

How to increase the demand for public transportation services among seniors?

An empirical study considering multiple elements of public transport in the municipalities of Stadskanaal and Westerwolde

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Summary

In rural areas with a declining population, such as the study area, public transport can play an important role in preventing seniors from becoming socially excluded, as well as helping them retain their mobility. Therefore, it would be beneficial to explore what elements make public transport more attractive for seniors. Although, a lack of research has focused on the seniors, as well as on rural areas. Moreover, too less research focused on the relationship between social exclusion and mobility. Therefore, the purpose of this study is to determine what variables influence the actual demand for public transportation services in the rural area of the municipalities of Stadskanaal and Westerwolde. When these variables are determined, public transport might become an important service to increase mobility for seniors and prevent social exclusion. By conducting surveys among 52 seniors aged 75 years or older data was gathered in order to perform a regression analysis.

Two significant relationships are discovered, which lead to the following conclusion: seniors owning a car have less demand for public transportation services than not car-owning seniors. It also leads to another, somewhat surprising conclusion, namely: when seniors in the study area get more offers from friends or relatives to provide them a lift, their demand for public transportation services increases. According to this research, the height of fares, the perceptions of public transport, the quality of services and accessibility do not significantly affect the demand for public transportation services among seniors in the study area.

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1 Introduction

1.1 Background

Public transport is an important service to prevent social exclusion in rural areas (Liddle et al., 2012; Fiedler, 2007). Seniors are vulnerable for losing their mobility in areas with population decline, such as the study area (Tillema et al., 2019). Making sure that seniors retain their mobility is vital (Delbosch & Currie, 2011; Hausteijn & Siren, 2014). Public transport can play an important role in people's mobility and the accessibility of services (McGrail & Humphreys, 2009). Limited access to public transport can also result in economic poverty (Engels & Liu, 2011).

Public transportation services are not only important for people, but also for regions because it has great influence and impact on regional patterns of development, economic viability, the environment and on maintaining socially acceptable levels of quality of life (Murray et al., 1998). Moreover, public transportation is a more environmental-friendly alternative for the use of a car (Holmgren, 2013; Redman et al., 2012). However, if we want to increase the use of public transportation, it is necessary to know what different elements affect the demand of these services. After identifying these elements, public transport can become part of the solution to environmental problems (Holmgren, 2013).

According to Engels and Liu (2011), a lack of research has focused on the elderly or seniors. Although these groups are often identified as being subject to social exclusion, because of difficulties facing with travelling outside their homes (Engels & Liu, 2011), too less research has focused on this relationship between social exclusion and mobility (Gray et al., 2006). Furthermore, the research which was conducted focused mainly on urban places and too less on rural areas (Milbourne & Kitchen, 2014). To partly fill this gap and reduce social exclusion among the people who are most socially excluded, it would be beneficial to explore the elements that make public transport more attractive for seniors (Social Exclusion Unit [SEU], 2000; Jehoel-Gijsberg & Vrooman, 2008).

Research about seniors or elderly is becoming increasingly relevant. This is because the Netherlands has an aging population (Böcker et al., 2017; Smits et al., 2013; Sistema van Eck et al., 2013). This research will take place in a rural setting, namely in the South-East of the province of Groningen. The goal of this research is to explore what variables (partly) determine the actual demand of public transport services among seniors in the rural area of the municipalities of Stadskanaal and Westerwolde. In the next section, the research questions are introduced.

1.2 Research Problem

As explained above, knowing what influences the actual demand for seniors in rural areas is important for a range of aspects, including diminishing social exclusion and contributing to a better environment. To explore the variables influencing the demand among seniors, empirical research is conducted in the municipalities of Stadskanaal and Westerwolde. The central research question of this thesis is presented below.

Which variables determine the actual demand of public transportation services among seniors in the rural area of the municipalities of Stadskanaal and Westerwolde?

The previous question can be answered with a quantitative data method, which is further introduced in the methodology section. Before being able to answer the central question, a couple of secondary research questions, which are presented below, need to be answered.

1. *Which variables positively affect the actual demand for public transport services among seniors in the rural area of the municipalities of Stadskanaal and Westerwolde?*

2. Which variables negatively affect the actual demand for public transport services among seniors in the rural area of the municipalities of Stadskanaal and Westerwolde?

This section is followed by a theoretical framework, containing relevant theories and concepts to this research, followed by the methodology section. In the methodology, the data collection method is explained, as well as the data analysis. Also, some ethical considerations are discussed. Next, the results are presented followed by the conclusions. The reflection on this thesis, as well as the recommendations for further research are also provided in the conclusions section. Finally, the references and appendices are presented.

2 Theoretical Framework

2.1 Public transport as a service to prevent social exclusion among seniors in rural areas

This study takes place in a rural area. Other researchers used multiple definitions to define rural areas as they find it hard to come up with one clear definition. Multiple criteria were used, among which economic, socioeconomic and administrative land use criteria (Cromartie & Bocholt, 2008). Rural areas are often characterized by a low population density, a loose infrastructure and service network, tight social networks, a strong identity of home localities, low levels of manufacturing and offices and a landscape dominated by farmland and forestry (Clout, 1984). The Organization for Economic Co-operation and Development (OECD) uses two measurable criteria to define rural areas in Europe. An area is defined rural when it has less than 500 inhabitants per square kilometer with no city located within thirty minutes of travelling (Steenbekkers et al., 2008). In this research, previous definition is used to define rural areas. In the Netherlands, there are seventy municipalities which are rural according to this definition (Steenbekkers et al., 2008).

In rural areas, public transport plays an important role in preventing people from becoming socially excluded (Liddle et al., 2012). Social exclusion occurs as a result of a series of problems that prevent people from being able to participate in activities that are considered normal in their society (Titheridge et al., 2009). According to Jehoel-Gijsberg (2004) the chance to become socially excluded increases when people become older, suffer from health problems and live in a health facility. Social exclusion is present in all EU-member states (Jehoel-Gijsberg & Vrooman, 2008).

As said, to combat social exclusion, enough supply of public transportation services is helpful (Liddle et al., 2012). In this research, the focus is mainly on planned public transport provided by different modes of transport, such as buses and trains (Balcombe et al., 2004). Although, demand responsive transport (DRT), often provided by community organizations with, for example, minibuses, is also considered as this is also an offered service in the study area (Gray et al., 2006). Later, DRT is further introduced.

In this thesis, seniors are considered as people aged 75 years or older. In the Netherlands, the percentage of people aged 75 years or older owning a car is much lower than the percentage of among the people aged 75 years or younger (Kamper et al., 2017; Centraal Bureau Statistiek [CBS], 2017). Furthermore, the 75+ population must pass a medical test when they want to extend their driver's license (Rijksdienst Wegverkeer, 2019). Moreover, according to Alsnih and Hensher (2003), health limitations become more prominent after the age of 75 which could influence people's ability to drive.

2.2 Variables affecting the demand for public transportation service

Different variables are researched to examine if they trigger demand for public transportation services in the study area. Earlier studies have proven that these independent variables have a certain influence on public transport. Examples of whom who used this research method are Balcombe et al. (2004), Paulley et al. (2006), Bresson et al. (2003) and Dell'Olio et al. (2011).

2.2.1 Fares

Fares are probably the most intensively studied transport demand factor, for two reasons: fares and changes in fares are relatively easy to identify and quantify, and they are the most frequently adjusted element (Balcombe et al., 2004). Fares are fundamental to the operation of public transport since they form a major source of income to operators (Paulley et al., 2006; Balcombe et al., 2004).

