area. The difference-in-difference models use this distance of the 2006 and 2017 data as control areas.

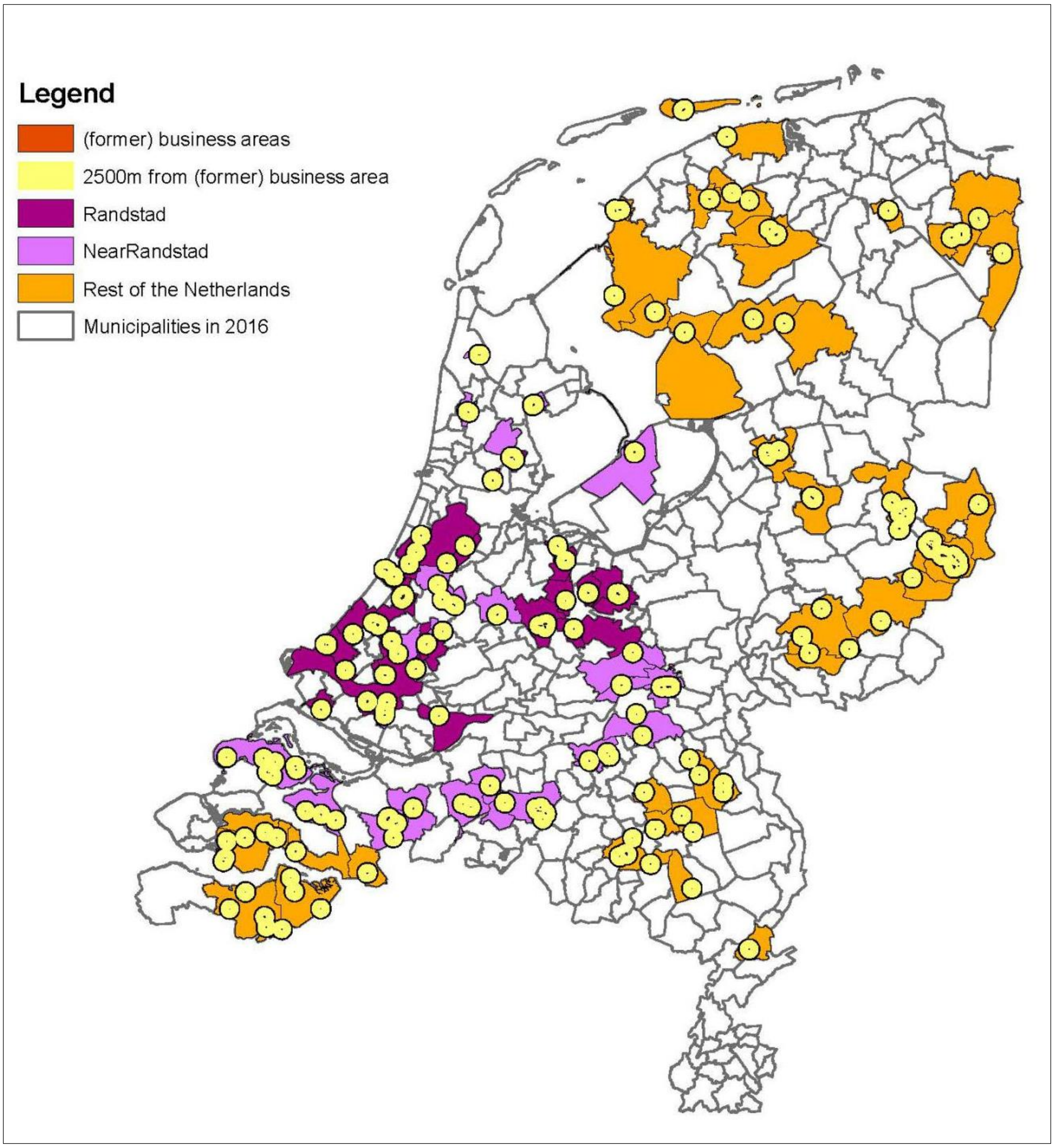

Figure 2. Overview of the disappeared business areas between 2006 and 2017 with the surrounding 2500 meter zones selected for the research.

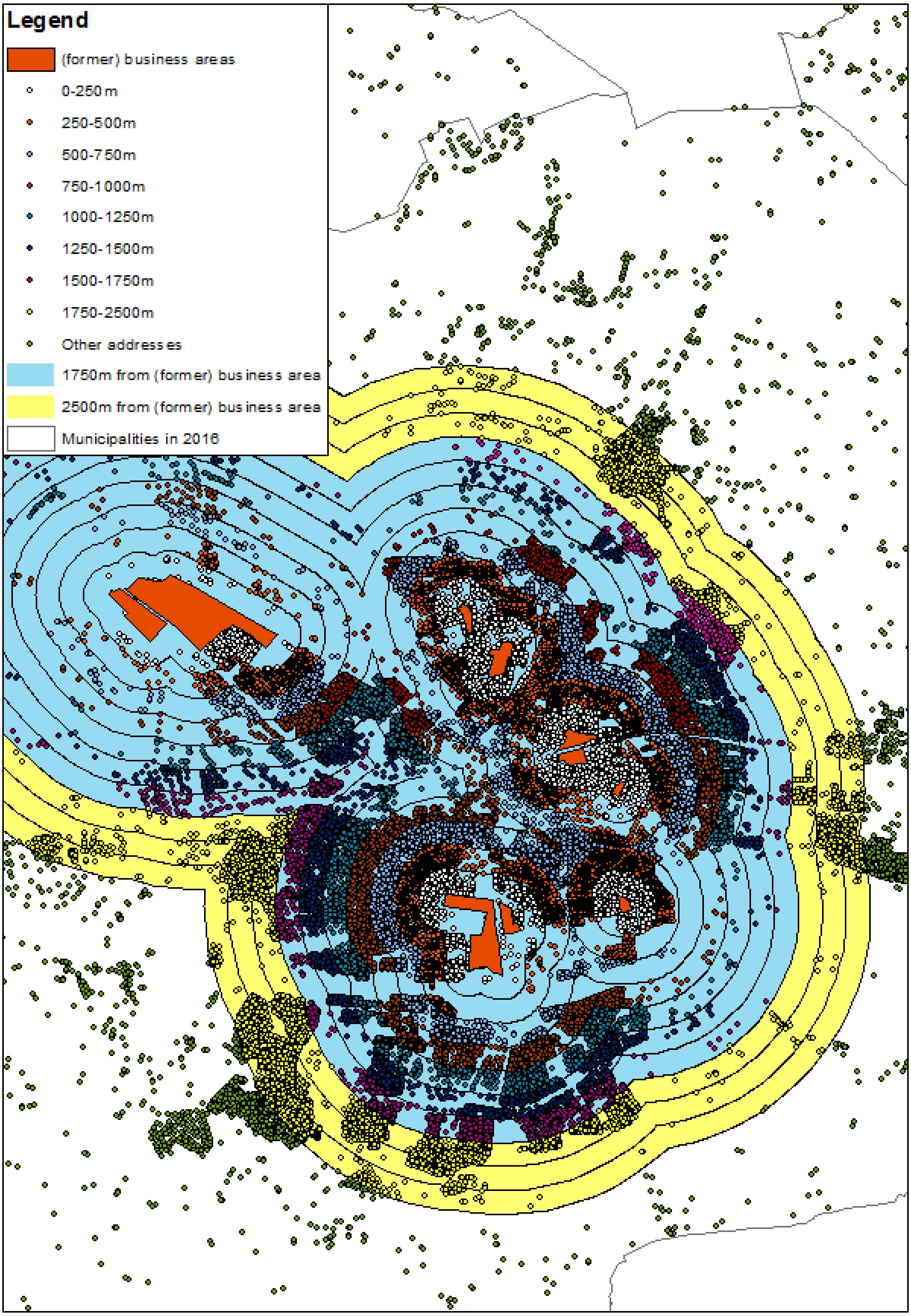

Figure 3. Example of the distance determination of addresses from former business areas around the city of Enschede.

The third data group came from the CBS (Central Bureau of Statistics). The data contained different characteristics over the local neighborhood based on postal codes. By combining those with the transaction data, the transaction prices are known with their individual and neighborhood characteristics as for the distance to (former) business areas. With these additional factors, control variables could be determined. The control variables assure a solid base for testing the effects on residential property prices when business areas disappear within their vicinity. However, there are still variables missing or needed editing to be applied in this study. The first added variable was a dummy for municipalities that had over 100.000 inhabitants and district dummies based on CBS district codes. The amount of business within the four-digit postal code in 2017, is divided into eight classes as already divided in the 2006 CBS dataset, see appendix C. Then, there are several dummies created from ordinal variables. These are; the property building periods, type of residential properties, amount of nearby road usage, availability of a fireplace and a monument(al) status. Also, from some variables there are several options removed within variables, as they were too small to properly measure differences between the groups. Only residential properties with a known building date, no rental or investment properties, and cases with only building plots and garages are included. With these adaptations, the dataset is tested for irregularities. There were irregularities with the amount of useable space in m^2 and the transaction price. All the data of useable space in m^2 and transaction price equal to -1, 0, or 99.999 were removed as they do not represent real numbers of properties.

A test model had been completed to see for other problems within the dataset. All the cases that had a standard deviation of 3 or more were checked on irregularities. It appeared that the majority of these cases was caused by faulty notations. This could be seen by comparing the first listing price, last listing price and transaction price by property transfer prices and with useable space in m^2 with gross m^2. For example; the first listing price is 100.000€, the last listing price 95.000€ and there is a 950.000€ transaction price, there could be assumed that this is due to a faulty notation in at least 1 of the notations. As result, these cases were removed from the dataset. Prices of properties below the 35.000€ and over 2.000.000€ in transaction prices appeared to weigh relatively much on the outcomes of the regression model. Also, it was also not always clear if these values did not came from faulty notations. As a precaution, these cases were removed from the database. After this was set, useable space in m^2 and the transaction price were set in a logarithmic scale. Again, the variance will be more constant and the positive skewed distributions now follow a normal distribution.

The resulting model had 6.453 cases in 2006 and 6.905 cases in 2017 and thus, a total of 13.358 cases. There are several factors in the theoretical framework chapter that could affect residential properties prices not included in this research. Three main limitations caused this;

1. There were no data available regarding that typical subject. For example: There is no nationwide data on district or lower scale on public health, and certainly not caused by business areas.
2. Only minor parts of a factor in the available data could be retrieved. For example: Of the disappeared business areas, only a third had information over an environmental zone and even less over noise production levels in the IBIS. Therefore, the representativeness of this study would decrease if only a small portion had these extra variables.
3. Measurement methods between two years could be different. Therefore, some data from the CBS was not comparable between 2006 and 2017.

As result, in appendix D are the factors discussed in the theoretical framework section and which of them could be included into the research. Appendix E shows how each individual variable is measured and what they exactly stand for.

