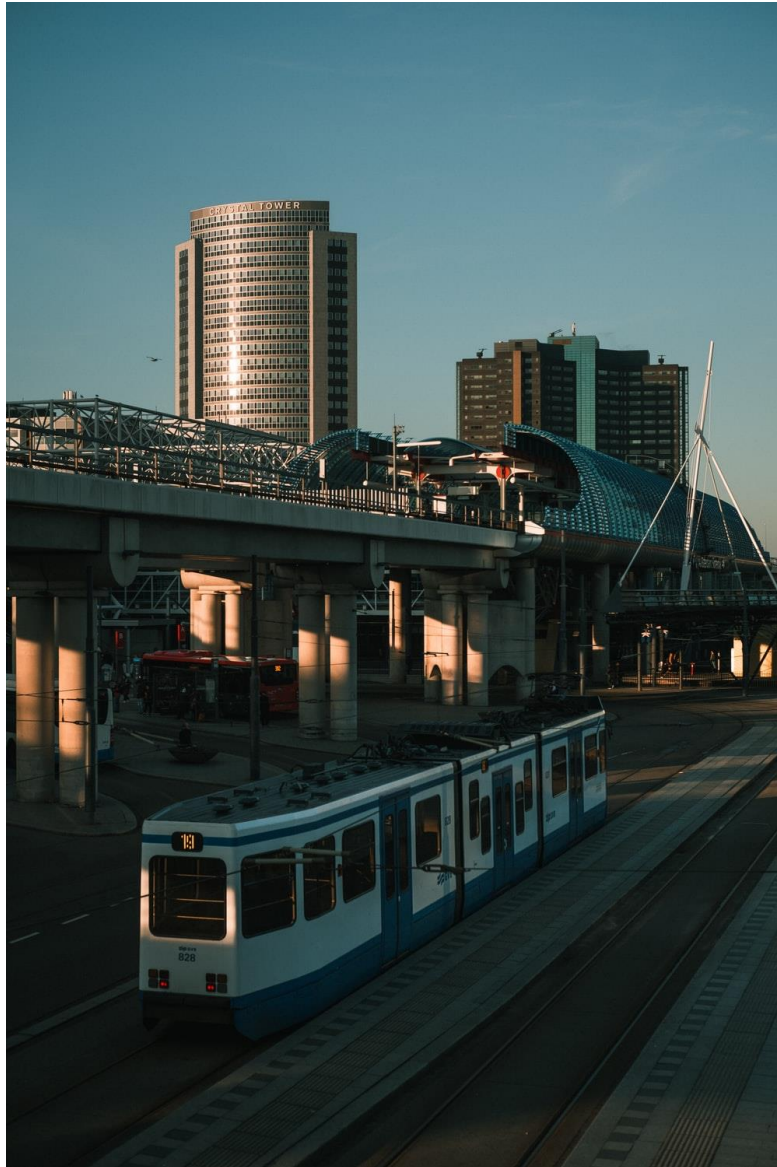# How does the accessibility to train stations influence residential property price?

A bachelor thesis on the influences of train station accessibility on property price

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17 June 2022

Abstract

This thesis deals with the effects of the accessibility of train stations on property prices. It is already known that a newly built train station can increase nearby property prices due to improved accessibility. However, the effects can vary greatly across different context. Prior studies mainly observe these impacts in urban areas. Very little is known about how the construction of a train station affects property prices in exurban municipalities. This is important because the station provides improved accessibility for residents, which may or may not be priced into real estate market. For this reason, this study fills the gap by examining the impact of newly built train station on property prices in rural municipalities in the Netherlands. The methodology used is a comparative case study with a difference-indifference framework, comparing three pairs of municipalities. The issue is relevant for society and especially for spatial planners, as new train station development improves residents' access to jobs and the social environment, whereas if prices rise as a result housing affordability may decline. In addition, knowledge of the impact of station construction on property prices provides planning certainty, improves cost calculation, and future forecasts can be made. The main conclusion is that no evidence can be seen that residential property prices do not increase when a new train station is built in the investigated area.

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1. Introduction

Accessibility describes the potential for spatial interaction. When establishing the residential property price, accessibility significantly influences the price. Urban economics often debates location choice (Debrezion et al., 2007). According to Debrezion et al. (2007), the discussion deals with the ideal location depending on constraints. It is dedicated to declaring the identity of property at specific whereabouts. Workers tend to choose their place of residence based on the distance between job and residence (Delventhal et al., 2021).

To get to a location, accessibility can be ensured by trains, buses and cars. People are switching to alternative modes of transport such as trains to avoid traffic jams. For this reason, a train station nearby a residential property is a critical decision factor for many people when choosing a place to live. The following work is intended to examine to which extent the accessibility of train stations influences the residential property price.

This issue is of relevance because investments in infrastructure such as new train stations improve urban accessibility at the municipal level. Improved accessibility is also associated with improved land value. A higher land value provides a way to finance transport infrastructure (Du & Mulley, 2012). Additionally, the study identifies the impact of the improved accessibility due to a newly constructed train station on property prices in exurban municipalities. Therefore, this paper aims to investigate how accessibility to train stations affects property prices, focusing on exurban municipalities. This is done through literature analysis and a comparative case study.

The following research question will be answered: "To what extent does the construction of a new transit station influences residential property price at the municipal level in exurban places in the Netherlands?"

The sub-questions are defined as follows:

1. How does the residential property price change when a new train station is built?
2. How does the proximity to large urban centres affect the relationship between building a new train station and property prices?

In the second chapter of the thesis, the existing literature is discussed, focusing on the changes that occur after constructing a train station. Chapter 3 deals with the methodology. The results of the elaboration are represented in chapter 4. The work is rounded off with a discussion in chapter 5 and a conclusion in chapter 6.

2. Theoretical Framework

There is a consensus in the literature that if a new train station is built and accessibility improves, it will affect property prices (Paliska & Drobne, 2020). exurban areas have low population density and increased distance to the nearest city (Starkey, 2022). However, it is important to ensure the communities' economic prosperity and provide social connectivity to the surrounding cities. For these reasons, Starkey (2022) believes that access to appropriate mobility systems such as the train station is important. An expanded mobility system, for example, through the construction of rail lines and a train station, creates greater accessibility for residents in exurban municipalities. Moreover, improved accessibility can affect land prices (He, 2020). However, the majority of research to date has been on urban areas. There is little literature on how the construction of a train station affects property prices in exurban areas. For this reason, this thesis examines the effect of improved accessibility through a newly built train station on property prices in exurban municipalities.

Most theories on land prices can be traced back to the work of van Thünen (1783 - 1850). He analyzed how the type and intensity of agricultural production vary spatially depending on transport costs to the sales market. It describes the additional profit of an area near the market compared to an area further away (Harvey & Jowsey, 2004). This means that the closer the property is to the centre, the higher the property prices. The van Thünen model was extended by Alonso (1933 - 1999). He developed a microeconomic model to differentiate land price, land use and land-use intensity. The central factors in the choice of location are the accessibility of the site and the associated transport costs (Harvey & Jowsey, 2004). The further the location is from the centre, the higher the transport costs, which are compensated for by lower rents.

First, it must be determined how accessibility is defined in this paper. Accessibility is the possibility of interaction with different locations. It describes how one place can be reached from another place (Leclerc & Hall, 2007). Furthermore, accessibility describes how transport systems make it possible for people to reach a place or activity. Travel distance, time, and costs to travel between places represent accessibility and can be an indicator to measure how accessible a place is (Du & Mulley, 2012).

In this thesis, it has to be defined when a municipality is called a rural area. If a rural area is defined according to the Organisation for Economic Co-operation and Development (OECD), there are no rural areas in the Netherlands (Haartsen et al., 2003). In a study conducted by Haartsen et al. (2003), the authors concluded that the idea of rurality is mainly based on visual dimensions. Rijnks and Strijker (2013), on the other hand, say that it is essential to define regions. In order to even create a definition of a region, characteristics have to be found, including geographical location and socioeconomic factors (Rijnks & Strijker, 2013). Moreover, the region must be distinguishable from others. It can be achieved through definitions. In the Netherlands, the state structure is three-tiered. The municipal level is thus at the lowest level. For the reasons mentioned above, this paper defines rural areas as those at the municipal level. In addition, geographic aspects are taken into account, such as the distance to the next larger city and socioeconomic factors, such as the number of inhabitants.