In general, if fares increase, patronage will decrease (Paulley et al., 2006; Bresson et al., 2003). This pattern has also been visible in the Netherlands (Van de Velde & Savelberg, 2016). People with access to a car are more responsive to fare changes. Probably, because they have an alternative mode of transport (Balcombe et al., 2004). Seniors in the Netherlands receive a discount when using public transport. Although, despite this discount the level of use is very low (Van den Berg et al., 2011).

2.2.2 Quality of service

Quality of service may be defined by a wide range of attributes influenced by planning authorities and transport operators, such as access time, service reliability, information provision and various bus specific factors, such as comfort (Paulley, 2006; Fiedler, 2007; Dell’Olio et al., 2011).

Regarding the waiting environment, passengers waiting for buses or trains prefer to wait in conditions of comfort, cleanliness, safety and protection from the weather (Paulley et al., 2006).

Public transport should be easy to use and staff should be approachable. Many seniors strand at complicated ticketing machines or complex tariff schemes (Fiedler 2007). Moreover, staff is important for seniors, as it informs, assists and improves safety and security (Fiedler, 2007).

Another important aspect is the way how information is provided and adapted to seniors. Technical issues need to be considered, such as audible information provision and readable font sizes. Furthermore, information needs to be easy to understand (Fiedler, 2007). Seniors pay much attention to service quality. In order to attract seniors, punctuality and cleanliness should be ensured (Fiedler, 2007; Dell’Olio et al., 2011).

2.2.3 Perceptions of public transport

The public transport system must be adapted to the needs and expectations of older people (Fiedler, 2007). The image of public transport among older people needs to be improved. Many of the older people seem not to be aware of the mobility opportunities that buses and trains offer them (Fiedler, 2007; Rosenbloom & Winsten-Bartlett, 2002; Kostyniuk & Shope, 2003). In the Netherlands, seniors perceive public transport more positively compared to younger generations. Although, people in rural areas perceive public transport less positively than urban citizens (Berveling et al., 2009). Focused marketing might help in order to attract more senior passengers (Fiedler, 2007). Furthermore, it should be considered how to make non-users familiar with public transport, using for example personal marketing (Fiedler, 2007).

2.2.4 Access to public transport

Accessibility is an important element in the decision for people to travel with public transportation services (Galdames et al., 2011). A popular and well-used definition of accessibility is “the extent to which land-use and transport systems enable (groups of) individuals to reach activities or destinations via a (combination of) transport mode(s).” established by Geurs and Ritsema van Eck (2001). Because of an aging population, it is important that transportation systems are highly accessible for the whole population (Lättman et al., 2016). Ideally, a viable transit service must be available within reasonable walking access from one’s origin and destination (Chia et al., 2016).

Proximity to public transport services is an important issue for senior residents. Accessibility to important activities is influential for their subjective wellbeing (De Vos et al., 2013; Olsson et al., 2013; Parkhurst & Meek, 2014). In the Netherlands, when reviewing accessibility of public transportation, the focus is mainly on reducing travel time. Too less attention is given to the physical access of transport systems. Moreover, the effects on social exclusion are overlooked (Geurs et al., 2009).

2.2.4.1. Demand-responsive public transport

Rural areas face several challenges. One of these is the experienced difficulty in providing access to services (Tolley & Turton, 1995). A possible solution actively considered is demand responsive

transport (Wang et al., 2015). DRT provides transport ‘on demand’ to pick up and drop off people in accordance to their needs (Mageean & Nelson, 2003). DRT seeks to combine the benefits of bus-based and taxi-based services, in order to deliver a relatively cheap yet comprehensive level of public transport in low demand environments (Wang et al., 2015). Also, it can meet transport niches, such as hospital transport (SEU, 2003). The ageing society will have a large impact on the planning of these services (Fiedler, 2007).

DRT is most effective in rural areas (Laws, 2009) and it is most used by females and older aged people (Nelson & Phonphitakchai, 2012; Mageean & Nelson, 2003; Barse et al., 2004). Although, the major problem for DRT is that the costs to run this service are high (Laws et al., 2009).

In Dutch rural areas, fixed-route public transport needs to change from an operator-oriented service to a service which places the user in the central position to meet the needs of the rural population (Evers, 2017; Van Hout et al., 2013). Although, extensive developments already occurred. RegioTaxi, a combination of a community transport, special transportation service (STS) and open-shared ride taxi service for non-eligible users has become very popular. This service fills the gap between mainstream public transport and conventional taxi services (Nelson et al, 2010).

2.2.5 Car-ownership

Seniors rely, less than before, on public transport and more on the car (Fiedler, 2007; Donaghy et al., 2004). Transport by private car is the most commonly used transport mode among seniors in rural areas (Shergold et al., 2012), and it is perceived as more comfortable, flexible, private and faster compared to public transport (Jakobsson Bergstad et al., 2011). As a consequence, seniors constitute the fastest growing segment of the driving population (Banister & Bowling, 2004), and passenger numbers of bus services are in decline (Wang et al., 2015).

Having a driver’s license and (even more so) owning a car enhances car use compared to other transport modes for seniors in the Netherlands (Schwanen et al., 2001; Van den Berg, 2011). Furthermore, in the Netherlands, senior women are more likely to use public transport than senior men (Böcker et al., 2017). Despite the importance of the car, many (in particularly single) seniors will have to re-think car ownerships due to increasing fuel costs and social inequalities. Thus, public transport will get a more important role to ensure independent living and social inclusion for parts of the population (Fiedler, 2007).

2.2.6. Lift-giving and Social Capital

Lift-giving is important as a means of mobility for certain groups in the population. Research has highlighted that people in non-car owning households make more journeys by car than by public transport (Commission for Integrated Transport [CfIT], 2001; Farrington et al., 2004; Nutley, 2005). Lift-giving and other forms of community transport imply vibrant communities and strong social networks (Gray et al., 2006). A local social network is important in conferring mobility on certain social groups (Farrington & Gray, 1999, Nutley; 2005). A Social network is the collection of social connections or the social capital of a person. Social networks create norms of reciprocity and a certain level of trustworthiness between people (Putnam, 1995). In areas where conventional public transport is not viable, senior non-car owning journey-makers rely on lifts from relatives or friends to access healthcare and other services (Farrington & Gray, 1999; Shergold, 2012). In the Netherlands, levels of observed social capital have been stable or rising (Gray et al., 2006).

After analyzing the literature on this research topic, a couple relationships are expected to be present in the study area. First, the expectation is that a better perception of public transport, a higher quality of service as well as better access to public transportation services result in a higher actual demand of public transport among seniors. Second, it is expected that more lift-giving, higher fares and increased car-ownership lead to a decrease in the actual demand of public transportation services among seniors in the study area. These expectations are visualized in the conceptual model (see figure 1).

2.4 Conceptual Model

In figure 1, the conceptual model is presented. This model is a visualization of the expectations that are going to be tested in this thesis. This model arises from the research which is summarized in the theoretical framework above.