4.2 Descriptive statistics

To give a broad overview for the differences in the data, a table with the descriptive statistics is included, see table 1. Notable means from some variables were the average property transaction price of 264.616€, 125 useable m^2 and 4,6 rooms. However, several differences exist between the target and control areas. An important difference is the average price of residential property transfers is lower in the target area (262.081€) than in the control area (270,811€). The difference in the observation numbers causes the average to be closer to the target area. In the target area there are 8500 complete cases and 3513 in the control area. This difference is caused through the percentage of unemployment benefits and percentage non-western immigrants. These are only measured by the CBS if there are more than 50 inhabitants in that measurement area. Another notable difference can be observed in the percentage of non-western immigrants. This is higher in control areas (11,02) than the target area (9,69). There is more unemployment in target area (1,72) than the control area (1,61) and more property transfers in the city center in the target area (0,07) and in the control area (0,10). There is a higher percentage of residential properties in the control areas that lay in the Randstad and Near Randstad areas than in the Rest of the Netherlands. The Rest of the Netherlands group is less urbanized. Consequently, the urban sprawl is smaller and fewer cases are outside the 1750 meter target area. There are several important variables that do not differ much from each other. The amount of useable m^2, age of the buildings, building type and most of the physical surrounding factors. Two other tables are set up for an overview of the data. The first table shows the transaction price per distance ring and can be observed in appendix F. The second table was set up to check if there are enough cases to split the dataset in three areas, Randstad, Near Randstad and the Rest of the Netherlands, next to the rings of 250 meter. This could be observed in appendix G. As the smallest group contained 76 cases, which is more than the minimum needed 30 cases (VanVoorhis & Morgan, 2007), the data could be used for the difference-in-difference method. The results of these models are in the subsequent chapter.

Table 1. Summary of the descriptive statistics for the treatment area, control area and the total area.

Descriptive Statistics	target 0-1750m		Control 1750-2500m		total 0-2500m	
	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
Transaction price	262081	(146167)	270811	(158969)	264616	(150042)
LN transaction price	12,36	(0,456)	12,38	(0,481)	12,37	(0,464)
M^2 useable space	124,42	(45,187)	126,41	(47,879)	125	(45,992)
LN M^2 useable space	4,77	(0,331)	4,78	(0,342)	4,77	(0,334)
Number of rooms	4,62	(1,362)	4,66	(1,43)	4,63	(1,382)
Garage	0,28		0,28		0,28	
Fireplace	0,07		0,07		0,07	
Balcony	0,22		0,25		0,23	
Monument(al)	0,01		0,01		0,01	
< 1906*	0,04		0,05		0,04	
1906-1930	0,1		0,09		0,1	
1931-1944	0,07		0,08		0,07	
1945-1959	0,08		0,07		0,07	
1960-1970	0,15		0,15		0,15	
1971-1980	0,17		0,17		0,17	
1981-1990	0,14		0,14		0,14	
1991-2000	0,16		0,17		0,16	
> 2001	0,09		0,1		0,09	
General house*	0,02		0,02		0,02	
Corner house	0,15		0,14		0,15	
Semi-detached house	0,17		0,17		0,17	
Detached house	0,15		0,13		0,14	
Apartment	0,18		0,21		0,19	
Single-family dwelling	0,64		0,6		0,63	
Mansion/Canal house	0,07		0,07		0,07	
Bungalow	0,03		0,03		0,03	
Villa	0,04		0,04		0,04	
Rural area	0,02		0,02		0,02	
Residential area	0,69		0,73		0,7	
In city center	0,1		0,07		0,09	
Near water area	0,07		0,08		0,07	
Near park or forest	0,06		0,07		0,06	
Unobstructed view	0,15		0,15		0,15	
Quiet road	0,5		0,5		0,5	
Busy road	0,02		0,02		0,02	
Urbanity degree	2,56	(1,27)	2,56	(1,26)	2,56	(1,267)
Class of amount of businesses	4,8	(1,289)	4,78	(1,355)	4,79	(1,309)
PNW. immigrants	9,69	(9,534)	11,02	(9,905)	10,08	(9,662)
Inhabitants density	4989,96	(2967,188)	5253,11	(3434,225)	5066,72	(3112,839)
P. unemployment benefits	1,72	(1,52)	1,61	(1,353)	1,69	(1,474)
Year 2017	0,52		0,51		0,52	
Randstad	0,38		0,48		0,41	
Near Randstad	0,27		0,23		0,26	
City above 100k inhabitants	0,4		0,44		0,41	
Total N	9480		3878		13358	
Valid N (listwise)	8500		3513		12013	

*Is the reference dummy for the particular group of variables.

5. Results

In this chapter, the results of the different regression models will be revealed. It starts with a basic hedonic price model with the aim to find the effect of business areas on residential property prices in 2006. It is followed with a basic difference-in-difference model of the effects on residential property prices when business areas disappear within their vicinity. This model has a single before and after target area. After that, the results of the extended difference-in-difference model will be presented. Here, the before and after distances are divided in smaller target areas. Here, the effects of the disappearance of business areas can be observed in separate distance classes of 250 meter each. At last, the results of the extended difference-in-difference model split into the three municipal groups is shown.

5.1 Result standard hedonic price model

In table 2, the results of the basic hedonic price model can be observed. Table 2 consist of 7 columns. The first column is the legend for the different distances and variable groups. The other columns are the results when more variable groups are added in the regression. Column 1 starts with no variables except the distances to business areas. After that, variables from individual scale to nationwide scale are added one by one. Because the transaction price is measured at a logarithmic scale, the coefficients are variations in percentages. The R-square of 0,881 means that 88,1 percent of the variance in house prices is explained by the variables in this hedonic price model. A number of this magnitude means the model fits properly. The complete model with the coefficients for the individual variables can be found in appendix H.

In column 2, when business area distances are the only variable, there is no significant difference between the residential property prices compared with the reference area. This can be noticed in the R-square, which is with 0,0012 rather small. There are 6543 observations. This number will be equal for the first three combinations of variable groups. In column 3 the individual variables are included. Now, there is a distance significant for a higher residential property price in comparison with the reference area. However, with only a 90 percent certainty that there is a difference at a distance between 500 and 750 meter. No major conclusions could be made at this point. The R-square increases to 0,6836, which meant relatively much of the variance of residential property prices are explained by the individual property variables. In column 4 the physical surrounding variables are added. This results in minor changes in the model. There is not a distance significant for a difference in residential property prices caused by the business areas and the R-square has barely been risen. When in column 5 the social surrounding factors are included, there is a negative effect caused by business areas with a 95 percent statistical certainty on the distances between 0 and 500 meter. The R-square has risen to 0,7325 and the number of observations has dropped to 5326. As noted in chapter 4, the lower number of observations is due to the fact that neighborhoods need at least 50 inhabitants before the CBS used percentages of unemployment benefits and non-western immigrants. In column 6 the district dummies are included. This results in a major shift in effects. Business areas now have a positive effect on residential property prices. Between 250 meter and 1500 meter, every distance is with at least 90 percent statistical certainty different than the reference area and the R-square has risen to 0,8809. There are barely changes when the market variables in column 6 are included, only a slightly increase in the R-square and small differences in the coefficients. As a result, residential property prices between the distances 250 and 1500 meter are between the 1,82 (=(exp$^{(0,0182)}$-1)*100) and 2,82 (=(exp$^{(0,0282)}$-1)*100) percent higher in value around business areas in 2006, with at least 90 percent statistical certainty.

The results from this standard hedonic price model are different than the research of De Vor & De Groot (2011). In that study, there was found that business areas caused negative price effects up to a distance of 2000 meter. This contradicting result could be caused by the differences in the selection of business areas. In the research of De Vor & De Groot (2011), there were several sizable heavy industrial areas included located near major population areas. The main examples are the port areas of Amsterdam, Rotterdam and Moerdijk. As the negative externalities of heavy industrial areas are larger than regular business areas, they can affect residential property prices over longer distances and cause a more negative price effects. It appeared that the positive and negative externalities are in equilibrium within 250 meter from a business areas. In the standard hedonic price model, there is no statistical significant difference in residential property prices in comparison with the reference area. Therefore, it could be that the inverted U-shaped rent gradient of Verhoef & Nijkamp (2002) starts somewhere within the distance group of 0 until 250 meter, and starts to decline within the 1250 until 1500 meter group from a business area.

Table 2. Summary of the results from the standard hedonic price model of the effect of business areas on the nearby residential property prices.

Sample size	< 2500m	< 2500m	< 2500m	< 2500m	< 2500m	< 2500m
Measurement area	0-1750	0-1750	0-1750	0-1750	0-1750	0-1750
Reference area	1750-2500	1750-2500	1750-2500	1750-2500	1750-2500	1750-2500
0-250	-0,0266	-0,0079	-0,0064	-0,0353**	0,0024	0,0023
	(,02612)	(,0155)	(,0156)	(,0149)	(,0135)	(,0135)
250-500	0,0058	-0,0099	-0,0098	-0,0255**	0,0233**	0,0230**
	(,0237)	(,0122)	(,0122)	(,0120)	(,0111)	(,0111)
500-750	0,0120	0,0201*	0,0181	0,0096	0,0285***	0,0282***
	(,0195)	(,0112)	(,0111)	(,0113)	(,0105)	(,0105)
750-1000	-0,0244	0,0102	0,0082	-0,0037	0,0185*	0,0189*
	(,0186)	(,0103)	(,0102)	(,0109)	(,0101)	(,0101)
1000-1250	-0,0306	-0,0013	-0,0021	-0,0036	0,0179*	0,0182*
	(,0190)	(,0114)	(,0113)	(,0114)	(,0097)	(,0097)
1250-1500	-0,0291	0,0000	0,0007	-0,0015	0,0256**	0,0256**
	(,0191)	(,0113)	(,0112)	(,0119)	(,0099)	(,0099)
1500-1750	-0,0206	0,0086	0,0082	-0,0014	0,0084	0,0084
	(,0210)	(,0109)	(,0108)	(,0116)	(,0095)	(,0095)
Individual factors	No	Yes	Yes	Yes	Yes	Yes
Physical surrounding factors	No	No	Yes	Yes	Yes	Yes
Social surrounding factors	No	No	No	Yes	Yes	Yes
District dummies	No	No	No	No	Yes	Yes
Market factors	No	No	No	No	No	Yes
Observations	6543	6543	6543	5226	5226	5226
Adjusted R-squared	0,0012	0,6836	0,6885	0,7325	0,8809	0,881

P<0,01***, P<0,05** P<0,10*

5.2 Results difference-in-difference models

In 2006, business areas had mainly a positive effect on nearby residential property prices. In this part of the chapter the effect on residential property prices caused when business areas disappear within their vicinity will be measured. As previously noticed, this is a shock in the real estate market and cannot be measured with a basic hedonic price model. In the second model, this shock, the disappearance of the business areas between 2006 and 2017, is measured with a difference-in-difference model. Again, there are 7 columns with 6 of those containing the results of the differ combinations of variables. The major difference is the distance Before and After variable. Before is the price of residential properties within 1750 meter from a business area in 2006 and After is the price of residential properties within 1750 meter of a disappeared business area in 2017. The control area has the same distance as the reference area in the basic hedonic price model. There is a year dummy added to the variables and the rest of the model keeps the same variables as the basic hedonic price model, see table 3.