2.1. Influences of existing train stations

Based on the mentioned theories, saving transport costs results in increased demand for accessible locations, and hence higher prices. Thus, train stations influence property prices in their vicinity. Some studies show that property prices are higher near train stations. For example, Bowes and Ihlanfeldt

(2001) find that prices are 3.5 % higher within 4.83 kilometres of a station. In an article examining 57 studies in a meta-analysis, Debrezion et al. (2007) conclude that for every 250 m of proximity to a train station, the price of a property increases by 2.4 %. The extent to which accessibility to train stations influences property prices is usually up to 1000 m but can also reach up to 2,000 m (Li & Huang, 2020). The different results can be explained by factors such as accessibility to motorways, station types, or socioeconomic factors.

Du and Mulley (2012) show in the study that property prices near train stations increase due to faster accessibility by public transport. However, this effect is more potent in poorer residential areas. Savings in station accessibility of up to one minute lead to a more considerable percentage change in property prices (up to 6 %) compared to the global average (1.2 %). For this reason, train stations and their accessibility influence property prices.

2.2. Influences of newly built train stations

The question now arises as to how the price of property changes when a new train station is added to an area, thus improving accessibility. Do prices rise sharply? How much does the new accessibility to the train station affect property price? It is assumed that property prices would rise if the accessibility to train stations improves. Du and Mulley (2012) state that improvement in public transport and, therefore, accessibility led to higher land value, calling land value uplift. Nevertheless, in a study, Nurlaela and Pamungkas (2014) found that only 5-7 % contribute to the accessibility of the capitalization of the property price. Indeed, they conclude that the relationship between property price and improved accessibility is weak. However, capitalization is done by spillover, meaning that other unobserved factors significantly impact capitalization. Additionally, the analysis scope and time factor are necessary and impact the study. In contrast to Nurlaela and Pamungkas (2014) findings are Diao et al. (2017) results. It is found that prices increase by 1.6 % after opening a new Mass Rapid Transit line. Furthermore, their results show that houses within a 400 m radius inside the line are strongly capitalized, namely 4.2 % more expensive than outside the 400 m. Additionally, the housing wealth effect for households increases strongly in the immediate vicinity. Apart from this, Bajic (1983) concluded that the direct savings in travel costs from the station extension were capitalized into housing prices. In other words, the savings in commuting costs were transferred to homeowners. Altogether, it can be said that, in general, a new train station affects property price because it improves accessibility. However, empirical evidence shows that the price increase can vary greatly.

2.3. Exurban impact of train station accessibility on property price

Public transport lines play a significant role as an economic artery in rural areas (Sieber et al., 2020). According to Sieber et al. (2020), they are an important factor because they provide residents with access to mobility and thus ensure economic prosperity. On the other hand, maintaining these rail lines can prove difficult due to low-capacity utilization. For the rail line operator, an urban environment with higher occupancy rates is more attractive, as it turns out to be more profitable (Sieber et al., 2020). For this reason, there is little literature on how new station construction affects property prices in exurban areas. In the study by Paliska and Drobne (2020), they examined how different modes of transportation affect housing prices in rural north-eastern Slovenia. They concluded that proximity to the train station was not significant. In contrast, He (2020) reached a different conclusion in the research. The result is, that the strongest capitalization is in the last stations at the suburban end. The different study locations

can probably explain the differences in the results. He (2020) study site is in Hong Kong, where the population density is much higher. Thus, a newly built train station has a much greater impact because it affects more people who have increased mobility, and thus the residential area becomes more attractive. In conclusion, it can be said that the construction of a new train station in exurban municipalities and its impact on property prices is strongly dependent on the area studied and population density.

2.4. Conceptual model and Hypothesis

The following section describes the conceptual model (see Figure 1). It is assumed that the distance to the station decreases when a station is built. This, in turn, improves accessibility. As a result, property prices increase. However, the price increase depends on the location. A distinction must be made here whether the location is urban or rural. The following hypothesis is made in this thesis. It is assumed that the property price will increase due to improved accessibility if a new train station is built.
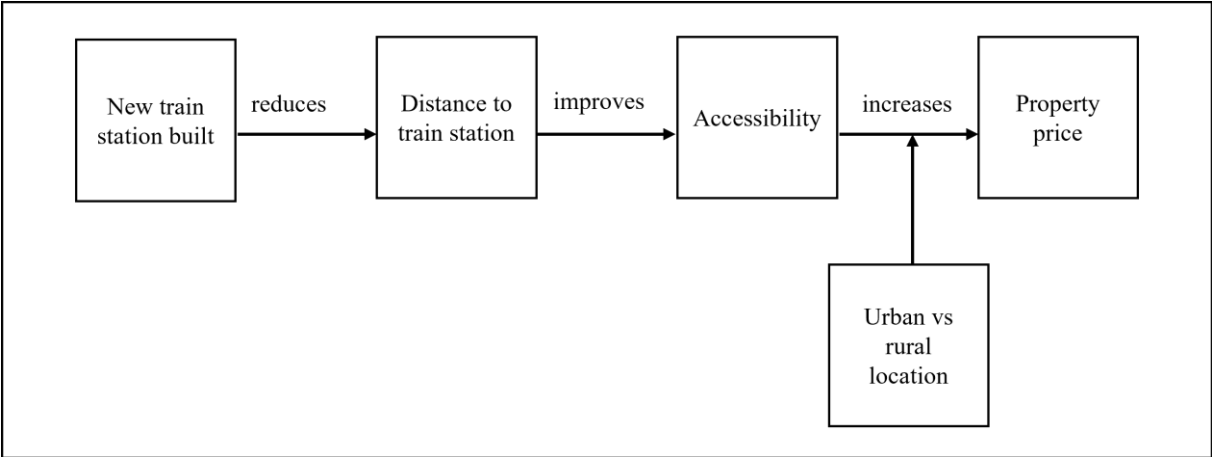

Figure 1 – Conceptual model of the factors that influence property price

3. Methodology

The following chapter presents the research method, ethical considerations and describes the case selection.

3.1. Research method

The variables examined in this case study are average house prices and the proximity of the distance to train stations. The selection of variables is based on the literature analysis. The data is taken from the CBS Statline website. It is the database of Statistics Netherlands. The data is provided free of charge. Access to the dataset was gained through the login of the university account. The owner of the dataset is CBS. The data was checked for quality. The dataset for the bachelor thesis shows the most important statistical data for different regional areas. The start of data recording for this dataset was in 1995. However, data for the variable "distance to station" has been recorded and registered only since 2007. The unit of analysis in the dataset is the municipality level, and the data is available on an annual basis.

3.2. Ethical considerations

In addition to data collection and analysis, the ethical aspect must be considered. In this thesis, the researcher is in the position of an outsider. No active observations are made. As secondary data is used, the data collection was already made through a different researcher. There is not much information about how the researcher collected the data. For this reason, the data must be critically scrutinized and examined to whether they meet the ethical requirements. The ethical requirements are valid, trustworthy and ethical.

3.3. Case selection

To answer the research question, three rural municipalities were selected to compare with similar rural municipalities. The municipalities to be compared were selected according to the criteria elaborated in chapter 2. The rationale for the selection of the localities is as follows.