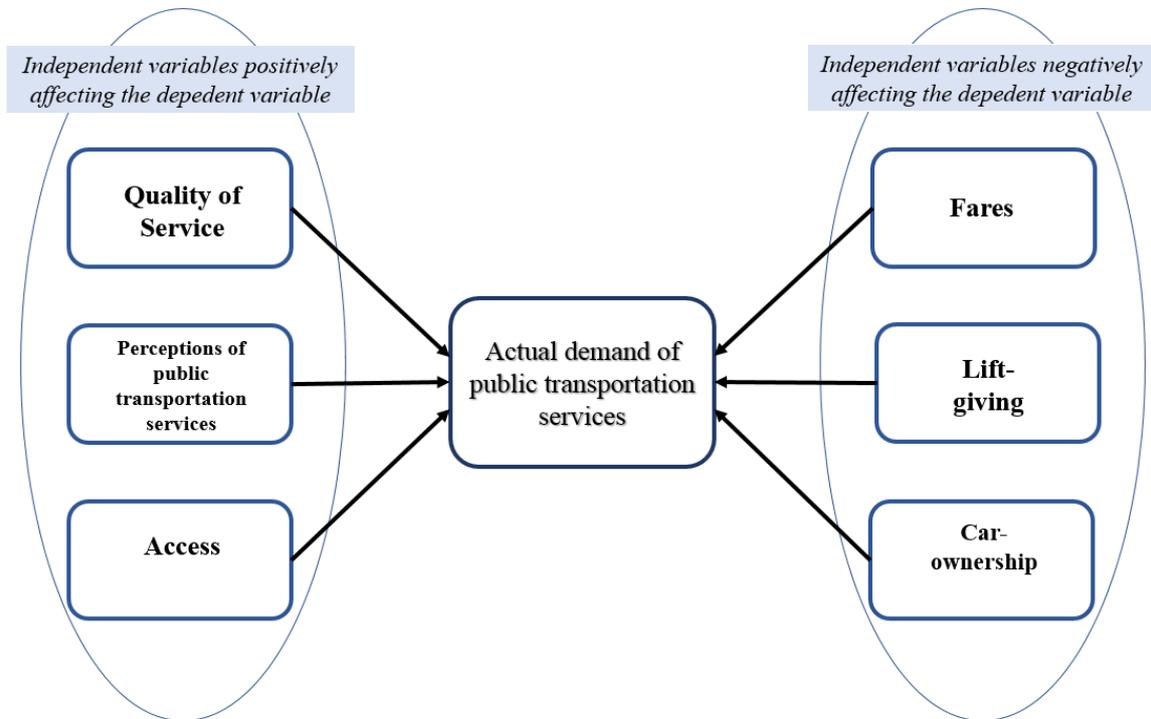


Figure 1: Conceptual model (own source).

3 Methodology

3.1 Data collection method

In this research, a survey (see appendix 7.1) is used to gather quantitative empirical data. The purpose of this research is not getting a more comprehensive understanding of people's belief, which can be obtained with a qualitative method (Pope & Mays, 1985; Silverman, 2000), but to determine the relationship between different independent variables and an outcome variable. This can be achieved with a quantitative method, such as a survey (Hopkins, 2008; O'Leary, 2010). The survey consists of four personal questions and nineteen opinion questions. These types of questions are often used in surveys (Clifford et al., 2010).

3.2 Study area

The study area is the rural area of the municipalities of Stadskanaal and Westerwolde. According to the definition of the OECD these areas are predominantly rural areas when looking on the scale of municipalities (CBS, 2019). In figure 2 is shown where the municipalities are located.

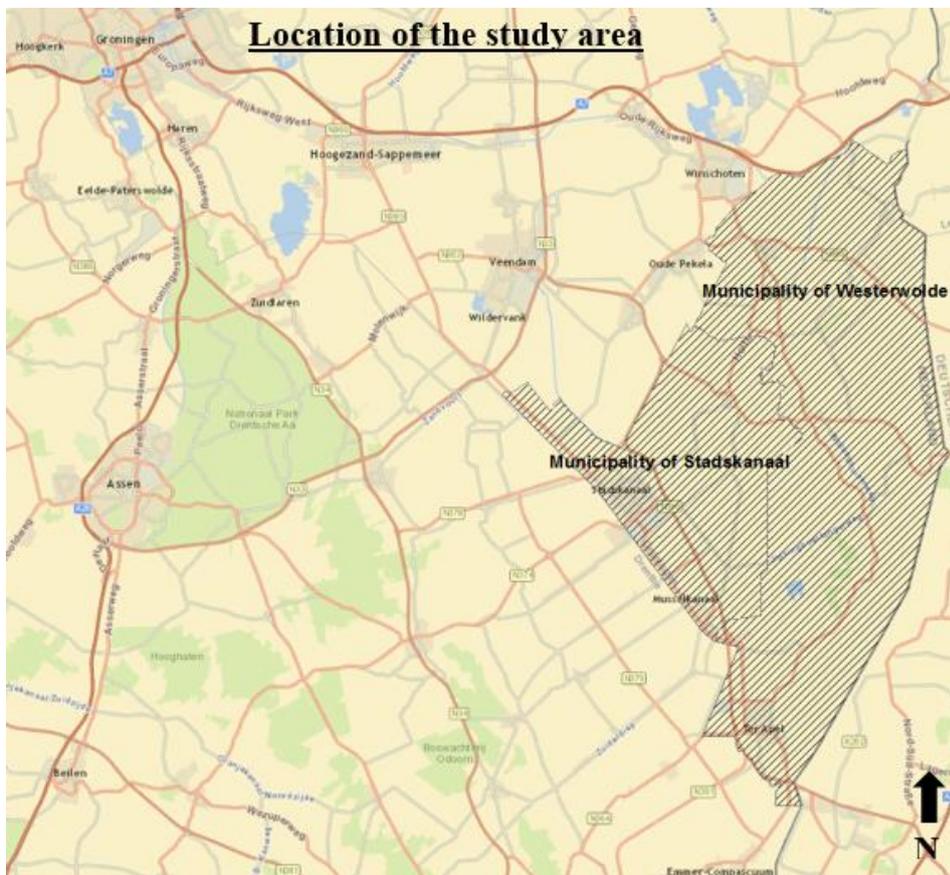


Figure 2: Location of the study area (own source).

3.3 Sampling

The used sampling method used is 'convenience sampling'. Convenience sampling is a type of nonprobability sampling where members of the target population meeting certain practical criteria, such as easy accessibility and geographical proximity, are included in the sample group. This makes it a good method when there is limited time to conduct the research (Dörnyei, 2007). The recruitment of

respondents can be done in multiple ways within this sampling method (Etikan et al., 2016). The sample consist of seniors, people aged 75 years or older.

Participants were recruited in different ways. First, participants were recruited via the social network of the researcher. Also, participants were recruited in the center of the villages and at the market. Finally, some participants were recruited via a small group of volunteers at a local sport club.

3.4 Ethical Considerations

The data collected is handled in anonymity and privacy is guaranteed for the respondents. The data becomes only available for the researcher and the thesis supervisor, as it is collected only for the purposes of this thesis. Both, the surveys and online data are safely stored and are only accessible for the researcher. Also, the researcher who conducted this research is completely independent and does not have any interest in any potential result.

Participation was based on informed consent. Before participating, respondents were informed about the research and received all the necessary information. Additionally, participants had to sign before participating. By signing, participants agreed to participate in this research and authorized the researcher to use the data for this research.

3.5 Statistical test and SPSS

In this research, the relation between several ratio variables and an ordinal outcome variable is investigated, considering multiple nominal and ratio control variables. These relationships can be tested using an ordinal regression analysis. With a regression analysis you can estimate the causal effects of different independent variables (Winship & Radbill, 1994). This analysis is performed in SPSS. The independent ratio variables are created from several ordinal variables using a tool in SPSS. SPSS was instructed to count the amount of times a respondent answered 'I agree' or 'I strongly agree' to a statement about a subject. Eventually, new scale variables were created. The scale of the variables varied as this is dependent on how many statements were created to test one variable.