In column 1, only the year dummy and the distance to (former) business areas are included in the model. This results in a 90 percent statistical significant difference between the control area and the after variable. It appears that there is a negative effect caused by the disappearance of business areas. The negative effect becomes lower when the individual factors are included, but stays at a 90 percent statistical significance level. However, the statistical significance disappears when the physical surrounding factors are added to the model. In the first three columns, there are 13358 observations. In the last three columns this decreases to 12013 caused by the earlier reasons noted in chapter 4. When in the fourth column the social surrounding variables are added to the model, a clear negative effect is visible in the model. With 99 percent statistical certainty that there is a negative effect on residential property transfer prices caused when business areas disappear within their vicinity. This effect changes when district dummies are added to the model. Now there is a 99 percent statistical significance that there is a positive effect caused by the existence of business areas within 1750 meter in 2006. Residential properties appeared to be 3,04 (=(exp$^{(0{,}0304)}$-1)*100) percent higher in price than the control area. However, when business areas disappeared in 2017, no statistical differences were found in comparison with the control area. There are slight changes when market factors are added. With all the variables the R-square is 0,8562, which meant that 85,62 percent of the variance in the model can be explained by the variables of the model. See appendix I for the entire result of the regression model.

Table 3. Summary of the results from the basic difference-in-difference model of the effect of the disappearance of business areas on residential property prices between 2006 and 2017.

Sample size	< 2500m	< 2500m	< 2500m	< 2500m	< 2500m	< 2500m
Target area	0-1750	0-1750	0-1750	0-1750	0-1750	0-1750
Control area	1750-2500	1750-2500	1750-2500	1750-2500	1750-2500	1750-2500
Before	-0,0168155 (0,0124)	0,0040751 (0,0069)	0,0051197 (0,0068)	-0,0016555 (0,0072)	0,0304718*** (0,0062)	0,0304775*** (0,0062)
After	-0,0253302* (0,0130)	-0,0137913* (0,0079)	-0,0113972 (0,0079)	-0,0244709*** (0,0073)	0,0078299 (0,0059)	0,0078357 (0,0059)
Individual factors	No	Yes	yes	Yes	Yes	Yes
Physical surrounding factors	No	No	Yes	Yes	Yes	Yes
Social surrounding factors	No	No	No	Yes	Yes	Yes
District dummies	No	No	No	No	Yes	Yes
Market factors	No	No	No	No	No	Yes
Transaction Year	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13358	13358	13358	12013	12013	12013
Adjusted R-squared	0,0079	0,6558	0,6620	0,6989	0,8562	0,8562

P<0,01***, P<0,05** P<0,10*

In the extended difference-in-difference model, the same variables are included as by the basic difference-in-difference model, see table 4 on the next page. However, now the 1750 meter for the target area is divided among groups of 250 meter each, similar to the basic hedonic price model of 5.1. The primary results are the same as the basic difference-in-difference model. It appears, that there is a strong positive effect of business areas on residential property prices in 2006 after district dummies are included. Between 0 and 1500 meter, there is a 99 perceptual statistical significance and 90 percent statistical significance between 1500 and 1750 meter that there is a difference in property prices between the target and control area. It appears, that there is a distance decay in 2006 (Before) after the distance of 500 until 750 meter. Here, residential property prices are 4,31 (=($\exp^{(0,0431)}$-1)*100) percent higher than properties in the control area and in the last distance only 1,74 (=($\exp^{(0,01741)}$-1)*100) percent. After business areas have disappeared from nearby residential property areas, it appears that the closest group to the former business areas do not seem to lose their additional value in comparison with the control area. See appendix J for the whole regression model.

In the difference-in-difference model, the positive externalities of business areas outweigh their negative externalities. Therefore, residential property prices tend to decline when business areas disappear within their vicinity. This result again contradict the findings of De Vor & De Groot (2011). De Vor & De Groot (2011) expected an increase in residential property prices after redevelopment of nearby business areas. However, in this research, the residential property prices were lower after business areas disappeared within their vicinity. The reduced residential property prices also contradict with the findings of Visser & Van Dam (2006). According to their research, residential property prices should increase when business areas disappear within their vicinity. However, there is a difference between the method of Visser & Van Dam (2006) and the used method in this research. Visser & Van Dam (2006) compared the percentage of a neighborhood used as business area with the average of the neighborhood residential property price. However, in this research it is not measured what percentage the size of a former business areas was in comparison with the neighborhood size**.** Thus, it cannot be excluded that there are different effects on residential property prices through the size of a disappeared business area. The reduced residential property prices caused by the departure of business areas are in line with the studies of Himmelberg et al. (2005) and Case & Mayer (1996). The main reason for the lower residential property prices should be the loss of local employment. This effect is earlier found in the studies of Oswald (1999), Gallin (2006) and Genesove & Mayer (1994). The loss of local employment could cause that former employees have to travel longer distances to new employment areas. This longer commuting distance could also lower residential property prices as found by Evans (2008) and So et al. (2001).

Table 4. Summary of the results from the extended difference-in-difference model of the effect on residential property prices when business areas disappear within their vicinity between 2006 and 2017.

Sample size	< 2500m	< 2500m	< 2500m	< 2500m	< 2500m	< 2500m
Target area	0-1750	0-1750	0-1750	0-1750	0-1750	0-1750
Control area	1750-2500	1750-2500	1750-2500	1750-2500	1750-2500	1750-2500
Before 0-250	-0,0266	-0,0054	-0,0032	-0,0288*	0,0366***	0,0366***
	(0,0261)	(0,0156)	(0,0157)	(0,0151)	(0,0126)	(0,0126)
Before 250-500	0,0058	-0,0071	-0,0057	-0,0257**	0,0378***	0,0378***
	(0,0237)	(0,0124)	(0,0124)	(0,0124)	(0,0106)	(0,0106)
Before 500-750	0,0120	0,0215*	0,0205*	0,0176	0,0430***	0,0431***
	(0,0195)	(0,0112)	(0,0111)	(0,0115)	(0,0096)	(0,0096)
Before 750-1000	-0,0244	0,0083	0,0098	0,0022	0,0366***	0,0365***
	(0,0186)	(0,0103)	(0,0102)	(0,0110)	(0,0092)	(0,0092)
Before 1000-1250	-0,0306	-0,0008	0,0002	-0,0005	0,0265***	0,0266***
	(0,0189)	(0,0114)	(0,0113)	(0,0116)	(0,0093)	(0,0093)
Before 1250-1500	-0,0291	-0,0016	0,0004	0,0060	0,0255***	0,0254***
	(0,0191)	(0,0114)	(0,0113)	(0,0123)	(0,0094)	(0,0095)
Before 1500-1750	-0,0206	0,0080	0,0088	-0,0015	0,0174*	0,0174*
	(0,0210)	(0,0109)	(0,0109)	(0,0117)	(0,0092)	(0,0092)
After 0-250	-0,0115	-0,0146	-0,0099	-0,0295**	0,0379***	0,0377***
	(0,0258)	(0,0156)	(0,0154)	(0,0149)	(0,0114)	(0,0114)
After 250-500	-0,0122	-0,0255	-0,0223	-0,0380***	-0,0059	-0,0059
	(0,0221)	(0,0140)	(0,0138)	(0,0132)	(0,0104)	(0,0104)
After 500-750	-0,0148	-0,0093	-0,0056	-0,0233**	0,0040	0,0041
	(0,0197)	(0,0116)	(0,0116)	(0,0110)	(0,0091)	(0,0091)
After 750-1000	-0,0345*	-0,0217*	-0,0203	-0,0369***	-0,0039	-0,0037
	(0,0188)	(0,0115)	(0,0113)	(0,0107)	(0,0087)	(0,0088)
After 1000-1250	-0,0227	-0,0120	-0,0112	-0,0282**	0,0151*	0,0150*
	(0,0199)	(0,0122)	(0,0121)	(0,0115)	(0,0089)	(0,0089)
After 1250-1500	-0,0546**	-0,0068*	-0,0059	-0,0102	0,0104	0,0103
	(0,0192)	(0,0121)	(0,0119)	(0,0112)	(0,0084)	(0,0084)
After 1500-1750	-0,0132	-0,0105	-0,0071	-0,0119	0,0119	0,0119
	(0,0217)	(0,0127)	(0,0126)	(0,0120)	(0,0084)	(0,0084)
Individual factors	No	Yes	Yes	Yes	Yes	Yes
Physical surrounding factors	No	No	Yes	Yes	Yes	Yes
Social surrounding factors	No	No	No	Yes	Yes	Yes
District dummies	No	No	No	No	Yes	Yes
Market factors	No	No	No	No	No	Yes
Transaction Year	Yes	Yes	Yes	Yes	Yes	Yes
Observations	13358	13358	13358	12013	12013	12013
Adjusted R-squared	0,0088	0,656	0,6621	0,6994	0,8565	0,8566

P<0,01***, P<0,05** P<0,10*

The last difference-in-difference models, the split between the Randstad, Near Randstad and the Rest of the Netherlands areas, consist of the same variables as the difference-in-difference extended model. The results can be seen in table 5. The results of the Near Randstad and the Rest of the Netherlands gives clear outcomes, but in the Randstad area the result is less apparent. In the Randstad, it seems that business areas had a positive effect on residential property prices in 2006. Between 0 and 1500 meter everything is at least with 90 percent statistical significant, with the exception between 250 and 500 meter. This positive effect seems, for the exception between 0 and 250 meter, to be disappeared in 2017. The previous indicates that lower residential property prices are expected in the Randstad when business areas disappear within their vicinity. The positive effect of business areas in 2006 can better be observed in the Near Randstad group. Here, every distance group before between 250 and 1750 meter is at 99 percent statistical significance different than the control area. Indicating a positive effect of business areas on residential property prices in the Near Randstad group. After business areas have disappeared, there are several changes in the Near Randstad group. There is a positive increase of residential property prices within 250 meter from former business areas. Between 250 and 500 meter, properties are 4 (=(exp$^{(0,0400)}$-1)*100) percent higher in price, this is more than 2 percent points lower than in 2006 (6,64(=(exp$^{(0,0664)}$-1)*100 percent). They both have a 99 percent statistical significant difference with the control area. This approximate 2 percent point drop in residential property values can also be observed in the other groups. All the groups between 250 and 1750 meter are at least 2 percent points lower in price in 2017. In the Rest of the Netherlands group, it evident that business areas had no effect on residential property prices. The disappearance of business areas did not change that either. No statistical differences with the control areas were found in both situations. See appendix K, L and M for the complete regression models.