Initially, Dronten and Lelystad were chosen. Dronten has a total of 38,182 inhabitants in 2007 (CBS Statline, 2022). Lelystad registers 72,252 inhabitants in the same year (CBS Statline, 2022). In this analysis, the municipalities have the most inhabitants, and the difference in the number of inhabitants is the highest. Nevertheless, the following points prevail, so the municipalities have been included in the comparison. The municipalities are direct neighbours in terms of geographic location and are surrounded by water, so there is a direct comparison in terms of location. The distance between Dronten and Lelystad's is only about 16 kilometres (Esri, 2022). Both municipalities are surrounded by larger cities such as Zwolle, Almere and Amsterdam. The distance to these cities is approximately between 22 kilometres and 58 kilometres (Esri, 2022). This creates an opportunity to live in rural municipalities and commute to urban areas. The following maps give an overview of the location of the municipalities up to the distance to the next larger city (see Figure 2).
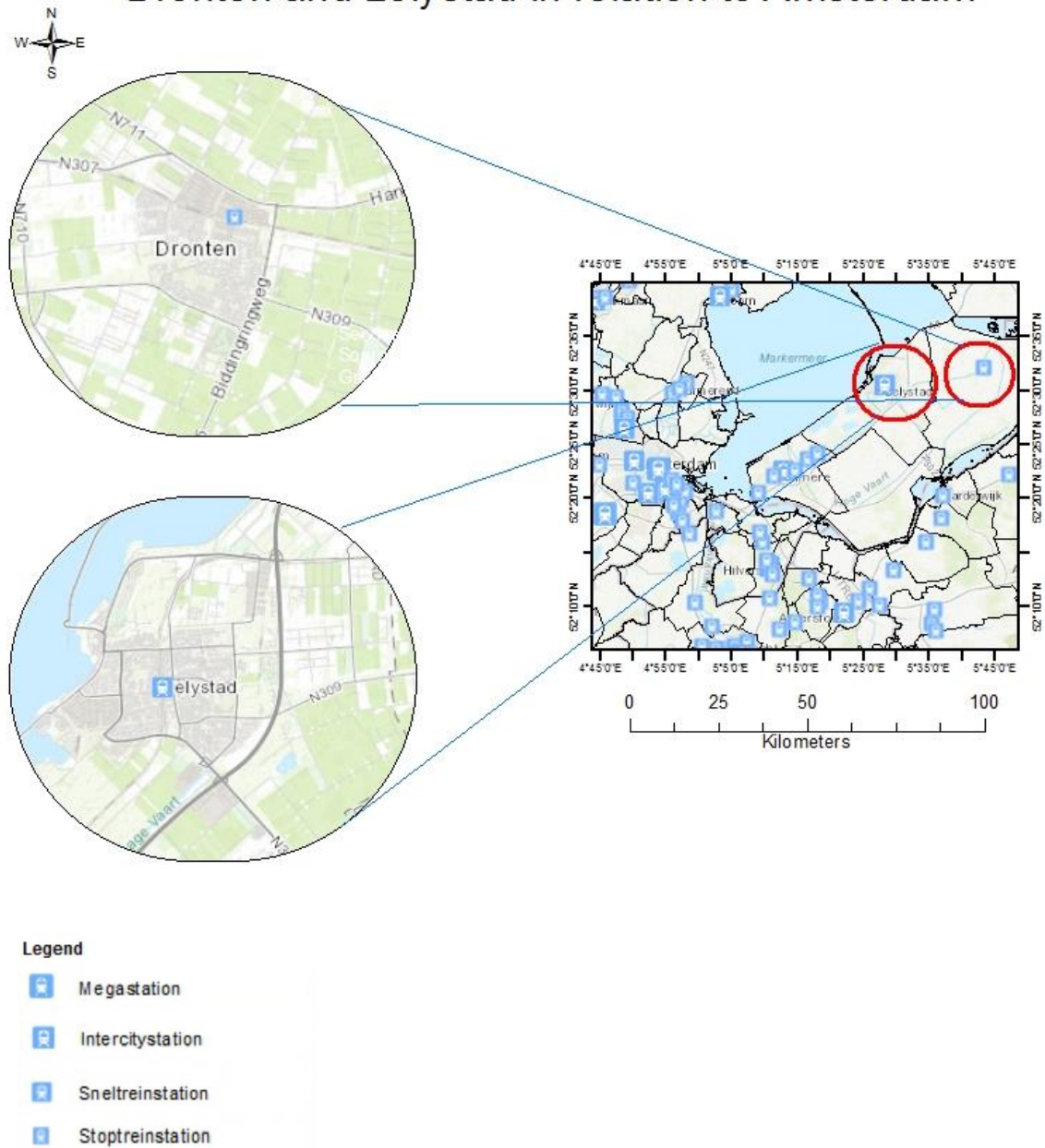
Figure 2 – Research area Dronten and Lelystad
(Esri, 2022)

Additionally, both municipalities are located on Flevoland, the artificial island and youngest province in the Netherlands. Thus, not only a geographical similarity but also physical features are given, which, as described in chapter 2, are important to compare municipalities with each other. In the further course, the socioeconomic factors, more precisely income, are viewed. The average income for Dronten is 42,120 €, and for Lelystad, 38,600 €. Both municipalities are in the middle class. The income distribution can be seen in Figure 4. Due to the fact that the income of the two municipalities is similar, the areas make themselves comparable.

Figure 3 – Average disposable income of private households excl. students Dronten and Lelystad (CBS Statline, 2022)

The railroad station in Dronten was opened for the first time on December 09, 2012 (Treinstationinfo.nl, n.d.b). In Flevoland are only three stations in the area, Almere, Lelystad, and the new Dronten station, which is remarkable. For this reason, the municipalities are getting compared, and it should become clear whether the newly opened train station and improved accessibility will affect property prices.

Mook en Middelaar is compared with the municipality of Bedum. This is done for the following reasons. Mook en Middelaar and Bedum differ in population by only 2,000, so the municipalities represent a comparable size (CBS Statline, 2022). Furthermore, they have similarities in geographical location. Both municipalities are located near a larger city, Bedum, close to Groningen and Mook en Middelaar, close to Nijmegen (see Figure 4 and Figure 5). The distance from both municipalities to the next larger city is about 10 kilometres (Esri, 2022).

Bedum in relation to Groningen

Legend

🚉 Megastation

🚉 Intercitystation

🚉 Sneltreinstation

🚉 Stoptreinstation
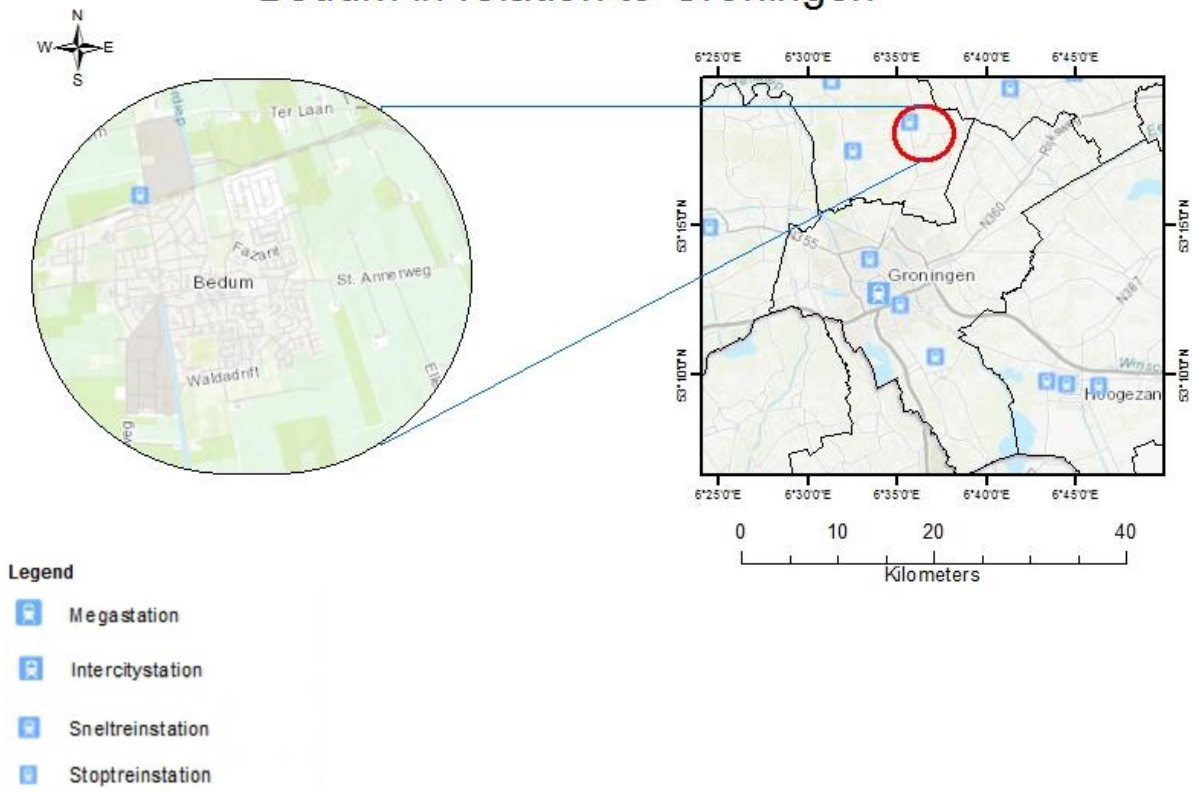
Figure 4 – Research area Bedum
(Esri, 2022)

Mook en Middelar in relation to Nijmegen

Legend

- Megastation
- Intercitystation
- Sneltreinstation
- Stoptreinstation

Figure 5 – Research area Mook en Middelaar
(Esri, 2022)