3.6 Data quality

To perform an ordinal regression, the data must meet certain criteria or assumptions (Garson, 2012). The first two assumptions are dealing with the level of measurement of which the variables need to be. Logically, the variables meet these criteria. The next assumption is that there is no multicollinearity (Garson, 2012). The data also meet this criterion, as the VIF-values have a value between one and ten (See appendix 7.4). The last assumption is that the data must have proportional odds (Garson, 2012). The insignificant value of the full likelihood ratio test, in appendix 7.3, gives proof that the data meet this criterion as well.

Some missing values were present in the dataset. These have been considered when transforming different ordinal variables into one ratio variable. Because of the chosen sampling method, it might be that some aspects of the data are not fully representative for the population, such as the distribution of the percentage of respondents from different places of residence. Furthermore, some categories had to be merged to correctly run the statistical analysis. These issues are further discussed in the discussion section.

4 Results

In this chapter, the results are presented. This section is divided in sub-sections discussing different aspects independently. First, some descriptive data about the participants is provided.

4.1 Participants

In the municipalities of Stadskanaal and Westerwolde, 52 seniors aged 75 years or older participated. In Appendix 7.2, four maps are presented to show where the participants live (on zip code level). Also, the bus-stops in the largest villages in the municipalities are included in these maps. In total, 27 women and 25 men participated. The age distribution of the sample is presented in figure 3.

In figure 4 is presented where the participants live. As is visible, the majority lives in Musselkanaal, Ter Apel, Mussel and Stadskanaal.

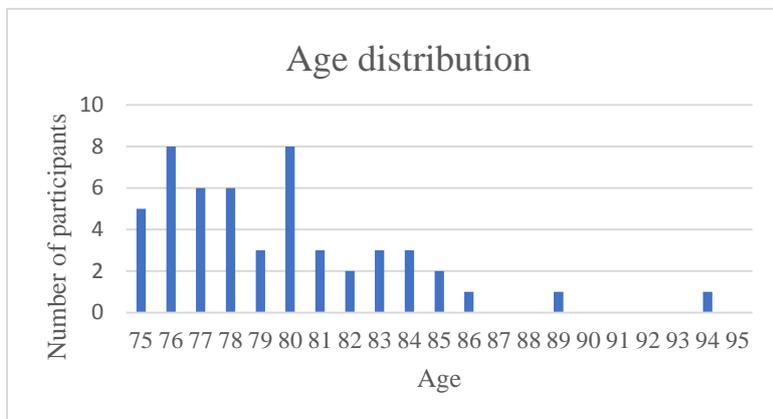


Figure 3: Age distribution (own source).



Figure 4: Distribution of the places of residences (own source).

4.2 Use of public transportation services

The dependent variable was measured by asking the participants how often they used public transportation in a three-month period. A conscious choice was made for this time period, because of the expectation that the level of use is low among the target group. Normally, there should be more differentiation between the levels of use when the period of measuring is increased. In figure 5 is shown how often the participants use public transportation services. Most of the participants never use public transport. Only 32,6% of the participants uses public transport at least one time per quarter.

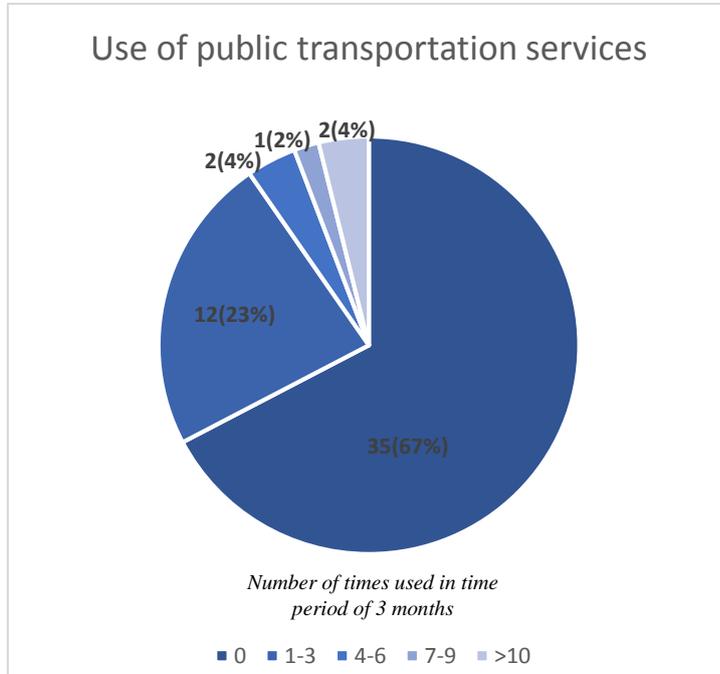


Figure 5: Use of public transportation services (own source).

4.3 Influence of the independent variables

4.3.1. Model

The influence of the variables during this research were measured by performing an ordinal regression. The output of this regression is presented in appendix 7.3. Based on the result, it becomes clear that the model, including the control variables is not significant, assuming a confidence interval of 95%, because it has a p-value of 0,145. Therefore, it is not possible to make any statements about, for example, how much variance in the dependent variable is explained by the chosen independent variables. In table 1, the p-values of the independent variables are presented.

Independent variables	p-value
Perception of public transportation services	0,508
Fares	0,830
Access	0,884
Car-Ownership	0,008
Lift-giving	0,036
Quality of service	0,648
Control variables	p-value
Age	0,280
Gender	0,301
Place of residence	0,741; 0,543; 0,482

Table 1: p-values out of the ordinal regression (own source).

4.3.2 Car-Ownership and Lift-giving

The only two variables having a significant influence on the dependent variable are car-ownership and lift-giving (see table 1). In table 2, some parameter estimates of these variables are presented.

Factor	Estimate	Standard error	Wald	Degrees of freedom	Significance	95% confidence interval: Lower bound	95% confidence interval: Upper Bound
Car-ownership	-1,969	0,745	6,981	1	0,008	-3,430	-0,508
Lift-giving	1,151	0,549	4,390	1	0,036	0,074	2,228

Table 2: Parameter estimates (own source).

Based on the results, the conclusion is that when car-ownership increases, demand for public transport decreases. The Estimate value of -1,969 indicates that when there is a one unit increase in the predictor value, the response value decreases with 1,969, assuming a 95% confidence interval. These results are in line with earlier studies. According to Fiedler (2007), Wang et al. (2015) and Donaghy et al. (2004) people rely more on the car and less on public transport. It is the preferred and most commonly used transport mode among seniors in rural areas (Shergold et al., 2012; Jakobsson Bergstad et al., 2011).

Earlier research has highlighted that people in non-car owning households make more journeys by car than by public transport (CfIT, 2001; Farrington et al., 2004; Nutley, 2005). Surprisingly, the output of the regression analysis in this research indicates that it is expected that when lift-giving increases by one unit, the demand for public transport increases with 1,151 unit, assuming a 95% confidence interval. Thus, the conclusion is that this results are not in line with the results obtained during the studies of CfIT (2001), Farrington et al. (2004) and Nutley (2005).

4.3.3 Fares, Quality of service, Perceptions of public transportation services and Access

It is not possible to make any certain statements about the connections or relationships between the dependent variable and the variables with a p-value higher than 0,05.