In Renes et al. (2009), it was stated that the effect on residential property prices in less urban areas was lower than in the more urban areas when business areas disappear within their vicinity. The results from the split difference-in-difference model confirm this statement. No significant price fluctuations were found in the Rest of the Netherlands group between 2006 and 2017. Also in Renes et al. (2009), an explanation can be found why the Randstad and Near Randstad areas had different results than the rest of the Netherlands**.** This is that in these areas a higher percentage of the former business areas should have be redeveloped into residential areas due to the higher demand. However, the assumption by Renes et al. (2009) that the higher quality of the urban environment caused by the redevelopment of business areas lead to higher residential property prices did not hold in this research. The reason could be that the new residential areas cause an additional supply of residential space to the local real estate market. This additional residential space can lead to lower residential property prices as noticed by Evans (2008), and the Four-Quadrant Model of DiPasquale & Wheaton (1992). The supply of additional residential properties will lead to a higher stock. Therefore, property prices should decrease if the other factors in the Four-Quadrant Model do not change with a new equilibrium.

Table 5. Summary of the results from the extended difference-in-difference model of the effect on residential property prices when business areas disappear within their vicinity between 2006 and 2017 and between the different areas in the Netherlands.

	Randstad	Near Randstad	Rest of the NL
Sample size	< 2500m	< 2500m	< 2500m
Target area	0-1750	0-1750	0-1750
Control area	1750-2500	1750-2500	1750-2500
Before 0-250	0,0540***	0,0195	0,0011
	(0,0194)	(0,0226)	(0,0216)
Before 250-500	0,0235	0,0664***	0,0052
	(0,0168)	(0,0157)	(0,0223)
Before 500-750	0,0539***	0,0546***	0,0097
	(0,0145)	(0,0158)	(0,0191)
Before 750-1000	0,0324**	0,0458***	0,0127
	(0,0132)	(0,0156)	(0,0195)
Before 1000-1250	0,0237*	0,0533***	-0,0183
	(0,0123)	(0,0158)	(0,0201)
Before 1250-1500	0,0316**	0,0505***	-0,0217
	(0,0143)	(0,0172)	(0,0177)
Before 1500-1750	0,0162	0,0445***	-0,0202
	(0,0133)	(0,0172)	(0,0183)
After 0-250	0,0446***	0,0482***	0,0163
	(0,0159)	(0,0220)	(0,0204)
After 250-500	-0,0218	0,0400***	-0,0228
	(0,0150)	(0,0174)	(0,0206)
After 500-750	-0,0122	0,0260	-0,0125
	(0,0140)	(0,0160)	(0,0177)
After 750-1000	-0,0158	0,0048	0,0081
	(0,0138)	(0,0148)	(0,0165)
After 1000-1250	0,0047	0,0327**	0,0041
	(0,0145)	(0,0144)	(0,0165)
After 1250-1500	0,0182	0,0290*	-0,0145
	(0,0121)	(0,0166)	(0,0155)
After 1500-1750	0,0208*	0,0104	-0,0122
	(0,0121)	(0,0170)	(0,0149)
Individual factors	Yes	Yes	Yes
Physical surrounding factors	Yes	Yes	Yes
Social surrounding factors	Yes	Yes	Yes
District dummies	Yes	Yes	Yes
Market factors	Yes	Yes	Yes
Transaction Year	Yes	Yes	Yes
Observations	4986	3202	3825
Adjusted R-squared	0,8746	0,8578	0,8469

P<0,01***, P<0,05** P<0,10*

6. Conclusion and discussion

This research investigated the effect on residential property prices when business areas disappear within their vicinity. The effect on residential properties prices is measured before and after business areas disappear within their vicinity. There were 210 different business areas in 110 different municipalities selected as they disappeared between 2006 and 2017.

A basic hedonic price model and several difference-in-difference models were applied to compare the affected residential areas with reference/control areas. The data for the research were provided by the IBIS, NVM and CBS. It contained statistics over business areas, residential property transfers and neighborhoods in 2006 and 2017 in the Netherlands. The target areas were residential properties within 1750 meter from a (former) business area and the reference and control areas were between 1750 and 2500 meter from a (former) business area. Residential property prices were regressed by different individual factors, physical surrounding factors, social surrounding factors, district characteristics and market factors. The first regression model was a basic hedonic price model, which measured the price effect of business areas on residential properties in 2006. This model had distance rings of 250 meter each. The second model was a difference-in-difference model, which measured the price effects before and after business areas disappeared within a distance of 1750 meter. The third model was the same as the second model, but had the distance of 1750 meter split into rings of 250 meter each. The final model was the same model as the third, but now the model is divided into three individual regressions. The deviation is based on three areas: The Randstad, Near Randstad and the Rest of the Netherlands.

The result from the first model is that residential property prices had higher values between 250 and 1500 meter from business areas in 2006 in comparison with the reference area. This contradict the hypothesis that business areas have a negative effect on residential property values. The results from the second and third model is that the positive effects of business areas in 2006 disappeared in 2017. The only exception is the distance between 0 and 250 meter, which stayed equally positive. This concludes the hypothesis that residential property values increase when business areas disappear within their vicinity to be incorrect. Therefore, it can be concluded that on general, there is a negative effect on residential property prices when business areas disappear within their vicinity. The last model showed that the effect of business areas on residential property prices came mainly from the Randstad and Near Randstad municipalities. Residential property prices were strongly reduced in the Near Randstad area and slightly reduced in the Randstad area when business areas disappear within their vicinity. The properties prices in the group Rest of the Netherlands were unaffected by the vicinity of business areas and their disappearance. This concludes, that the third hypothesis, stating that there is a more positive effect on residential property values in the Randstad than in the other areas in the Netherlands when business areas disappear within their vicinity, is also incorrect. This leads to the final conclusion that lower residential property values are expected up to a distance of 1750 meter in the Randstad and near Randstad areas in the Netherlands when business areas disappear within their vicinity.

There are several opportunities to improve the results of this research. One of the improvements for this research could be in the obtained data. Now only data for 2006 and 2017 were available. This had as consequence, that it is not clear what the price effect was when business areas disappeared in the years between, and outside the two measurement points**.** Also, it is unknown when each business areas disappeared exactly. Some business areas could have been disappeared in 2007, and others perhaps as late as 2016. When data over business areas between those years are included, improved estimations of the total effect on residential property prices can be obtained. Also, because the aim of the research was to find the general effect on residential property prices when business areas disappear within their vicinity, there is not investigated what the individual redevelopments were of those disappeared business areas. Thus, it is unknown if there are differences between the effects on residential property prices between the types of redevelopments. When each individual redevelopment is included in the research, there can be investigated if there are per redevelopment type differences on nearby residential property prices. It would also be preferred to extend the research period. Especially regeneration projects can take a long period for completion. Than at several points in the redevelopment process the effects on residential property prices can be measured. To start with the residential property prices when a business area is still in its vicinity. Than measurements should take place after the announcement of redevelopment, the remediation phase, the urban renewal phase, direct after completion and several years after its completion. This process will lead to additional insights over the total effect of redevelopment of business areas, especially the effects after the remediation phase. Other improvements could be to enlist variables for the loss of total employment, and the age, size, safety and environmental zones of each business area. Improvement for more accurate residential property prices could come from additional control variables. Examples of these are: crime rates, proximity of schools and other amenities and the distance to the several types of public transport.

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Appendix

Appendix A: overview of the distances and its effects

Target area Control area	0-1000 1000-2500		0-1250 1250-2500		0-1500 1500-2500		0-1750 1750-2500		0-2000 2000-2500		0-1750 2000-2500		0-1500 2000-2500		0-1750 2000-2500	
	Coef.	Sign.	Coef.	Sign.	Coef.	Sign.	Coef.	Sign.	Coef.	Sign.	Coef.	Sign.	Coef.	Sign.	Coef.	Sign.
Before 0-250	0,0217	0,0680	0,0258	0,0330	0,0312	0,0110	0,0366	0,0040	0,0359	0,0070	0,0372	0,0050	0,0410	0,0030	0,0382	0,0030
Before 250-500	0,0229	0,0190	0,0270	0,0070	0,0325	0,0020	0,0378	0,0000	0,0372	0,0010	0,0378	0,0010	0,0415	0,0000	0,0394	0,0000
Before 500-750	0,0283	0,0010	0,0322	0,0000	0,0377	0,0000	0,0431	0,0000	0,0423	0,0000	0,0436	0,0000	0,0472	0,0000	0,0446	0,0000
Before 750-1000	0,0213	0,0100	0,0254	0,0030	0,0310	0,0000	0,0365	0,0000	0,0358	0,0000	0,0364	0,0000	0,0421	0,0000	0,0398	0,0000
Before 1000-1250			0,0152	0,0770	0,0210	0,0180	0,0266	0,0040	0,0259	0,0110	0,0265	0,0100	0,0331	0,0020	0,0306	0,0010
Before 1250-1500					0,0196	0,0290	0,0254	0,0070	0,0247	0,0160	0,0269	0,0100	0,0325	0,0020	0,0286	0,0030
Before 1500-1750							0,0174	0,0600	0,0167	0,0980	0,0186	0,0700				
Before 1750-2000									-0,0011	0,9020						
After 0-250	0,0279	0,0090	0,0307	0,0040	0,0332	0,0030	0,0377	0,0010	0,0338	0,0050	0,0342	0,0050	0,0373	0,0030	0,0396	0,0010
After 250-500	-0,0153	0,1100	-0,0125	0,1990	-0,0101	0,3100	-0,0059	0,5720	-0,0097	0,3780	-0,0086	0,4430	-0,0071	0,5300	-0,0054	0,6030
After 500-750	-0,0054	0,5050	-0,0027	0,7480	-0,0002	0,9830	0,0041	0,6540	0,0003	0,9780	0,0000	0,9970	0,0037	0,7180	0,0067	0,4710
After 750-1000	-0,0134	0,0820	-0,0105	0,1850	-0,0080	0,3320	-0,0037	0,6690	-0,0076	0,4240	-0,0080	0,4060	-0,0033	0,7350	-0,0002	0,9810
After 1000-1250			0,0080	0,3230	0,0107	0,2030	0,0150	0,0890	0,0112	0,2460	0,0117	0,2290	0,0168	0,0910	0,0184	0,0400
After 1250-1500					0,0058	0,4590	0,0103	0,2180	0,0064	0,4870	0,0068	0,4710	0,0098	0,3130	0,0124	0,1490
After 1500-1750							0,0119	0,1580	0,0080	0,3860	0,0082	0,3810				
After 1750-2000									-0,0095	0,3210						

Appendix B: The municipalities included in the research divided into their groups