Residents in Mook en Middelaar have an average income of 48,490 €. Bedum, on the other hand, has a slightly lower average income of 39,175 €. The average disposable income distribution can be seen in Figure 6.
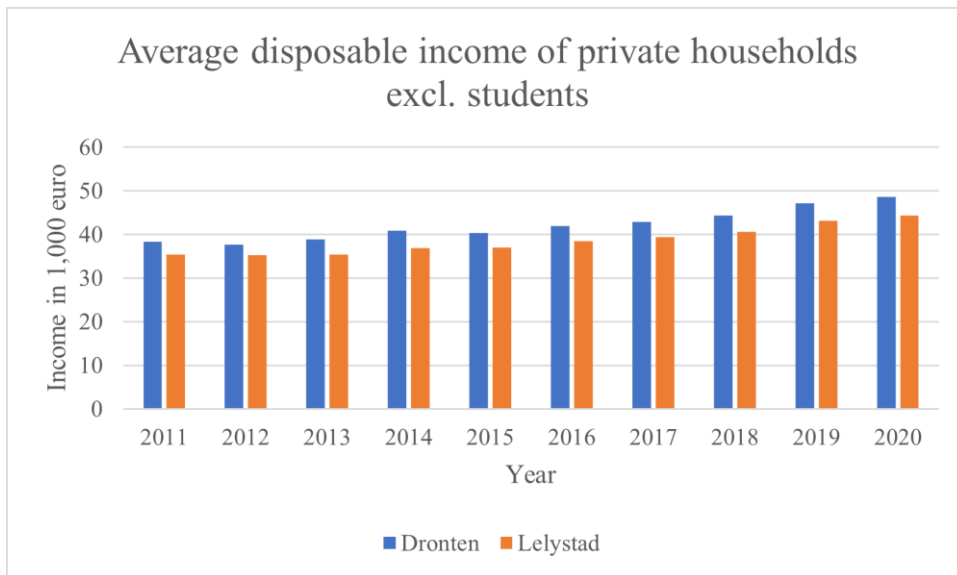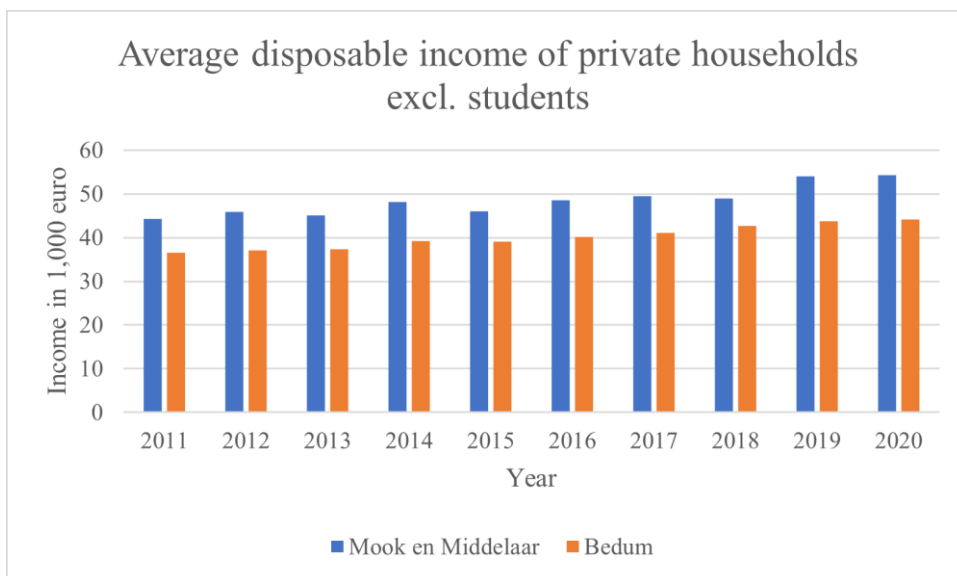

Figure 6 – Average disposable income of private households excl. students Mook en Middelaar and Bedum
(CBS Statline, 2022)

The railroad station in Mook en Middelaar was opened on Wednesday, May 06 2009, under the name Mook – Molenhoek (Infrasite, 2009). The new station should lead to a reduction in car traffic and thus contribute to environmental protection. Additionally, the newly built station should improve local transport to the next larger city Nijmegen and thus provide an alternative to the car (Infrasite, 2009). The station in Bedum, on the other hand, was opened in June 1884 (Treinstationinfo.nl, n.d.a). Because this station has been in existence and operation for a long time, and their commonalities in terms of distance to the nearest city, as well as socioeconomic factors it can be assumed that the influences of a newly built station and thus the improved accessibility can be seen in this example.