Based on this research, the conclusions of Paulley et al. (2006) and Bresson et al. (2003) cannot be confirmed. Due to an insignificant result, it is not possible to state that when fares increase, demand for public transportation services decrease.

Paulley et al. (2006), Fiedler (2007) and Dell'Olio et al. (2011) concluded that several elements, such as service reliability, friendly staff and sufficient information provision are important and affect seniors demand for public transportation services. These statements cannot be made based on this research, as an insignificant result was identified. Thus, it cannot be concluded that demand will increase when quality of service increases.

Furthermore, people's perceptions of public transport do not significantly influence their demand for public transport, based on the results. Fiedler (2007), Rosenbloom and Winsten-Bartlett (2002), as well as Kostyniuk and Shope (2003) concluded that people seem not to be aware of the opportunities offered by public transport. Due to an insignificant result, it is not possible to confirm previous statements as well as stating something about the relation between the independent and dependent variable.

In contrast to the research of Galdames et al. (2011), based on this research, it cannot be confirmed that accessibility plays an important role in the decision for people to travel with public transport. Due to an insignificant result, no conclusions can be extracted from the obtained results.

4.3.4 Control variables

Like the variables discussed in the previous section, all the control variables do not significantly influence senior's demand for public transport in the study area. Although, the variables gender, age and place of residence are of some importance. Because, due to considering these variables it can be concluded that other significant relationships identified cannot be contributed to differences in gender, age or place of residence among participants.

5 Conclusions

5.1 Discussion

When critically reviewing the research (process), several limitations and remarks must be made.

The sample is rather small and close to minimal for performing an ordinal regression analysis. A low level of participants results in a lower level of reliability as the sample might be not completely representative.

Due to a low level of participants, some categories had to be combined, as explained in the methodology. For example, some residences are combined to resolve certain issues within SPSS. Furthermore, the obtained data is transformed into scale variables in order to run a regression. Therefore, several questions are combined and not analyzed individually.

Some statements can be a bit leading for the respondent. Also, the variables tested are broad concepts. Thus, it might be that aspects are overlooked. Furthermore, despite the level of attention given to the operationalization of the concepts, some definitions of concepts might be not completely accurate. This can be due to the influence of the personal perceptions of the researcher. Previous limitations make the research less valid and less reliable.

The sampling method has some limitations as well. This way of sampling can cause that the sample might not be completely representative as you select based on convenience.

During the data collection, it occurred that a lot of people were not willing to participate. People were often very skeptical and afraid that their information was going to be misused. Moreover, people thought that their opinion was not valuable as their knowledge about public transport is limited. People's unwillingness to participate made it more difficult to gather participants. This has had influence on the sample size.

As presented in the results, most independent variables, as well as all the control variables do not significantly influence the dependent variable. Multiple causes are already provided, such as a too small sample size or inaccurate operationalization of concepts. Furthermore, after analyzing the methodologies of the earlier research, it became clear that most of the research did (partly) used another research design. Despite that most of the studies conducted quantitative research, the research designs are not very comparable. Differences are present in sample size and time period. Moreover, not all relationships between the independent and dependent variable were identified in a Dutch rural context but in an international or urban setting. Also, a couple of studies used another research method. These differences in methodology or study area can be the cause that most of the relationships between the variables are not present in the study area, based on this research. If previous reasons are not the cause, then it might be that these relationships are simply not present in the study area. Ultimately, it might be questioned if there is relation between the independent variables and the dependent variable at all.

As public transport can be important in preventing social exclusion in rural areas (Liddle et al, 2012; Fiedler, 2007) and the fact that too less focus has been on seniors (Engels & Liu, 2011) and on rural areas (Milbourne & Kitchen, 2014), it might be helpful to further explore this theme and hopefully find more helpful results. To let public transport become an important transport service in rural areas it is helpful to further explore what triggers the demand for this service. Extending the quantitative research by enlarging the sample size might result in more reliable and useful conclusions. Because apparently most of the investigated variables do not have a significant influence on the demand for public transport, it might be useful to include other variables in the quantitative research. A factor which might be of influence, and which has not been tested in this research, is the mobility of people (Preston & Rajé, 2007). If there are no other or not enough variables available in the existing

literature, it could be useful to first conduct qualitative research before conducting further quantitative research, in order to explore variables which can be of a certain influence.

Based on the results, the low level of reliability of the data and other limitations of this research, no suggestions or recommendations for policy makers are possible to make.

5.2 Conclusion

In this section, the main conclusions are presented. Also, answers to the research questions are given. Not all the expectations outlined at the end of the theoretical framework turned out to be true. These expectations reflect on the research questions. Therefore, they are discussed together with the questions itself.

The first secondary research question is: *“Which variables positively affect the actual demand for public transport services among seniors in the rural area of the municipalities of Stadskanaal and Westerwolde?”*. The expectation was that perceptions of public transport, as well as access to public transport and quality of service would have a positive influence on the demand. Eventually, none of these variables significantly influences the dependent variable. Although, unexpectedly, the variable lift-giving positively influences the demand for public transport among seniors in the municipalities of Stadskanaal and Westerwolde. One of the main conclusions of this research is that when someone is in the position to make more use of lifts from friends and relatives, their demand for public transport increases. This conclusion is contradictory to the conclusions made by Wang et al. (2015), Donaghy et al. (2004) and Fiedler (2007). A possible cause might be that seniors who get often lifts do not possess a car or a driver’s license. Therefore, when there is no lift available, they depend mostly on public transport to travel around.

The next secondary research question is: *“Which variables negatively affect the actual demand for public transport services among seniors in the rural area of the municipalities of Stadskanaal and Westerwolde?”*. Based on the literature summarized in the theoretical framework, the expectation was that car-ownership, an increase in lift-giving, as well as fare increases would result in a decrease in the demand for public transportation services. The major part of this expectation turned also out to be false as lift-giving happened to be positively related to the demand and no significant relationship between the level of fares and the demand for public transportation services was identified. Although, based on this research, the conclusion is that car-ownership has a negative relation with someone’s demand for public transportation. Thus, someone’s demand for public transportation services decreases when they own a car. This conclusion is in line with the results obtained in the studies of CfIT (2001), Farrington et al. (2004) and Nutley (2005).

Now, the secondary research questions are answered an answer to the central question will be provided. The central research questions in this thesis is: *“Which variables determine the actual demand for public transportation services among seniors in the rural area of the municipalities of Stadskanaal and Westerwolde?”*. Based on the results of this research, only the variables car-ownership and lift-giving partly determine the actual demand for public transportation services in the rural areas of the municipalities of Stadskanaal and Westerwolde. More precisely, demand will increase when lift-giving increases. Also, someone’s demand for public transport will decrease if someone owns a car.

Logically, these two variables are not the only variables determining the level of demand in the study area. Therefore, there is a range of other variables with an influence as well. Although, these variables are not considered in this thesis or the relationships of these variables with the dependent variable are simply not identified in this research due to limitations or other characteristics of this research which are discussed in the discussion section.

6 References

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7 Appendices

7.1 Questionnaire

On the next page, the survey which is used as research method during this thesis is presented. This document is in Dutch, as this survey was used to interrogate Dutch-speaking people.