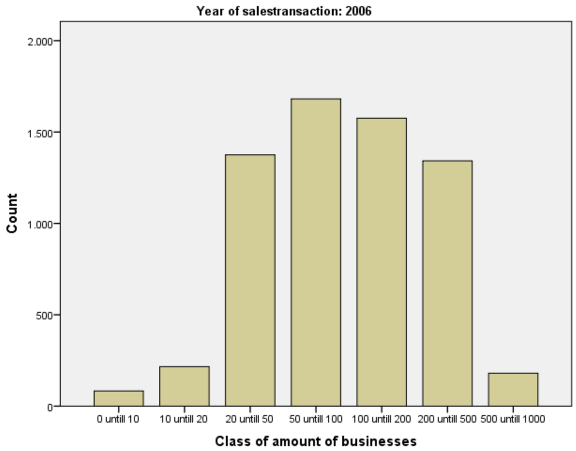
Randstad	Near Randstad	Rest of Netherlands
Amersfoort*	Buren	Bellingwedde
De Bilt	Druten	Haren
Bunnik	Tiel	Veendam
Leusden	Rhenen	Vlagtwedde
Soest	Alkmaar	Dongeradeel
Utrecht*	Beemster	Ameland
Nieuwegein	Hoorn	Harlingen
Aalsmeer	Schagen	Leeuwarden
Bussum	Alphen aan de Rijn	Lemsterland
Haarlemmermeer*	Oud-Beijerland	Opsterland
Hilversum	Waddinxveen	Smallingerland
Laren	Woerden	Weststellingwerf
Oostzaan	Tholen	Almelo
Purmerend	Breda*	Enschede*
Dordrecht*	Gilze en Rijen	Haaksbergen
’s-Gravenhage*	’s-Hertogenbosch*	Hengelo
Hellevoetsluis	Oosterhout	Losser
Hillegom	Oss	Noordoostpolder
Katwijk	Rucphen	Raalte
Leiden*	Tilburg*	Zwolle*
Lisse	Lelystad	Doetinchem
Maassluis	Lansingerland	Gaasterlân-Sleat
Noordwijkerhout	Halderberge	Borsele
Oegstgeest	Roosendaal	Goes
Rotterdam*	Schouwen-Duiveland	Hulst
Schiedam	Neder-Betuwe	Kapelle
Spijkenisse	Kaag en Braasem	Reimerswaal
Albrandswaard		Terneuzen
Zoeterwoude		Tytsjerksteradiel
Zwijndrecht		Pekela
Teylingen		Eindhoven*
Utrechtse Heuvelrug		Mill en Sint Hubert
Westland		Someren
Zuidplas		Veghel
Leidschendam-Voorburg		Woensdrecht
Pijnacker-Nootdorp		Roermond
		Gemert-Bakel
		Laarbeek
		Twenterand
		Westerveld
		Sint Anthonis
		Geldrop-Mierlo
		Dinkelland
		Berkelland
		Bronckhorst
		Oldambt
		Súdwest Fryslân

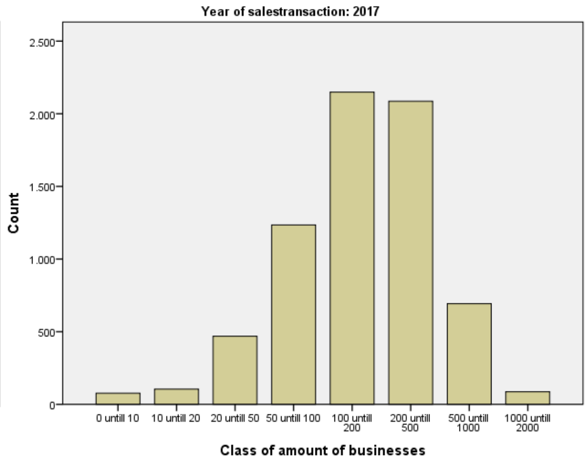
*Municipalities with more than 100.000 inhabitants

Appendix C: the variation of the amount of businesses in classes, in total and per year.

Total of class of amount of businesses

Business class	Frequency	Percent	Valid Percent	Cumulative Percent
0 until 10	160	1,2	1,2	1,2
10 until 20	321	2,4	2,4	3,6
20 until 50	1844	13,8	13,8	17,4
50 until 100	2916	21,8	21,8	39,2
100 until 200	3725	27,9	27,9	67,1
200 until 500	3428	25,7	25,7	92,8
500 until 1000	873	6,5	6,5	99,3
1000 until 2000	87	0,7	0,7	100
Total	13354	100	100	
missing	4	0		
All total	13358	100		





Appendix D: Factors which influence the residential property prices with their effect and the literature where it is concluded.

Factors	Effect	Literature
Market factors		
Randstad area	+	De Vor & De Groot (2011)
Elasticity of the market	+/-	Zietz et al. (2008)
Tax systems	+/-	(Van den Noord, (2005)
Market demand	+/-	(Van den Noord, (2005)
Individual factors		
Number of rooms	+/-	Zietz et al. (2008); Van Duijn et al. (2016); Paterson & Boyle (2002)
Number of m²	+	Zietz et al. (2008); Van Duijn et al. (2016); De Vor & De Groot (2011);
Age of the property	+/-	Zietz et al. (2008); Bartolomew & Ewing (2011); Paterson & Boyle (2002); De Vor & De Groot (2011)
Type of the property	+/-	Van Duijn et al, (2016); De Vor & De Groot (2011)
Monument(al)	+	Van Duijn et al, (2016)
Garage	+	Paterson & Boyle (2002); De Vor & De Groot (2011); Zietz et al. (2008)
Balcony	+	Bartolomew & Ewing (2011)
Fireplace	+	Paterson & Boyle (2002)
Physical surrounding factors		
Urbanity degree	+/-	Beekmans et al. (2014)
Rural area	+	Paterson & Boyle (2002)
Residential area	+	Andersson et al. (2010)
Closeness to city center	+	Van Duijn et al. (2016); Van Dam & Visser (2006)
Near park or forest	+	Van Dam & Visser (2006); Paterson & Boyle (2002)
Closeness to water areas	+	Bartolomew & Ewing (2011); Paterson & Boyle (2002)
Unobstructed view	+	Paterson & Boyle (2002)
Traffic nuisance	-	Beekmans, et al. (2014); De Vor & De Groot (2011)
Closeness to business areas	+/-	De Vor & De Groot (2011); Verhoef & Nijkamp (2002)
Noise disturbance	-	Martin et al. (2006); Beekmans, et al. (2014)
Pollution	-	Martin et al. (2006); Verhoef & Nijkamp (2002); Smolen et al. (1991); Beekmans, et al. (2014)
Commuting costs	-	Verhoef & Nijkamp (2002); De Vor & De Groot (2011)
Spatial quality	-	De Vor & De Groot (2011); Verhoef & Nijkamp (2002)
Regeneration project	+	De Vor & De Groot (2011); Greenberg et al. (2001)
Social surrounding factors		
Amount of Not-Western immigrants	-	Van Duijn et al. (2016); De Vor & De Groot (2011)
Population density	-	Van Duijn et al. (2016); Van Dam & Visser (2006); De Vor & De Groot (2011)
Unemployment	-	Bartolomew, Ewing (2011)
Employment opportunities	+	Gallin (2006); Himmelberg et al. (2006); Case & Mayer (1996); Da Souca (2005); DeFusco et al. (2016); De Vor & De Groot (2011)
Public health	-	Xie & Li (2010)

Green = Described in theoretical framework and included in the measurement of the research.
Orange = Described in theoretical framework but not included in measurement of the research due to lack of comprehensible data.

Appendix E: Measurement methods of the residential property characteristics.

LN Transaction price	Logarithm of the transaction price
Year	Dummy if the property has been sold in the year 2017 (1=yes)
LN m^2 useable space	Logarithm of the amount of net living space inside the property
Number of rooms	Number of rooms available in the property
Garage	Dummy if the property has a garage (1=yes)
Fireplace	Dummy if the property has a fireplace (1=yes)
Balcony	Dummy if the property has a Balcony (1=yes)
Monument(al)	Dummy if the property is a monument or monumental (1=yes)
1906-1930	Dummy age of the property is between the year 1906 and 1930 (1=yes)
1931-1944	Dummy age of the property is between the year 1931 and 1944 (1=yes)
1945-1959	Dummy age of the property is between the year 1945 and 1959 (1=yes)
1960-1970	Dummy age of the property is between the year 1960 and 1970 (1=yes)
1971-1980	Dummy age of the property is between the year 1971 and 1980 (1=yes)
1981-1990	Dummy age of the property is between the year 1981 and 1990 (1=yes)
1991-2000	Dummy age of the property is between the year 1991 and 2000 (1=yes)
>2000	Dummy age of the property is newer than the year 2000 (1=yes)
Corner house	Dummy if the property is a corner house (1=yes)
Semi-detached house	Dummy if the property is a semi-detached house (1=yes)
Detached house	Dummy if the property is a Detached house (1=yes)
Apartment	Dummy if the property is an apartment (1=yes)
Single-family dwelling	Dummy if the property is a single-family house (1=yes)
Mansion/Canal house	Dummy if the property is a mansion or a canal house (1=yes)
Bungalow	Dummy if the property is a bungalow (1=yes)
Villa	Dummy if the property is a villa (1=yes)
Rural area	Dummy property is located in a rural area (1=yes)
Residential area	Dummy property is located in a residential area (1=yes)
In city center	Dummy property is located in the city/town center (1=yes)
Near water area	Dummy property is located near water(area) (1=yes)
Near park or forest	Dummy property is located near park or forest (1=yes)
Unobstructed view	Dummy property has unobstructed view/free view of surrounding (1=yes)
Quiet road	Dummy property is located to a quiet road (1=yes)
Busy road	Dummy property is located to a busy road (1=yes)
Urbanity degree	The density of the amount of addresses in the postal area
P.N.W. immigrants	Percentage of Not Western immigrant inhabitants in the postal area
Inhabitants density	The inhabitants density of the postal area
P. unemployment benefits	Percentage of unemployment receivers of the inhabitants in the postal area
Amount of businesses in classes	The amount of businesses located within the postal area divided into the 8 classes according to the CBS in 2006.
Randstad	Dummy property located in a Randstad municipality according to the CPB(1=yes)
Near Randstad	Dummy property located in a municipality that is max 30 kilometer from the Randstad area(1=yes)
City above 100k inhabitants	Dummy property located in a municipality that has 100.000 or more inhabitants(1=yes)
0-1750m from business area	Property within 0 to 1750 meter from a (former) business area(1=yes)
0-250m from business area	Property within 0 to 250 meter from a (former) business area(1=yes)
250-500m from business area	Property within 250 to 500 meter from a (former) business area(1=yes)
500-750m from business area	Property within 500 to 750 meter from a (former) business area(1=yes)
750-1000m from business area	Property within 750 to 1000 meter from a (former) business area(1=yes)
1000-1250m from business area	Property within 1000 to 1250 meter from a (former) business area(1=yes)
1250-1500m from business area	Property within 1250 to 1500 meter from a (former) business area(1=yes)
1500-1750m from business area	Property within 1500 to 1750 meter from a (former) business area(1=yes)

Appendix F: Price of property transfers in 2006 and 2017, split between the different distance groups.

Distance in meters	Both			2006			2017		
	N	Mean	Std.Dev.	N	Mean	Std.Dev.	N	Mean	Std.Dev.
0-250	835	266328	156798	397	251256	147426	438	279988	163806
250-500	1081	268108	152117	520	261590	161021	561	274151	143250
500-750	1497	265810	139962	702	256404	135340	795	274114	143493
750-1000	1504	256025	132268	707	244658	124394	797	266108	138176
1000-1250	1551	259303	139485	761	245063	129847	790	273020	146960
1250-1500	1653	256030	140311	797	247887	136264	856	263611	143642
1500-1750	1359	267804	168358	652	253371	161192	707	281113	173759
1750-2000	1414	266424	160126	698	259287	153536	716	273382	166112
2000-2250	1311	278992	165274	654	259190	149829	657	298704	177261
2250-2500	1153	266888	149740	565	252330	142356	588	280876	155347

Appendix G: price of property transfers split between the different years, distances and areas.