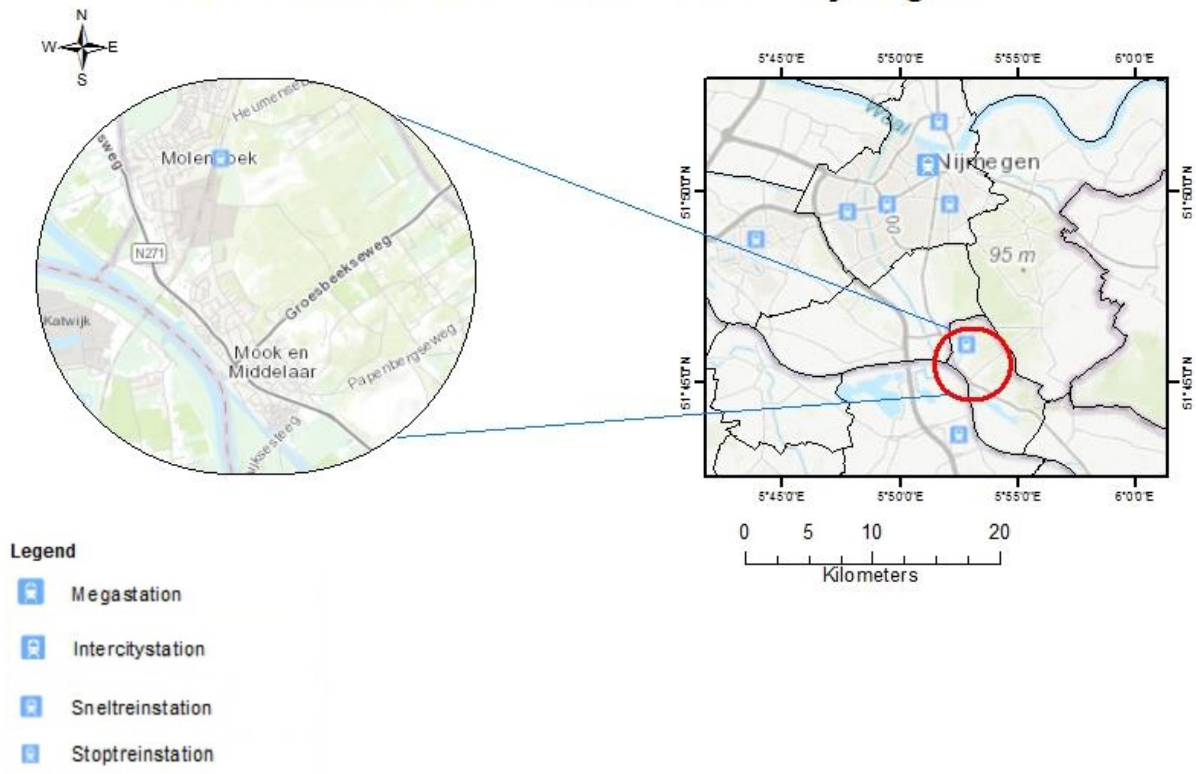Furthermore, Hardinxveld-Giessendam and Weesp are considered municipalities to be compared in this thesis. One criterion for comparing the municipalities is the number of inhabitants. This is almost identical. In 2007, the number of inhabitants in Hardinxveld-Giessendam was 17,693 (CBS Statline, 2022). In Weesp, the same year, the number of inhabitants was 17,556. However, the municipalities differ most in this study in terms of distance to the nearest larger city. Weesp is located just outside Amsterdam; the distance is about 12 kilometres (Esri, 2022). Hardinxveld-Giessendam, on the other hand, is about 30 kilometers from Rotterdam (Esri, 2022). Both municipalities can be considered suburbs of the larger cities because of their location. The localization can be seen on the following maps Figure 7 and Figure 8.
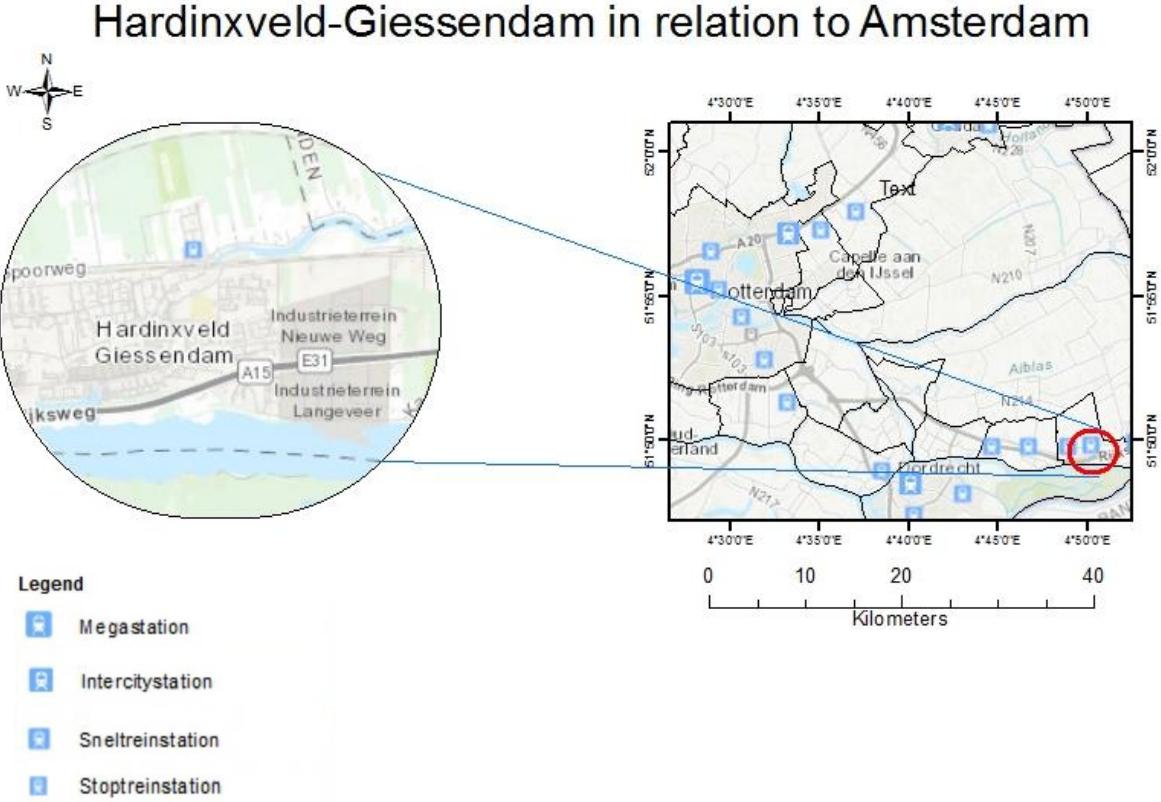
Figure 7 – Study area Hardinxveld-Giessendam
(Esri, 2022)
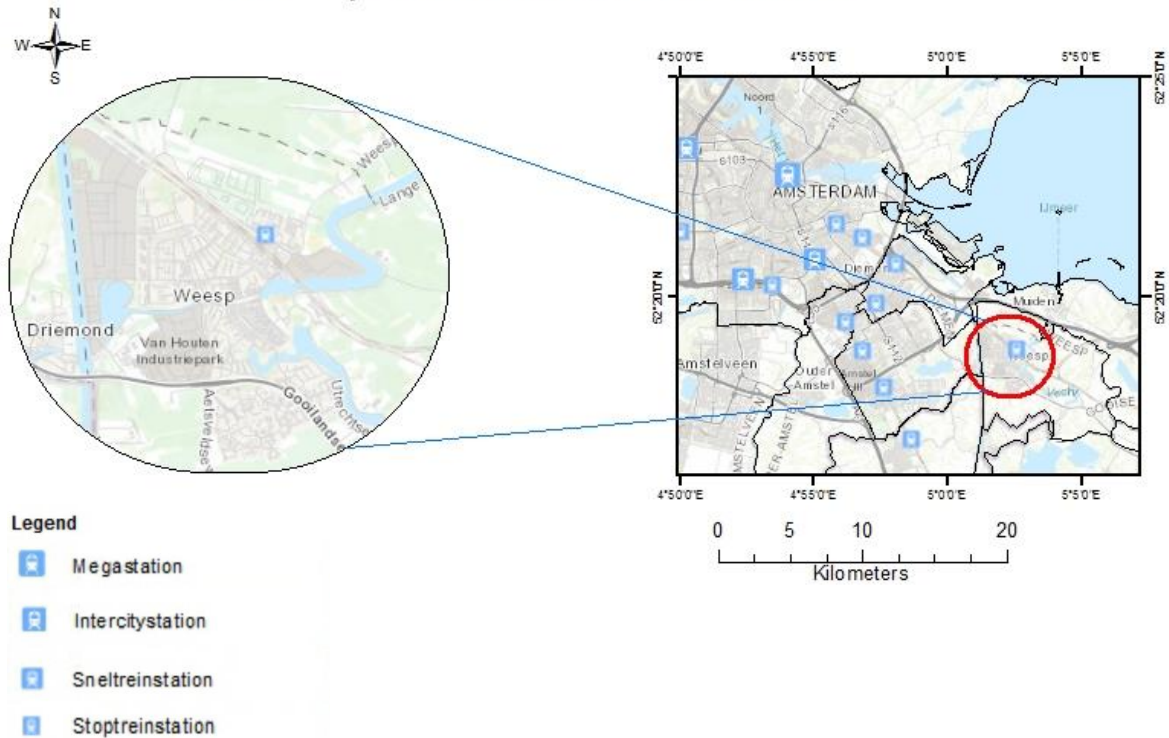
Figure 8 – Study area Weesp
(Esri, 2022)

The distribution of the two municipalities can be seen in Figure 9. The median income of residents of the municipality Hardinxveld-Giessendam is 45,140 €. Weesp, on the other hand, has an average income of 42,820 €. Both municipalities are in the middle-class classification.
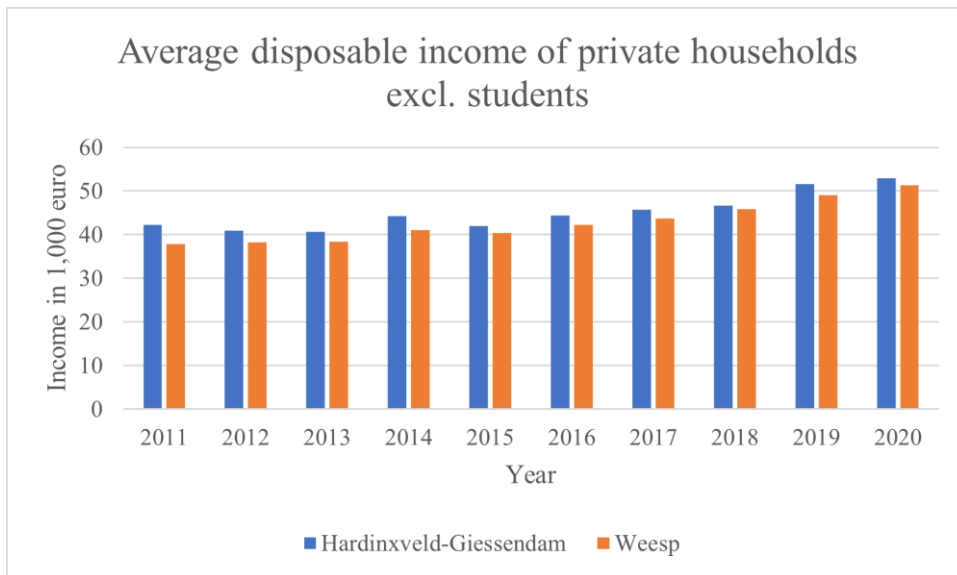
Figure 9 – Average disposable income of private households excl. students Hardinxvel-Giessendam and Weesp (CBS Statline, 2022)

The station in Hardinxveld-Giessendam was put into use in December in 2011 (Treinstationinfo.nl, n.d.c). The station has the name Hardinxveld Blauwe Zoom. Hardinxveld-Giessendam already has a train station, so the newly built station serves as an additional function to connect the new residential area built in Giessendam. This is to ensure accessibility in this neighbourhood as well. Over the years, several residential quarter projects have been built in the district. These include de IJergieterij, Ons Dorp and de Oog (Nieuwbouw Hardinxveld-Giessendam, n.d.). The train station in Weesp, on the other hand, was opened in 1874 (Treinstationinfo.nl, n.d.d). The station has already been expanded twice to date, making it a critical interchange station. Since the station in Hardinxveld-Giessendam was built to ensure accessibility in the residential areas and the station in Weesp is a vital interchange station, the municipalities are comparable, and it can be assumed that both stations are equally important, which is the basis of the analysis.