Enquête – Vraag naar openbaar vervoer in Zuidoost Groningen

Beste inwoner van de gemeente Stadskanaal of Westerwolde,

Mijn naam is Frank Zwiers, ik ben 21 jaar en ik woon in Musselkanaal. Op dit moment ben ik aan het afstuderen voor mijn opleiding Sociale Geografie en Planologie die ik volg aan de universiteit in Groningen. Tijdens mijn afstudeeronderzoek probeer ik te ontdekken wat ervoor zorgt dat senioren in de gemeenten Stadskanaal en Westerwolde meer of minder gebruik maken van het openbaar vervoer. Om dit te kunnen ontdekken kan ik uw hulp erg goed gebruiken. Hieronder staan een aantal vragen die ingaan op dit onderwerp.

De gegevens die u hieronder invult zullen volledig anoniem en vertrouwelijk verwerkt worden. Daarnaast zullen ze op een veilige plek worden opgeslagen gedurende het onderzoek. Op het moment dat de gegevens geen verder nut meer hebben voor dit onderzoek zullen ze verwijderd worden. Het invullen duurt maar een paar minuten. Mocht u verdere vragen of opmerkingen hebben dan kunt u via onderstaand emailadres of telefoonnummer contact met mij opnemen.

E-mailadres: f.zwiers@student.rug.nl

Telefoonnummer: 0640705080

Heel erg bedankt dat u de tijd neemt om deel te nemen aan dit onderzoek.

Met vriendelijke groet,

Frank Zwiers

Uw toestemming is nodig om de gegevens te mogen gebruiken voor dit onderzoek. Als u hiermee akkoord gaat, kunt u in het daarvoor bestemde vakje hieronder tekenen.

Persoonlijke vragen

Wat is uw geslacht? Man / Vrouw

Wat is uw leeftijd?

Wat is uw woonplaats?

- Stadskanaal
- Musselkanaal
- Ter Apel
- Mussel
- Vlagtwedde
- Sellingen
- Ter Apelkanaal
- Onstwedde
- Vledderveen
- Blijham
- Veelerveen
- Vriescheloo
- Wedde
- Bourtange

Wat is uw postcode?

Vragen over openbaar vervoer gebruik

Hoe vaak maakt u gemiddeld gebruik van het openbaar vervoer? Hieronder vallen de trein, bussen en het wmo-vervoer (taxi). (*Aantal keren per kwartaal*).

Wilt u alstublieft het meest passend antwoord omcirkelen?

<1 1-3 4-6 7-9 10+

Geef aan hoeverre u het eens bent met onderstaande stellingen:

Uitleg:

- Met 'openbaar vervoer' wordt in deze enquête treinen, bussen en wmo-taxi's bedoeld.
- 1: Sterk mee oneens, 2: Mee oneens, 3: Niet mee oneens/niet mee eens, 4: Mee eens, 5: Sterk mee eens

1. Ik weet (ongeveer) wat de prijzen zijn van het reizen met het openbaar vervoer.

Sterk mee oneens 1 - 2 - 3 - 4 - 5 *Sterk mee eens*

2. Ik vind het reizen met het openbaar vervoer te duur.

Sterk mee oneens 1 - 2 - 3 - 4 - 5 *Sterk mee eens*

3. Omdat de prijzen te hoog zijn reis ik niet/minder met het openbaar vervoer.

Sterk mee oneens 1 - 2 - 3 - 4 - 5 *Sterk mee eens*

4. Wanneer de prijzen zouden dalen, zou ik meer gebruik maken van het openbaar vervoer.

Sterk mee oneens 1 - 2 - 3 - 4 - 5 *Sterk mee eens*

5. Ik ben me bewust van de opties die de verschillende vormen van openbaar vervoer mij bieden.

Sterk mee oneens 1 - 2 - 3 - 4 - 5 *Sterk mee eens*

6. De informatie over belangrijke zaken omtrent het openbaar vervoer (dienstregeling, prijzen, locatie van bushaltes, etc.) is duidelijk en eenvoudig te begrijpen.

Sterk mee oneens 1 - 2 - 3 - 4 - 5 *Sterk mee eens*

7. Wanneer ik informatie nodig heb over het openbaar vervoer kan ik deze altijd gemakkelijk vinden.

Sterk mee oneens 1 - 2 - 3 - 4 - 5 *Sterk mee eens*

8. Ik reis liever met de auto dan met het openbaar vervoer.

Sterk mee oneens 1 - 2 - 3 - 4 - 5 *Sterk mee eens*

9. Omdat ik in het bezit ben van een auto reis ik niet of minder met het openbaar vervoer.

Sterk mee oneens 1 - 2 - 3 - 4 - 5 *Sterk mee eens*

10. Ik maak (mede) weinig/minder gebruik van het openbaar vervoer omdat vrienden en familie mij meenemen of een lift aanbieden.

Sterk mee oneens 1 - 2 - 3 - 4 - 5 *Sterk mee eens*

11. Ik heb voldoende familie en/of vrienden die mij een lift zouden kunnen geven.

Sterk mee oneens 1 - 2 - 3 - 4 - 5 *Sterk mee eens*

12. Ik vind de opstaplocaties voor het openbaar vervoer (bushaltes, treinstations) goed bereikbaar.

Sterk mee oneens 1 - 2 - 3 - 4 - 5 *Sterk mee eens*

13. Ik maak (mede) gebruik van het openbaar vervoer omdat ik de mogelijkheid heb om gebruik te maken van de regiotaxi of andere alternatieven waarbij ik thuis word opgehaald.

Sterk mee oneens 1 - 2 - 3 - 4 - 5 *Sterk mee eens*

14. Ik zal eerder gebruik maken van het openbaar vervoer wanneer er voordelige alternatieven zouden zijn waarbij ik thuis opgehaald kan worden.

Sterk mee oneens 1 - 2 - 3 - 4 - 5 *Sterk mee eens*

15. Wanneer ik duidelijke informatie zal ontvangen over belangrijke informatie (bv. dienstregeling, prijzen, locaties van haltes) omtrent het openbaar vervoer zal ik er meer gebruik van maken.

Sterk mee oneens 1 - 2 - 3 - 4 - 5 *Sterk mee eens*

16. Ik vind het belangrijk dat ik op een droge, warme, veilige en comfortabele plek kan wachten wanneer ik gebruik maak van het openbaar vervoer.

Sterk mee oneens 1 - 2 - 3 - 4 - 5 *Sterk mee eens*

17. Ik vind het belangrijk dat het personeel (buschauffeur, treinconductor, taxichauffeur) vriendelijk is en mij kan helpen met eventuele vragen.

Sterk mee oneens 1 - 2 - 3 - 4 - 5 *Sterk mee eens*

18. Ik vind het tarieven- en ticketsysteem van het openbaar vervoer eenvoudig te begrijpen.

Sterk mee oneens 1 - 2 - 3 - 4 - 5 *Sterk mee eens*

19. Ik vind het belangrijk dat de bussen en treinen op tijd en volgens dienstregeling rijden.

Sterk mee oneens 1 - 2 - 3 - 4 - 5 *Sterk mee eens*

Einde! Heel erg bedankt voor uw tijd en uw deelname aan het onderzoek!

7.2 Places of residence of the participants

Below, some figures are presented in which is visible where the participants live in the different villages. In the survey, participants were asked to provide their zip code. The bus-stops in the villages are also included in the maps.