Transaction Year	Distance in meters	Area	N	Mean	Std. Deviation
2006	0-250	Rest NL	157	225494	104973
		Near Randstad	76	259305	200311
		Randstad	164	272190	150613
	250-500	Rest NL	171	244756	144902
		Near Randstad	167	271065	138099
		Randstad	182	268713	191658
	500-750	Rest NL	213	236873	106919
		Near Randstad	220	251755	113989
		Randstad	269	275673	166002
	750-1000	Rest NL	222	229967	115299
		Near Randstad	226	244951	124324
		Randstad	259	256996	130913
	1000-1250	Rest NL	262	226428	118714
		Near Randstad	190	263405	161638
		Randstad	309	249587	114479
	1250-1500	Rest NL	309	223143	115106
		Near Randstad	163	275464	181939
		Randstad	325	257583	124141
	1500-1750	Rest NL	212	230557	116138
		Near Randstad	140	273022	162758
		Randstad	300	260324	184770
	1750-2000	Rest NL	196	219214	121028
		Near Randstad	176	304668	188308
		Randstad	326	258881	143490
	2000-2250	Rest NL	181	228236	122710
		Near Randstad	144	252277	127528
		Randstad	329	279246	168481
	2250-2500	Rest NL	151	232322	111397
		Near Randstad	87	243916	103265
		Randstad	327	263808	161866
2017	0-250	Rest NL	184	248649	134324
		Near Randstad	110	249271	108677
		Randstad	144	343499	209416
	250-500	Rest NL	206	271005	158103
		Near Randstad	166	282932	131704
		Randstad	189	269868	136189
	500-750	Rest NL	252	241839	119107
		Near Randstad	269	279699	142045
		Randstad	274	298318	159546
	750-1000	Rest NL	265	254570	133945
		Near Randstad	264	274518	135807
		Randstad	268	269235	144229
	1000-1250	Rest NL	270	251268	133880
		Near Randstad	240	269889	127362
		Randstad	280	296680	169916
	1250-1500	Rest NL	298	240721	113923
		Near Randstad	221	265376	148947
		Randstad	337	282695	160231
	1500-1750	Rest NL	244	243983	140788
		Near Randstad	141	273113	127738
		Randstad	322	312753	205433
	1750-2000	Rest NL	247	231018	123917
		Near Randstad	164	309878	217051
		Randstad	305	288068	157542
	2000-2250	Rest NL	178	252712	130694
		Near Randstad	160	275374	135495
		Randstad	319	336069	208025
	2250-2500	Rest NL	169	240314	135478
		Near Randstad	149	277094	129705
		Randstad	270	308353	173618

Appendix H: Basic hedonic price model of the logarithmic of transaction price.

	Coef.	Std. Err. Robust	t	P>|t|	[95% Conf. Interval]	
LN m² useable space	0,6733	0,0175	38,4500	0,0000	0,6390	0,7076
Number of rooms	0,0176	0,0029	6,0000	0,0000	0,0119	0,0234
Garage	0,0964	0,0082	11,7700	0,0000	0,0803	0,1125
Fireplace	0,0533	0,0100	5,3400	0,0000	0,0337	0,0728
Balcony	0,0005	0,0072	0,0700	0,9470	-0,0137	0,0146
Monument(al)	0,0847	0,0380	2,2300	0,0260	0,0102	0,1591
1906-1930	-0,0658	0,0222	-2,9600	0,0030	-0,1094	-0,0222
1931-1944	-0,0356	0,0230	-1,5500	0,1220	-0,0808	0,0095
1945-1959	-0,0753	0,0241	-3,1200	0,0020	-0,1226	-0,0280
1960-1970	-0,1107	0,0224	-4,9400	0,0000	-0,1547	-0,0668
1971-1980	-0,0796	0,0223	-3,5800	0,0000	-0,1233	-0,0360
1981-1990	-0,0355	0,0221	-1,6100	0,1080	-0,0788	0,0078
1991-2000	0,0610	0,0223	2,7400	0,0060	0,0174	0,1046
>2000	0,1425	0,0244	5,8500	0,0000	0,0947	0,1903
Corner house	0,0434	0,0062	6,9700	0,0000	0,0312	0,0556
Semi-detached house	0,1223	0,0097	12,5900	0,0000	0,1033	0,1414
Detached house	0,2734	0,0152	17,9800	0,0000	0,2436	0,3032
Apartment	-0,0134	0,0265	-0,5000	0,6140	-0,0652	0,0385
Single-family dwelling	-0,0229	0,0234	-0,9800	0,3290	-0,0688	0,0231
Mansion/Canal house	0,0587	0,0252	2,3300	0,0200	0,0093	0,1080
Bungalow	0,1502	0,0301	4,9800	0,0000	0,0911	0,2093
Villa	0,1729	0,0294	5,8900	0,0000	0,1154	0,2305
Rural area	0,0626	0,0433	1,4400	0,1490	-0,0224	0,1476
Residential area	-0,0209	0,0086	-2,4400	0,0150	-0,0377	-0,0041
In city center	0,0008	0,0138	0,0600	0,9530	-0,0263	0,0280
Near water area	0,0712	0,0111	6,4400	0,0000	0,0495	0,0930
Near park or forest	0,0249	0,0128	1,9500	0,0510	-0,0001	0,0499
Unobstructed view	0,0323	0,0072	4,5100	0,0000	0,0182	0,0463
Quiet road	0,0042	0,0051	0,8300	0,4080	-0,0057	0,0141
Busy road	-0,0232	0,0198	-1,1700	0,2410	-0,0620	0,0156
Urbanity degree	0,0112	0,0061	1,8300	0,0670	-0,0008	0,0232
P.N.W. immigrants	-0,0035	0,0005	-6,3500	0,0000	-0,0046	-0,0024
Inhabitants density	0,0000	0,0000	-2,6300	0,0080	0,0000	0,0000
P. unemployment benefits	0,0057	0,0027	2,1000	0,0350	0,0004	0,0110
Amount of businesses in classes	-0,0036	0,0045	-0,8200	0,4140	-0,0124	0,0051
Randstad	0,3824	0,0419	9,1200	0,0000	0,3002	0,4645
Near Randstad	0,1031	0,0944	1,0900	0,2750	-0,0820	0,2881
City above 100k inhabitants	0,0997	0,0793	1,2600	0,2090	-0,0559	0,2553
0-250m from business area	0,0023	0,0135	0,1700	0,8640	-0,0241	0,0287
250-500m from business area	0,0230	0,0111	2,0600	0,0390	0,0011	0,0448
500-750m from business area	0,0282	0,0105	2,6800	0,0070	0,0076	0,0487
750-1000m from business area	0,0189	0,0101	1,8800	0,0610	-0,0009	0,0387
1000-1250m from business area	0,0182	0,0097	1,8700	0,0620	-0,0009	0,0372
1250-1500m from business area	0,0256	0,0099	2,5800	0,0100	0,0061	0,0451
1500-1750m from business area	0,0084	0,0095	0,8900	0,3750	-0,0102	0,0270
Constant	8953779	0,1049	85,3900	0,0000	8748208	9159351

The regression of the basic hedonic price model with the 475 district dummies (these are not shown here).

Linear regression Number of obs =5,226
F(438, 4705)= .
Prob > F = .
R-squared= 0.8810
Root MSE = .16264

Appendix I: The basic difference-in-difference model of the logarithmic of transaction price.

	Coef.	Std. Err. Robust	t	P>|t|	[95% Conf. Interval]	
LN m² useable space	0,6685	0,0117	57,1900	0,0000	0,6456	0,6914
Number of rooms	0,0168	0,0022	7,6600	0,0000	0,0125	0,0211
Garage	0,0784	0,0055	14,3400	0,0000	0,0677	0,0891
Fireplace	0,0605	0,0075	8,0700	0,0000	0,0458	0,0752
Balcony	0,0146	0,0052	2,8100	0,0050	0,0044	0,0249
Monument(al)	0,0763	0,0227	3,3600	0,0010	0,0318	0,1209
1906-1930	-0,0445	0,0151	-2,9600	0,0030	-0,0741	-0,0150
1931-1944	0,0023	0,0156	0,1500	0,8830	-0,0284	0,0330
1945-1959	-0,0547	0,0159	-3,4500	0,0010	-0,0857	-0,0236
1960-1970	-0,0977	0,0149	-6,5500	0,0000	-0,1269	-0,0684
1971-1980	-0,0647	0,0148	-4,3800	0,0000	-0,0937	-0,0358
1981-1990	-0,0222	0,0148	-1,5000	0,1330	-0,0511	0,0068
1991-2000	0,0802	0,0147	5,4600	0,0000	0,0514	0,1090
>2000	0,1409	0,0152	9,2600	0,0000	0,1111	0,1708
Corner house	0,0411	0,0046	8,9000	0,0000	0,0321	0,0502
Semi-detached house	0,1240	0,0065	19,0500	0,0000	0,1112	0,1368
Detached house	0,2774	0,0098	28,4400	0,0000	0,2582	0,2965
Apartment	-0,0045	0,0152	-0,2900	0,7680	-0,0343	0,0253
Single-family dwelling	0,0433	0,0130	3,3300	0,0010	0,0178	0,0689
Mansion/Canal house	0,1287	0,0150	8,5800	0,0000	0,0993	0,1581
Bungalow	0,1655	0,0189	8,7400	0,0000	0,1284	0,2026
Villa	0,2023	0,0181	11,1600	0,0000	0,1668	0,2378
Rural area	0,1490	0,0236	6,3200	0,0000	0,1028	0,1952
Residential area	-0,0102	0,0052	-1,9600	0,0500	-0,0204	0,0000
In city center	0,0083	0,0093	0,8900	0,3730	-0,0100	0,0266
Near water area	0,0798	0,0077	10,3200	0,0000	0,0647	0,0950
Near park or forest	0,0441	0,0091	4,8600	0,0000	0,0263	0,0619
Unobstructed view	0,0373	0,0051	7,3900	0,0000	0,0274	0,0472
Quiet road	0,0138	0,0036	3,8100	0,0000	0,0067	0,0209
Busy road	-0,0181	0,0152	-1,1900	0,2350	-0,0479	0,0117
Urbanity degree	0,0013	0,0038	0,3400	0,7310	-0,0061	0,0087
P.N.W. immigrants	-0,0038	0,0003	-10,9400	0,0000	-0,0045	-0,0031
Inhabitants density	0,0000	0,0000	-0,1200	0,9050	0,0000	0,0000
P. unemployment benefits	-0,0026	0,0015	-1,7300	0,0840	-0,0056	0,0004
Amount of businesses in classes	0,0035	0,0026	1,3200	0,1850	-0,0017	0,0087
Year	0,1089	0,0070	15,5100	0,0000	0,0951	0,1227
Randstad	0,0061	0,0817	0,0700	0,9410	-0,1540	0,1662
Near Randstad	-0,1120	0,0464	-2,4100	0,0160	-0,2029	-0,0210
City above 100k inhabitants	0,0115	0,0508	0,2300	0,8210	-0,0881	0,1111
Before 0-1750	0,0305	0,0061536	4.95	0,000	0,0184	0,0425
After 0-1750	0,0078	0,0059046	1.33	0,185	-0,0037	0,0194
Constant	9038253	0,1196	75,59	0.000	8803888	9272618

The regression of the difference-in-difference basic model with the 577 district dummies (not shown in this table.