4. Results

In this section, the previously analyzed factors from the literature analysis are considered and applied to the municipalities in order to arrive a result.

4.1. Comparison of municipalities Dronten and Lelystad

First, the comparison of the municipalities Dronten and Lelystad will be explained in the results. The accessibility before the opening of the new station in Dronten was 16.6 km. This has improved drastically after the opening of a train station in 2012. The accessibility to the station as of 2013 is 5.1 km. This is a reduction of about 69.28 %. This is the highest reduction in this research and thus the greatest improvement in the accessibility of the station. The improvement in accessibility can be seen in the following Figure 10. Red represents the time when the station was opened. In Dronten, on the other hand, the accessibility is constantly at 2.6 km.

Consequently, the property prices are now surveyed in comparison with the accessibility improvement of the station. The property prices can be taken from Figure 11. Here red again represents the time when the train station in Dronten was put into operation. As a result of the literature analysis, it is expected that the property price will increase in Dronten after the improved train station accessibility. However, it is noticeable that the property prices do not increase as predicted. In fact, the opposite is occurring – prices are falling. Only from the year 2016 a first increase can be seen. If the prices are now compared to Lelystad, it is striking that the development curves of the municipalities run parallel. Both municipalities went through a slight property price increase until 2009, which steadily decreased and significantly increased in 2016. Property price is higher in Dronten, which is the only feature that distinguishes the municipalities.
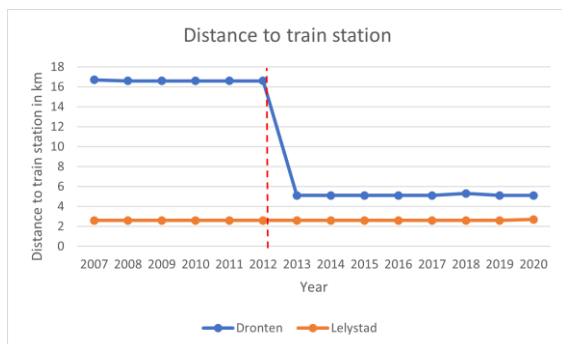
Figure 10 – Distance to train station Dronten and Lelystad (CBS Statline, 2022)
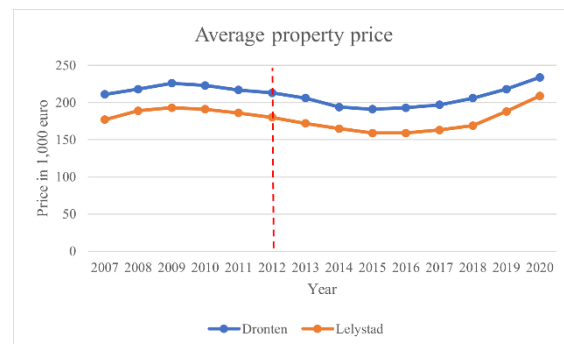
Figure 11 – Average property price Dronten and Lelystad (CBS Statline, 2022)

A more detailed investigation, analyzing property price differences before and after the station's opening, is considered. Firstly, the property prices are observed for the municipality, which has received a new train station, which is Dronten. The average property price before the opening of the train station is 218,000 €. After opening the train station, the average property price is 186,000 €. This is a reduction of 14.68 %. The same is examined for the municipality Lelystad, which already has a train station. The prices up to 2012 are considered since this was the date when Dronten opened a new station. This is done because the two municipalities are compared with each other. The average property price before 2012 is 204,000 € and after 173,000 €. The reduction is 15.2 %. With a difference of only 0.52 %, it can be concluded that the newly opened station in Dronten has no effect on property prices. It was also

examined how the price in Dronten would develop if no train station was opened. For this purpose, the difference between the property price in Lelystad before 2012 and after 2012 was determined. The outcome is -13 €. Consequently, this was deducted from the property price in Dronten before 2012. This calculation makes it possible to determine how the property price in Dronten would have developed if no train station had been built. The result is 205,000 €. Remarkably, this price is with 1.000 € difference the same amount Dronten has after opening a train station. This means that opening a new train station and improving accessibility does not increase the property price. Concluding, no evidence can be seen that the new train station's opening affects property prices.

To conclude the results for the comparison of Dronten and Lelystad, it can be said that the construction of a new train station and improved accessibility does not affect property prices. Although the distance to the nearest station has improved significantly, prices seem to be declining. The property price comparison has shown no treatment for opening the new train station.

4.2. Comparison of municipalities Mook en Middelaar and Bedum

Secondly, the results from the comparison of the municipalities Mook en Middelaar and Bedum are considered. The distance in Mook en Middelaar has improved from 5.1 km to 2.3 km after the station's construction in 2009. This is a reduction of 54.9 %. As shown from the graph in Figure *12*, it is striking that the distance has improved slightly over the years. Why this is the case is not known. A prognosis can be that several houses are built near the station, so the distance generally improves. The accessibility to the train station in Bedum remains at 2.2 km the same.

Subsequently, the property price progression is reviewed compared to improved accessibility. Based on the results of the literature analysis, the property prices must increase significantly after the construction of a station that allows better accessibility. As can be seen in Figure *13*, this is not the case. In fact, the opposite is initially the case. The prices decrease up to and including the year 2016. Thereafter, a rise is depicted. If the course of the property price curve of Bedum is considered, it is apparent that the prices over time are more constant. However, a slight downward trend can be seen up to 2016. The municipality Mook en Middelaar has a higher property price than Bedum and a more significant fluctuation. However, it is shown that the property prices are not connected with the improved accessibility after opening a new train station.
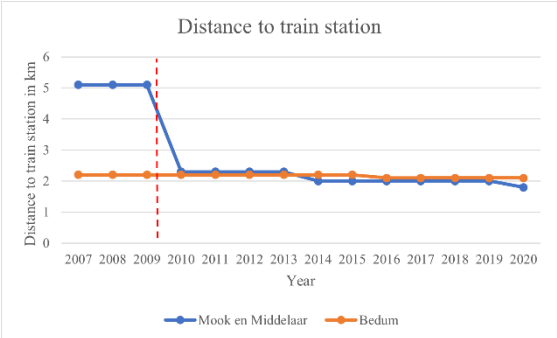

Figure 12 – Distance to train station Mook en Middelaar and Bedum
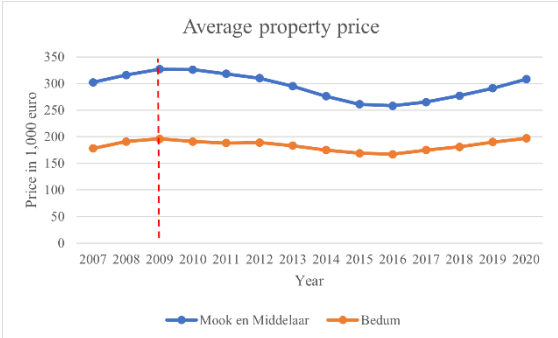(CBS Statline, 2022)

Figure 13 – Average property price Mook en Middelaar and Bedum
(CBS Statline, 2022)

Subsequently, a calculation was performed to determine how high the newly built train station's effect on property prices is. Firstly, the results for the municipality Mook en Middelaar are considered before

a station has been newly built. The property price of the municipality Mook en Middelaar before 2009 is accordingly an average of 315,000 €. After the opening of the station, the average price is 289,000 €. The fact that the property price is lower after the station's opening is already an indicator that the treatment has a negative effect. The prices are compared with the municipality of Bedum. This is for control purposes to determine whether the train station actually has an effect on property prices. The prices for Bedum are 188,000 € before and 182,000 € afterwards. Furthermore, an additional price is determined. The price refers to Mook en Middelaar as it would evolve if no station had been opened. In other words, what happens if the property price of Mook en Middelaar increases by the same price as that of Bedum? It is calculated from the difference of the before and after price from the municipality Bedum and subtracted from the before price of Mook en Middelar. This results in a property price of 309,000 €. This shows that the current property price in Bedum is too low, and there was no improvement in property price after the opening of the train station. Altogether, this result means that there no effect can be seen, and Bedum has even evolved in a negative direction.

Mook en Middelaar and Bedum are only about 10 kilometres away from a major city. This offers the inhabitants mainly to commute to jobs. Because a new train station has been built, commuting costs are saved. As described in the literature, it can be assumed that the savings in commuting costs are transferred to the homeowner. This could not be seen in the study.