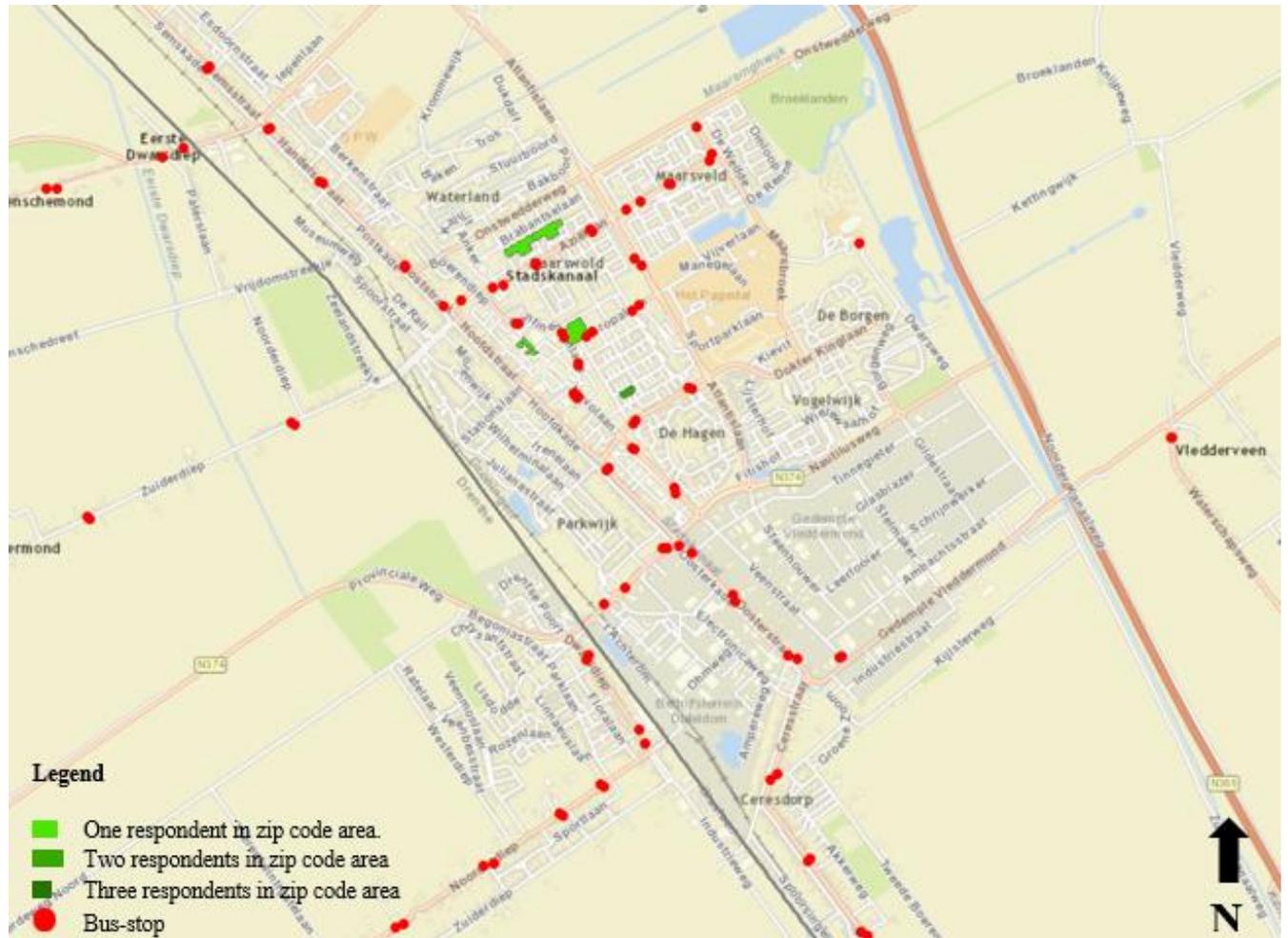


Figure 6: Zip code areas of respondent and bus-stops in Stadskanaal (own source).

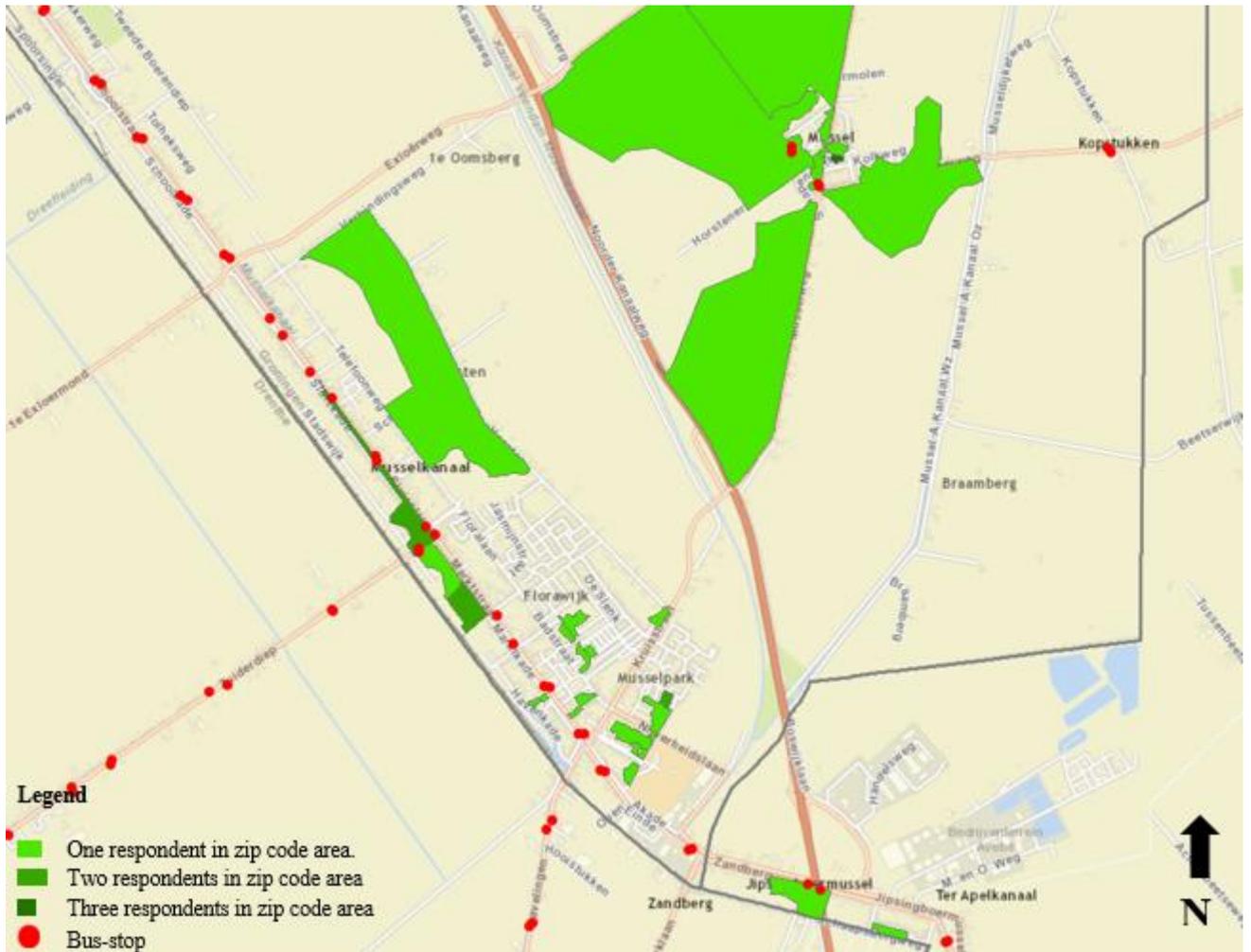


Figure 7: Zip code areas of respondent and bus-stops in Musselkanaal, Mussel and Ter Apelkanaal (own source).