Linear regression Number of obs = 12,013
F(566, 11394) = .
Prob > F = .
R-squared= 0.8562
Root MSE = .18012

Appendix J: The extended difference-in-difference model of the logarithmic of transaction price.

	Coef.	Std. Err. Robust	t	P>|t|	[95% Conf.	Interval]
LN m² useable space	0,6690	0,0117	57,2800	0,0000	0,6461	0,6919
Number of rooms	0,0168	0,0022	7,6700	0,0000	0,0125	0,0211
Garage	0,0780	0,0055	14,2700	0,0000	0,0672	0,0887
Fireplace	0,0604	0,0075	8,0700	0,0000	0,0457	0,0751
Balcony	0,0146	0,0052	2,8000	0,0050	0,0044	0,0248
Monument(al)	0,0763	0,0227	3,3600	0,0010	0,0318	0,1208
1906-1930	-0,0453	0,0150	-3,0100	0,0030	-0,0748	-0,0158
1931-1944	0,0023	0,0156	0,1500	0,8810	-0,0283	0,0330
1945-1959	-0,0547	0,0158	-3,4600	0,0010	-0,0858	-0,0237
1960-1970	-0,0982	0,0149	-6,5900	0,0000	-0,1273	-0,0690
1971-1980	-0,0649	0,0148	-4,3900	0,0000	-0,0938	-0,0359
1981-1990	-0,0227	0,0147	-1,5400	0,1240	-0,0515	0,0062
1991-2000	0,0801	0,0147	5,4600	0,0000	0,0513	0,1088
>2000	0,1404	0,0152	9,2400	0,0000	0,1106	0,1702
Corner house	0,0414	0,0046	8,9600	0,0000	0,0324	0,0505
Semi-detached house	0,1237	0,0065	18,9900	0,0000	0,1109	0,1365
Detached house	0,2770	0,0097	28,4200	0,0000	0,2579	0,2961
Apartment	-0,0038	0,0152	-0,2500	0,8010	-0,0336	0,0260
Single-family dwelling	0,0436	0,0130	3,3500	0,0010	0,0181	0,0692
Mansion/Canal house	0,1293	0,0150	8,6300	0,0000	0,1000	0,1587
Bungalow	0,1660	0,0189	8,7600	0,0000	0,1288	0,2031
Villa	0,2030	0,0181	11,2000	0,0000	0,1675	0,2386
Rural area	0,1486	0,0236	6,2800	0,0000	0,1022	0,1949
Residential area	-0,0107	0,0052	-2,0500	0,0400	-0,0209	-0,0005
In city center	0,0080	0,0093	0,8600	0,3920	-0,0103	0,0263
Near water area	0,0794	0,0077	10,2900	0,0000	0,0643	0,0945
Near park or forest	0,0441	0,0091	4,8600	0,0000	0,0263	0,0619
Unobstructed view	0,0370	0,0051	7,3200	0,0000	0,0271	0,0469
Quiet road	0,0142	0,0036	3,9100	0,0000	0,0071	0,0213
Busy road	-0,0186	0,0152	-1,2200	0,2220	-0,0484	0,0112
Urbanity degree	0,0009	0,0038	0,2400	0,8140	-0,0065	0,0082
P.N.W. immigrants	-0,0038	0,0003	-10,9900	0,0000	-0,0045	-0,0031
Inhabitants density	0,0000	0,0000	-0,1400	0,8920	0,0000	0,0000
P. unemployment benefits	-0,0028	0,0015	-1,8200	0,0680	-0,0057	0,0002
Amount of businesses in classes	0,0032	0,0026	1,2100	0,2250	-0,0020	0,0084
Year	0,1094	0,0070	15,5700	0,0000	0,0956	0,1232
Randstad	-0,0025	0,0810	-0,0300	0,9750	-0,1612	0,1562
Near Randstad	-0,1043	0,0464	-2,2500	0,0250	-0,1952	-0,0134
City above 100k inhabitants	0,0090	0,0502	0,1800	0,8570	-0,0894	0,1074
Before 0-250	0,0366	0,0126	2,9000	0,0040	0,0118	0,0614
Before 250-500	0,0378	0,0106	3,5700	0,0000	0,0171	0,0586
Before 500-750	0,0431	0,0096	4,4700	0,0000	0,0242	0,0620
Before 750-1000	0,0365	0,0092	3,9600	0,0000	0,0184	0,0545
Before 1000-1250	0,0266	0,0093	2,8700	0,0040	0,0085	0,0448
Before 1250-1500	0,0254	0,0095	2,6900	0,0070	0,0069	0,0440
Before 1500-1750	0,0174	0,0092	1,8800	0,0600	-0,0007	0,0355
After 0-250	0,0377	0,0114	3,3000	0,0010	0,0153	0,0600
After 250-500	-0,0059	0,0104	-0,5700	0,5720	-0,0262	0,0145
After 500-750	0,0041	0,0091	0,4500	0,6540	-0,0138	0,0220
After 750-1000	-0,0037	0,0088	-0,4300	0,6690	-0,0209	0,0134
After 1000-1250	0,0150	0,0089	1,7000	0,0890	-0,0023	0,0324
After 1250-1500	0,0103	0,0084	1,2300	0,2180	-0,0061	0,0268
After 1500-1750	0,0119	0,0084	1,4100	0,1580	-0,0046	0,0284
Constant	9049512	0,1187	76,22	0,0000	8816775	9282249

The regression of the difference-in-difference extended model with the 577 district dummies (not shown in this table.

Linear regression Number of obs = 12,013
F(578, 11382) = .
Prob > F = .
R-squared= 0.8566
Root MSE = .18002

Appendix K: The extended difference-in-difference model of the logarithmic of transaction price Randstad.

	Coef.	Std. Err. Robust	t	P>|t|	[95% Conf. Interval]	
LN m² useable space	0,6865	0,0177	38,8300	0,0000	0,6518	0,7211
Number of rooms	0,0170	0,0038	4,4500	0,0000	0,0095	0,0244
Garage	0,0974	0,0090	10,7700	0,0000	0,0797	0,1152
Fireplace	0,0604	0,0107	5,6400	0,0000	0,0394	0,0813
Balcony	0,0039	0,0070	0,5600	0,5780	-0,0098	0,0175
Monument(al)	0,0575	0,0305	1,8800	0,0600	-0,0024	0,1173
1906-1930	-0,0482	0,0225	-2,1400	0,0320	-0,0923	-0,0041
1931-1944	0,0002	0,0242	0,0100	0,9940	-0,0473	0,0476
1945-1959	-0,0927	0,0249	-3,7200	0,0000	-0,1416	-0,0438
1960-1970	-0,1430	0,0230	-6,2100	0,0000	-0,1881	-0,0978
1971-1980	-0,1131	0,0221	-5,1300	0,0000	-0,1564	-0,0699
1981-1990	-0,0692	0,0221	-3,1300	0,0020	-0,1125	-0,0259
1991-2000	0,0539	0,0217	2,4800	0,0130	0,0113	0,0964
>2000	0,0961	0,0224	4,2900	0,0000	0,0522	0,1401
Corner house	0,0305	0,0068	4,4700	0,0000	0,0171	0,0439
Semi-detached house	0,1231	0,0112	10,9600	0,0000	0,1011	0,1451
Detached house	0,2617	0,0213	12,2800	0,0000	0,2199	0,3035
Apartment	0,0256	0,0254	1,0100	0,3130	-0,0241	0,0753
Single-family dwelling	0,1128	0,0242	4,6700	0,0000	0,0654	0,1601
Mansion/Canal house	0,1945	0,0270	7,2000	0,0000	0,1416	0,2475
Bungalow	0,2829	0,0374	7,5600	0,0000	0,2095	0,3563
Villa	0,2853	0,0321	8,8800	0,0000	0,2224	0,3483
Rural area	-0,0298	0,0636	-0,4700	0,6400	-0,1545	0,0949
Residential area	0,0128	0,0080	1,6100	0,1080	-0,0028	0,0284
In city center	0,0230	0,0149	1,5500	0,1220	-0,0061	0,0522
Near water area	0,0755	0,0101	7,4500	0,0000	0,0556	0,0954
Near park or forest	0,0298	0,0128	2,3200	0,0200	0,0046	0,0549
Unobstructed view	0,0343	0,0071	4,8100	0,0000	0,0203	0,0483
Quiet road	0,0045	0,0053	0,8400	0,4010	-0,0060	0,0149
Busy road	-0,0139	0,0223	-0,6200	0,5350	-0,0576	0,0299
Urbanity degree	0,0098	0,0057	1,7200	0,0850	-0,0014	0,0209
P.N.W. immigrants	-0,0036	0,0006	-6,4300	0,0000	-0,0047	-0,0025
Inhabitants density	0,0000	0,0000	1,9100	0,0560	0,0000	0,0000
P. unemployment benefits	0,0012	0,0026	0,4500	0,6560	-0,0039	0,0062
Amount of businesses in classes	0,0050	0,0044	1,1400	0,2530	-0,0036	0,0136
Year	0,1555	0,0106	14,6900	0,0000	0,1347	0,1763
City above 100k inhabitants	-0,0879	0,0308	-2,8500	0,0040	-0,1483	-0,0274
Before 0-250	0,0540	0,0194	2,7800	0,0050	0,0160	0,0921
Before 250-500	0,0235	0,0168	1,4000	0,1620	-0,0094	0,0565
Before 500-750	0,0539	0,0145	3,7100	0,0000	0,0254	0,0824
Before 750-1000	0,0324	0,0132	2,4600	0,0140	0,0066	0,0582
Before 1000-1250	0,0237	0,0123	1,9200	0,0550	-0,0005	0,0479
Before 1250-1500	0,0316	0,0143	2,2100	0,0270	0,0036	0,0596
Before 1500-1750	0,0162	0,0133	1,2200	0,2220	-0,0098	0,0422
After 0-250	0,0446	0,0159	2,8000	0,0050	0,0134	0,0758
After 250-500	-0,0218	0,0150	-1,4500	0,1470	-0,0512	0,0077
After 500-750	-0,0122	0,0140	-0,8700	0,3820	-0,0396	0,0152
After 750-1000	-0,0158	0,0138	-1,1500	0,2520	-0,0429	0,0112
After 1000-1250	0,0047	0,0145	0,3200	0,7470	-0,0237	0,0331
After 1250-1500	0,0182	0,0121	1,5000	0,1330	-0,0056	0,0419
After 1500-1750	0,0208	0,0121	1,7100	0,0870	-0,0030	0,0446
Constant	8891241	0,1037	85,77	0,0000	8688013	9094469

The regression of the difference-in-difference extended model Randstad with the 186 district dummies (not shown in this table).