Finally, a brief overview of the results for the municipalities is given. A clear improvement in accessibility after opening a train station is visible. However, the factors previously analyzed in the literature do not influence the property price. There are property price fluctuations, but the new construction of the station is not the cause.

4.3. Comparison of municipalities Hardinxveld-Giessendam and Weesp

Finally, the municipalities of Hardinxveld-Giessendam and Weesp are compared. Since the station's opening in 2011 in Hardinxveld-Giessendam, the average distance to the station has only improved by 100 m (see Figure *14*). However, it is noticeable that in 2013 the distance continued to decrease from 1.9 km to 1.1 km. This is a reduction of 42.11 %. Here, a connection to the new construction projects can be made. On the other hand, the accessibility to a train station in Weesp remained at 1.3 km.

As explained earlier, based on the literature review, property prices would increase after the station's opening because improved accessibility is assured. Again, this is not the case. The property price was still 248,000 € in the year 2011. Afterwards, it has steadily fallen to 216,000 € until the year 2016. In the last three years, however, the price has risen massively. This may be due not least to the new construction projects. An illustration of the property price trend is shown in Figure *15*. The price development characteristic feature is that the curves run pretty parallel. A further property price development can be seen in the last three years, in which property price in Weesp rose more drastically compared to Hardinxveld-Giessendam. To sum up, it can be reported that the improved accessibility through opening a new station does not lead to a rise in property prices.
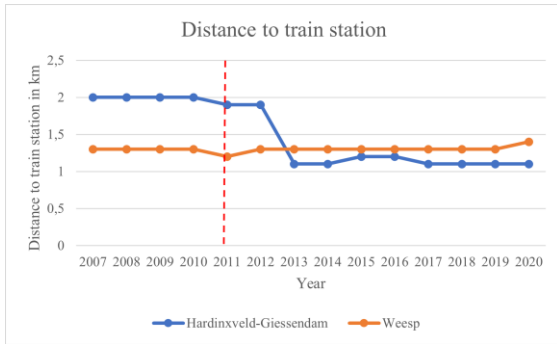
Figure 14 – Distance to train station Hardinxveld-Giessendam and Weesp
(CBS Statline, 2022)

Figure 15 – Average property price Hardinxveld-Giessendam and Weesp
(CBS Statline, 2022)

Consequently, the newly built station's effect will be determined. The average property price of municipality Hardinxveld-Giessendam before the treatment is 249,000 €. In this case, treatment is meant to open a new train station in the year 2011. After the treatment, the average property price is 233,000 €. A reduction of 6.43 % is involved. To compare this with a municipality where no train station was opened, the property prices are compared with the municipality of Weesp. Bevor the year 2011, the average property price is 239,000 €, and after 251,000 €. Here the prices have increased by 5.02 %. Again, the result is negative, and thus there is no effect that the newly built station will affect property prices regards the improved accessibility.

Although the distance to the next larger cities differs the most between the two municipalities, both municipalities are considered as suburbs. From the literature, it was found that there is an effect on property prices on the city's edge when a train station is built. This could not be observed for Hardinxveld-Giessendam.

Concluding, the results have shown that a new train station does not influence property price. The distance has improved minimally and did not affect property price. The price development of the municipalities has a fairly exact course with the expectation of the last three years. Moreover, there can be no effect seen of the proximity to the next urban area on property prices. In summary, it can be said that the newly built station does not affect property price.

5. Discussion

Unlike expected, in this case study, property prices have not changed since the construction of a train station. At the municipal level, no evidence can be seen that property prices change after the construction of a train station in this research. However, this is no evidence that there are no changes. This must be measured at a different measurement scale. An explanation for why the results are inconsistent with the literature is that people commute more in urban places than in rural areas. However, attention must be paid to the following. In the literature, Debrezion et al. (2007) and Li and Huang (2020) have cited distances from 250 m up to 2,000 m to the train station as having an effect on the property price. In this work, such a detailed investigation of the distance and thus the impact of the newly built train station on property prices was not possible. The reason for this is that the specific data required was not available. Prices are needed for properties in the immediate vicinity of the train station, which are not accessible to the public. This had made it significantly challenging to study the impact of a new train station on property prices, as it was limited to using publicly available data. For this reason, the work can be improved by using more detailed data in the future to obtain a more transparent result on the change in property price after the construction of a train station.

Further, the work has highlighted something that has not been explored in any research to date. It is remarkable that after the train station's construction, the property price does not change at the municipal level. Studies like these by Du and Mulley (2012), Diao et al. (2017), and Bowes and Ihlanfeldt (2001) concluded that there are effects on property prices after the construction of a train station. However, none of the studies has shown that there can be no evidence either. In this study, it has been shown that a newly built train station in exurban areas improves accessibility drastically (up to 69.28 %). With this improvement, according to the studies by Du and Mulley (2012), Diao et al. (2017), and Bowes and Ihlanfeldt (2001), property prices should have increased. However, this study has shown no evidence that the improvement affects the property price in the studied municipalities.

6.   Conclusion

This thesis aimed to investigate to what extent the opening of a new train station influences property prices due to the improved accessibility. The hypothesis was that prices would increase after the station opened. As determined in the results, no effect can be seen, and thus the hypothesis needs to be rejected. To answer the first sub-question: "How does the residential property price change when a new train station is built?" it was looked at how the property price reacts to the change. However, it was found that all prices decrease after the opening and do not increase as expected. Here, the prices do not react after the station's opening. Additionally, the prices in all six municipalities develop similarly. They are decreasing, and from 2016 on, there is an increase, regardless of the improved accessibility. To answer the second sub-question, it was examined whether proximity to urban areas affects property prices in the municipalities. Here, no effect was found in all three municipalities. Additionally, it was shown that the prices all follow a similar trend. Concluding, the main question, "To what extent does the construction of a new transit station influences residential property price at the municipal level in the Netherlands?" can thus be answered. Considering the sub-questions answers, the answer is that there is no evidence that the construction of a train station influences residential property prices in the studied municipalities.

Moreover, the work must be viewed from a broader perspective. It was elaborated in the literature review that a newly built train station affects the property prices in the immediate (up to 2,000 m) vicinity. It was researched that property prices are not affected at the municipality level in this research. It can be assumed that the results will be similar in other municipalities. As already described in chapter 5, this is due to the size of the distance measurement. Thus, the results from this thesis can be applied mainly to all municipalities in the Netherlands.

One reason for the results is related to limitations. As determined in the literature, the radius in which the newly built station influences the property price is 2,000 m. As mentioned in chapter 5, such an accurate measurement cannot occur due to the data set. To investigate whether the newly built train station affects the property price in this radius, accurate measurements and exact numbers on property prices must be provided, which was not the case. Additionally, other essential factors are significant and decisive for property prices, such as the square footage of a house. These factors have been left out of this review.

However, the work provides a reasonable basis for further research. Socioeconomic factors, such as income, can be factors that influence property prices. In lower-income neighbourhoods, proximity to the train station is more critical and prices fall with each distance from the station. (Bowes & Ihlanfeldt, 2001). This is because people rely on the station due to low income. The higher-income areas do not rely on the train station, and thus property prices increase in the opposite direction. Further research can examine how socioeconomic facors affect property prices in rural areas when a new train station is being built, thus improving accessibility.

The results of this research may be useful to policymakers and are relevant for spatial planning. Knowing the impact of newly built stations is valuable for understanding rural real estate market and evaluating property prices. Additionally, the results allow policymakers to make decisions about station construction. Regarding public interest, it is recommended for the administration to promote and continue the development of train stations so that residents can have better accessibility since, as shown in the results, it improves drastically. Thus, residents in the communities have better access to public facilities and employment opportunities that do not exist locally. Furthermore, this is also relevant for

spatial planning. Spatial planning is vital to delivering economic benefits by creating more stable and predictable conditions for investment and development. Planners and developers can build reliable forecasts and calculate future costs with the results.

References

Bajic, V. (1983). The Effects of a New Subway Line on Housing Prices in Metropolitan Toronto. *Urban Studies*, 20(2), 147–158 from http://www.jstor.org.proxy-ub.rug.nl/stable/43082337.

Bowes, D. R., & Ihlanfeldt, K. R. (2001). Identifying the Impacts of Rail Transit Stations on Residential Property Values. *Journal of Urban Economics*, 50(1), 1–25. https://doi.org/10.1006/juec.2001.2214.