Linear regression Number of obs =3,825 F(289, 3506)= . Prob > F = . R-squared= 0.8469 Root MSE = .18931

Appendix L: The extended difference-in-difference model of the logarithmic of transaction price Near Randstad.

	Coef.	Std. Err. Robust	t	P>|t|	[95% Conf. Interval]	
LN m² useable space	0,6120	0,0185	33,0200	0,0000	0,5757	0,6484
Number of rooms	0,0159	0,0042	3,7600	0,0000	0,0076	0,0242
Garage	0,0560	0,0094	5,9400	0,0000	0,0375	0,0745
Fireplace	0,0423	0,0138	3,0600	0,0020	0,0152	0,0694
Balcony	0,0251	0,0095	2,6600	0,0080	0,0066	0,0437
Monument(al)	0,0692	0,0400	1,7300	0,0830	-0,0092	0,1476
1906-1930	-0,0286	0,0250	-1,1400	0,2540	-0,0776	0,0205
1931-1944	0,0294	0,0252	1,1600	0,2440	-0,0201	0,0789
1945-1959	-0,0057	0,0256	-0,2200	0,8240	-0,0560	0,0446
1960-1970	-0,0648	0,0238	-2,7200	0,0070	-0,1116	-0,0181
1971-1980	-0,0112	0,0238	-0,4700	0,6370	-0,0579	0,0354
1981-1990	0,0227	0,0237	0,9600	0,3380	-0,0237	0,0691
1991-2000	0,1111	0,0241	4,6100	0,0000	0,0638	0,1584
>2000	0,1953	0,0247	7,9100	0,0000	0,1469	0,2437
Corner house	0,0522	0,0083	6,3000	0,0000	0,0359	0,0684
Semi-detached house	0,1433	0,0117	12,2700	0,0000	0,1204	0,1662
Detached house	0,3018	0,0161	18,7800	0,0000	0,2703	0,3333
Apartment	0,0365	0,0254	1,4400	0,1510	-0,0134	0,0863
Single-family dwelling	0,0580	0,0216	2,6800	0,0070	0,0156	0,1004
Mansion/Canal house	0,1496	0,0270	5,5400	0,0000	0,0967	0,2025
Bungalow	0,2291	0,0302	7,6000	0,0000	0,1700	0,2882
Villa	0,2106	0,0315	6,6900	0,0000	0,1488	0,2723
Rural area	0,1844	0,0421	4,3700	0,0000	0,1017	0,2670
Residential area	-0,0131	0,0087	-1,5000	0,1330	-0,0302	0,0040
In city center	0,0209	0,0148	1,4100	0,1590	-0,0082	0,0499
Near water area	0,0765	0,0122	6,2700	0,0000	0,0526	0,1004
Near park or forest	0,0710	0,0152	4,6600	0,0000	0,0411	0,1008
Unobstructed view	0,0286	0,0092	3,1000	0,0020	0,0105	0,0467
Quiet road	0,0192	0,0065	2,9700	0,0030	0,0066	0,0319
Busy road	-0,0139	0,0275	-0,5000	0,6140	-0,0679	0,0401
Urbanity degree	0,0108	0,0077	1,4100	0,1600	-0,0042	0,0258
P.N.W. immigrants	-0,0022	0,0041	-0,5400	0,5880	-0,0103	0,0058
Inhabitants density	-0,0022	0,0005	-4,2800	0,0000	-0,0032	-0,0012
P. unemployment benefits	0,0000	0,0000	-3,0300	0,0020	0,0000	0,0000
Amount of businesses in classes	0,0010	0,0035	0,2900	0,7740	-0,0059	0,0079
Year	0,0880	0,0123	7,1600	0,0000	0,0639	0,1121
City above 100k inhabitants	0,0349	0,0735	0,4700	0,6350	-0,1092	0,1790
Before 0-250	0,0195	0,0226	0,8600	0,3880	-0,0248	0,0638
Before 250-500	0,0664	0,0157	4,2300	0,0000	0,0357	0,0972
Before 500-750	0,0546	0,0158	3,4600	0,0010	0,0237	0,0856
Before 750-1000	0,0458	0,0156	2,9500	0,0030	0,0153	0,0763
Before 1000-1250	0,0533	0,0158	3,3700	0,0010	0,0223	0,0843
Before 1250-1500	0,0505	0,0172	2,9300	0,0030	0,0167	0,0843
Before 1500-1750	0,0445	0,0172	2,5900	0,0100	0,0108	0,0783
After 0-250	0,0482	0,0220	2,1900	0,0280	0,0051	0,0914
After 250-500	0,0400	0,0174	2,3000	0,0220	0,0058	0,0741
After 500-750	0,0260	0,0160	1,6300	0,1030	-0,0052	0,0573
After 750-1000	0,0048	0,0148	0,3300	0,7450	-0,0241	0,0337
After 1000-1250	0,0327	0,0144	2,2700	0,0230	0,0045	0,0609
After 1250-1500	0,0290	0,0166	1,7500	0,0800	-0,0035	0,0615
After 1500-1750	0,0104	0,0170	0,6100	0,5410	-0,0229	0,0437
Constant	9.314.806	0,0925041	100,7	0,0000	9.133.429	9.496.183

The regression of the difference-in-difference extended model Randstad with the 126 district dummies (not shown in this table).

Linear regression Number of obs =3,202
F(168, 3024)= .
Prob > F = .
R-squared= 0.8578
Root MSE = .16157

Appendix M: The extended difference-in-difference model of the logarithmic of transaction price Rest of the Netherlands.

	Coef.	Std. Err. Robust	t	P>|t|	[95% Conf. Interval]	
LN m² useable space	0,6120	0,0185	33,0200	0,0000	0,5757	0,6484
Number of rooms	0,0159	0,0042	3,7600	0,0000	0,0076	0,0242
Garage	0,0560	0,0094	5,9400	0,0000	0,0375	0,0745
Fireplace	0,0423	0,0138	3,0600	0,0020	0,0152	0,0694
Balcony	0,0251	0,0095	2,6600	0,0080	0,0066	0,0437
Monument(al)	0,0692	0,0400	1,7300	0,0830	-0,0092	0,1476
1906-1930	-0,0286	0,0250	-1,1400	0,2540	-0,0776	0,0205
1931-1944	0,0294	0,0252	1,1600	0,2440	-0,0201	0,0789
1945-1959	-0,0057	0,0256	-0,2200	0,8240	-0,0560	0,0446
1960-1970	-0,0648	0,0238	-2,7200	0,0070	-0,1116	-0,0181
1971-1980	-0,0112	0,0238	-0,4700	0,6370	-0,0579	0,0354
1981-1990	0,0227	0,0237	0,9600	0,3380	-0,0237	0,0691
1991-2000	0,1111	0,0241	4,6100	0,0000	0,0638	0,1584
>2000	0,1953	0,0247	7,9100	0,0000	0,1469	0,2437
Corner house	0,0522	0,0083	6,3000	0,0000	0,0359	0,0684
Semi-detached house	0,1433	0,0117	12,2700	0,0000	0,1204	0,1662
Detached house	0,3018	0,0161	18,7800	0,0000	0,2703	0,3333
Apartment	0,0365	0,0254	1,4400	0,1510	-0,0134	0,0863
Single-family dwelling	0,0580	0,0216	2,6800	0,0070	0,0156	0,1004
Mansion/Canal house	0,1496	0,0270	5,5400	0,0000	0,0967	0,2025
Bungalow	0,2291	0,0302	7,6000	0,0000	0,1700	0,2882
Villa	0,2106	0,0315	6,6900	0,0000	0,1488	0,2723
Rural area	0,1844	0,0421	4,3700	0,0000	0,1017	0,2670
Residential area	-0,0131	0,0087	-1,5000	0,1330	-0,0302	0,0040
In city center	0,0209	0,0148	1,4100	0,1590	-0,0082	0,0499
Near water area	0,0765	0,0122	6,2700	0,0000	0,0526	0,1004
Near park or forest	0,0710	0,0152	4,6600	0,0000	0,0411	0,1008
Unobstructed view	0,0286	0,0092	3,1000	0,0020	0,0105	0,0467
Quiet road	0,0192	0,0065	2,9700	0,0030	0,0066	0,0319
Busy road	-0,0139	0,0275	-0,5000	0,6140	-0,0679	0,0401
Urbanity degree	0,0108	0,0077	1,4100	0,1600	-0,0042	0,0258
P.N.W. immigrants	-0,0022	0,0005	-4,2800	0,0000	-0,0032	-0,0012
Inhabitants density	0,0000	0,0000	-3,0300	0,0020	0,0000	0,0000
P. unemployment benefits	0,0010	0,0035	0,2900	0,7740	-0,0059	0,0079
Amount of businesses in classes	-0,0022	0,0041	-0,5400	0,5880	-0,0103	0,0058
Year	0,0880	0,0123	7,1600	0,0000	0,0639	0,1121
City above 100k inhabitants	0,0349	0,0735	0,4700	0,6350	-0,1092	0,1790
Before 0-250	0,0195	0,0226	0,8600	0,3880	-0,0248	0,0638
Before 250-500	0,0664	0,0157	4,2300	0,0000	0,0357	0,0972
Before 500-750	0,0546	0,0158	3,4600	0,0010	0,0237	0,0856
Before 750-1000	0,0458	0,0156	2,9500	0,0030	0,0153	0,0763
Before 1000-1250	0,0533	0,0158	3,3700	0,0010	0,0223	0,0843
Before 1250-1500	0,0505	0,0172	2,9300	0,0030	0,0167	0,0843
Before 1500-1750	0,0445	0,0172	2,5900	0,0100	0,0108	0,0783
After 0-250	0,0482	0,0220	2,1900	0,0280	0,0051	0,0914
After 250-500	0,0400	0,0174	2,3000	0,0220	0,0058	0,0741
After 500-750	0,0260	0,0160	1,6300	0,1030	-0,0052	0,0573
After 750-1000	0,0048	0,0148	0,3300	0,7450	-0,0241	0,0337
After 1000-1250	0,0327	0,0144	2,2700	0,0230	0,0045	0,0609
After 1250-1500	0,0290	0,0166	1,7500	0,0800	-0,0035	0,0615
After 1500-1750	0,0104	0,0170	0,6100	0,5410	-0,0229	0,0437
Constant	9314806	0,0925	100,7	0,0000	9133429	9496183

The regression of the difference-in-difference extended model Randstad with the 268 district dummies (not shown in this table).

Linear regression Number of obs =3,202
F(168, 3024)= .
Prob > F = .
R-squared= 0.8578
Root MSE = .16157