CBS Statline (2022). *StatLine - Regionale kerncijfers Nederland*. Retrieved on 2022 from https://opendata-cbs-nl.proxy-ub.rug.nl/statline/#/CBS/nl/dataset/70072ned/table?ts=1646753201645.

Debrezion, G., Pels, E., & Rietveld, P. (2007). The Impact of Railway Stations on Residential and Commercial Property Value: A Meta-analysis. *The Journal of Real Estate Finance and Economics*, 35(2), 161–180. https://doi.org/10.1007/s11146-007-9032-z.

Delventhal, M. J., Kwon, E., & Parkhomenko, A. (2021). JUE Insight: How do cities change when we work from home? *Journal of Urban Economics*, 103331. https://doi.org/10.1016/j.jue.2021.103331.

Diao, M., Fan, Y., & Sing, T. F. (2017). A New Mass Rapid Transit (MRT) Line Construction and Housing Wealth: Evidence from the Circle Line. *SSRN Electronic Journal.* Advance online publication. https://doi.org/10.2139/ssrn.2899470.

Du, H., & Mulley, C. (2012). Understanding spatial variations in the impact of accessibility on land value using geographically weighted regression. *Journal of Transport and Land Use*, 5(2), 46–59 from http://www.jstor.org/stable/26201690.

Esri (2022). *Topographic:* Basemap. Retrieved on 02-04-2022 from https://rug.maps.arcgis.com/home/webmap/viewer.html?useExisting=1.

Haartsen, T., Huigen, P. P., & Groote, P. (2003). Rural Areas in the Netherlands. *Tijdschrift Voor Economische En Sociale Geografie*, 94(1), 129–136. https://doi.org/10.1111/1467-9663.00243.

Harvey, J., & Jowsey, E. (2004). *Urban land economics* (6. ed.). Basingstoke: Palgrave Macmillan..

He, S. Y. (2020). Regional impact of rail network accessibility on residential property price: Modelling spatial heterogeneous capitalization effects in Hong Kong. *Transportation Research Part a: Policy and Practice*, 135, 244–263. https://doi.org/10.1016/j.tra.2020.01.025.

Infrasite, R. (2009, May 6). Opening station Mook - Molenhoek. *Infrasite* from https://www.infrasite.nl/rail/2009/05/06/opening-station-mook-molenhoek/?gdpr=accept.

Leclerc, G., & Hall, C. A. S. (Eds.) (2007). *Making world development work: Scientific alternatives to neoclassical economic theory*. Albuquerque, NM: Univ. of New Mexico Press..

Li, J., & Huang, H. (2020). Effects of transit-oriented development (TOD) on housing prices: A case study in Wuhan, China. *Research in Transportation Economics*, 80, 100813. https://doi.org/10.1016/j.retrec.2020.100813.

Marc Kleen (2021). *Metro-, tram- and train station Amsterdam Sloterdijk with some nice light on a cold and sunny winter day*. Retrieved on 2021 from https://unsplash.com/photos/1CJLoic9cjs.

Nieuwbouw Hardinxveld-Giessendam (n.d.). *Nieuwbouw Hardinxveld-Giessendam projectoverzicht*. Retrieved on n.d. from https://www.nieuwbouw-hardinxveld-giessendam.nl/projecten/.

Nurlaela, S., & Pamungkas, A. (2014). Assessing the Impact of Accessibility Improvement on Property Value Capitalization Post Perth – Mandurah Railway Opening. *Procedia - Social and Behavioral Sciences*, 135, 96–105. https://doi.org/10.1016/j.sbspro.2014.07.331.

Paliska, D., & Drobne, S. (2020). Impact of new motorway on housing prices in rural North-East Slovenia. *Journal of Transport Geography*, 88, 102831. https://doi.org/10.1016/j.jtrangeo.2020.102831.

Rijnks, R. H., & Strijker, D. (2013). Spatial effects on the image and identity of a rural area. *Journal of Environmental Psychology*, 36, 103–111. https://doi.org/10.1016/j.jenvp.2013.07.008.

Sieber, L., Ruch, C., Hörl, S., Axhausen, K. W., & Frazzoli, E. (2020). Improved public transportation in rural areas with self-driving cars: A study on the operation of Swiss train lines. *Transportation Research Part a: Policy and Practice*, 134, 35–51. https://doi.org/10.1016/j.tra.2020.01.020.

Starkey, P. (2022). Complementing infrastructure: enhancing rural mobility through motorized and non-motorized transport.

Treinstationinfo.nl (n.d.a). *Bedum*. Retrieved on n.d. from https://www.treinstationinfo.nl/treinstations/bedum/.

Treinstationinfo.nl (n.d.b). *Dronten*. Retrieved on n.d. from https://www.treinstationinfo.nl/treinstations/dronten/.

Treinstationinfo.nl (n.d.c). *Hardinxveld Blauwe Zoom*. Retrieved on n.d. from https://www.treinstationinfo.nl/treinstations/hardinxveld-blauwe-zoom/.

Treinstationinfo.nl (n.d.d). *Weesp*. Retrieved on n.d. from https://www.treinstationinfo.nl/treinstations/weesp/.

Appendices

Appendix A – Overview of the Dataset

Data Dronten

		Average house value	Average income	Distance to train station
Region	Periods	1,000 Euro	1,000 Euro	km
Dronten	2007	211		16.7
	2008	218		16.6
	2009	226		16.6
	2010	223		16.6
	2011	217	38.4	16.6
	2012	213	37.7	16.6
	2013	206	38.9	5.1
	2014	194	40.9	5.1
	2015	191	40.3	5.1
	2016	193	42	5.1
	2017	197	42.9	5.1
	2018	206	44.3	5.3
	2019	218	47.2	5.1
	2020	234	48.6	5.1

■ = New train station opened

Data Lelystad

		Average house value	Average income	Distance to train station
Region	Periods	1,000 Euro	1,000 Euro	km
Lelystad	2007	177		2.6
	2008	189		2.6
	2009	193		2.6
	2010	191		2.6
	2011	186	35.4	2.6
	2012	180	35.3	2.6
	2013	172	35.4	2.6
	2014	165	36.9	2.6
	2015	159	37	2.6
	2016	159	38.5	2.6
	2017	163	39.4	2.6
	2018	169	40.6	2.6
	2019	188	43.1	2.6
	2020	209	44.4	2.7

Data Mook en Middelaar

Region	Periods	Average house value	Average income	Distance to train station
		1,000 Euro	1,000 Euro	km
Mook en Middelaar	2007	302		5.1
	2008	316		5.1
	2009	327		5.1
	2010	326		2.3
	2011	318	44.3	2.3
	2012	310	45.9	2.3
	2013	295	45.1	2.3
	2014	276	48.2	2
	2015	261	46	2
	2016	258	48.6	2
	2017	265	49.5	2
	2018	277	49	2
	2019	291	54	2
	2020	308	54.3	1.8

▬ = New train station opened

Data Bedum

Region	Periods	Average house value	Average income	Distance to train station
		1,000 Euro	1,000 Euro	km
Bedum	2007	178		2,2
	2008	191		2,2
	2009	196		2,2
	2010	191		2,2
	2011	188	36,6	2,2
	2012	189	37,1	2,2
	2013	183	37,4	2,2
	2014	175	39,2	2,2
	2015	169	39,1	2,2
	2016	167	40,2	2,1
	2017	175	41,1	2,1
	2018	181	42,7	2,1
	2019			
	2020			

Data Hardinxveld-Giessendam

Region	Periods	Average house value	Average income	Distance to train station
		1,000 Euro	1,000 Euro	km
Mook en Middelaar	2007	230		2
	2008	248		2
	2009	259		2
	2010	258		2
	2011	248	42,3	1,9
	2012	243	40,9	1,9
	2013	233	40,7	1,1
	2014	224	44,3	1,1
	2015	216	42	1,2
	2016	217	44,4	1,2
	2017	221	45,7	1,1
	2018	228	46,6	1,1
	2019	240	51,6	1,1
	2020	255	52,9	1,1

■ = New train station opened

Data Weesp

Region	Periods	Average house value	Average income	Distance to train station
		1,000 Euro	1,000 Euro	km
Bedum	2007	219		1,3
	2008	237		1,3
	2009	246		1,3
	2010	254		1,3
	2011	250	37,9	1,2
	2012	242	38,2	1,3
	2013	233	38,4	1,3
	2014	224	41	1,3
	2015	221	40,4	1,3
	2016	221	42,3	1,3
	2017	228	43,7	1,3
	2018	253	45,9	1,3
	2019	288	49,1	1,3
	2020	351	51,3	1,4