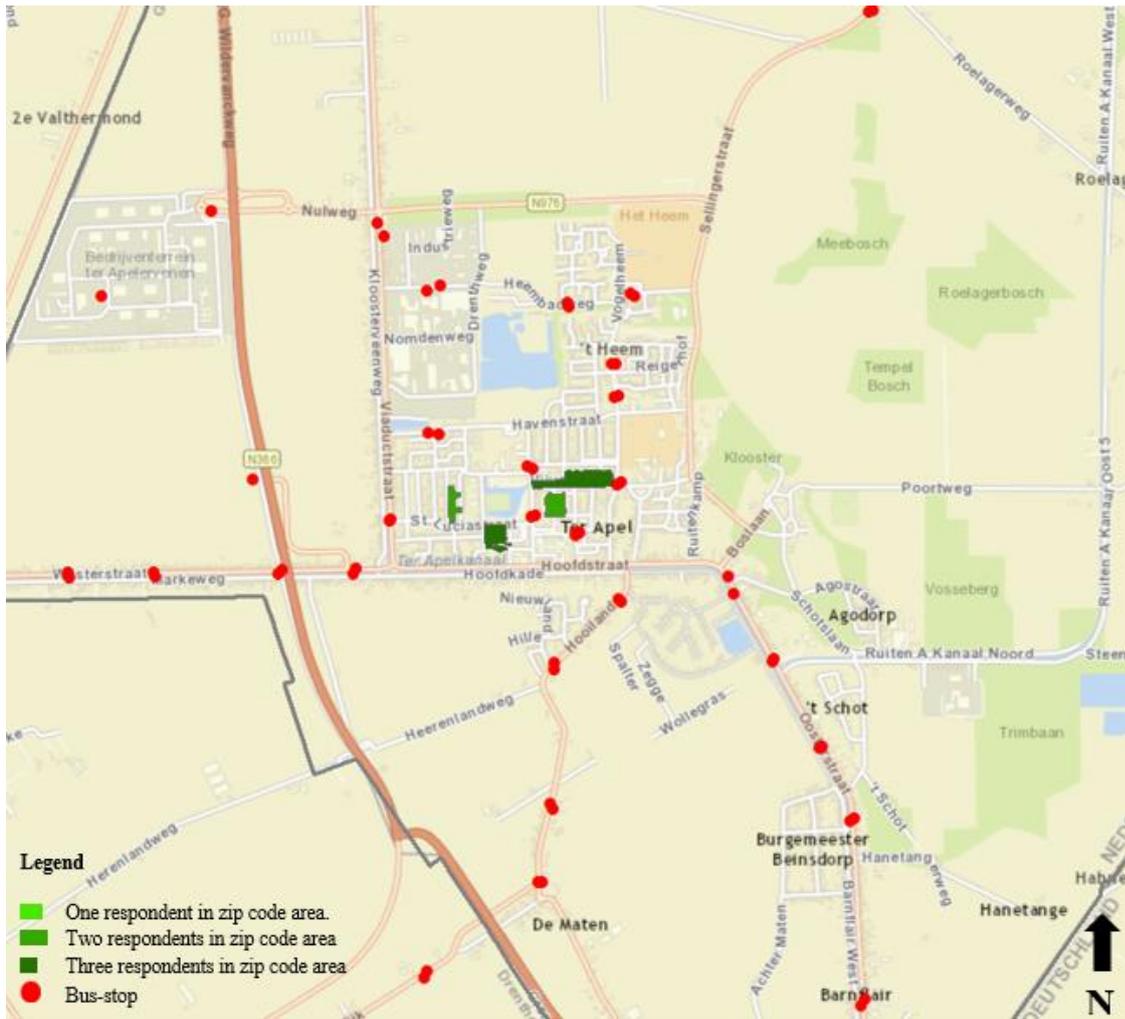


Figure 8: Zip code areas of respondent and bus-stops in Ter Apel (own source).

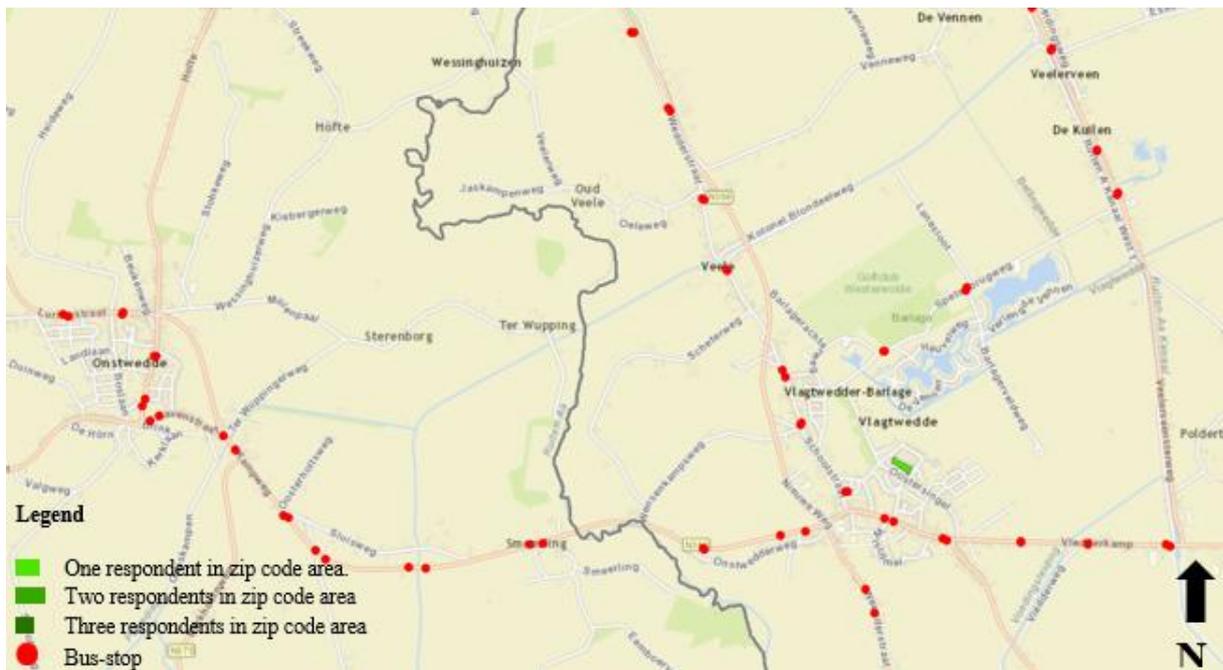


Figure 9: Zip code areas of respondent and bus-stops in Vlagtwedde and Onstwedde (own source).

7.3 SPSS output – Ordinal regression

Below, the original SPSS output from the ordinal regression is displayed.

PLUM PublicTransport_Use BY Gender Residence_combined_2 WITH Age Count_Perception
Count_Fares

Count_Access Count_CarOwnership Count_LiftGiving Count_Quality

/CRITERIA=CIN(95) DELTA(0) LCONVERGE(0) MXITER(100) MXSTEP(5)
PCONVERGE(1.0E-6) SINGULAR(1.0E-8)

/LINK=LOGIT

/PRINT=FIT PARAMETER SUMMARY TPARALLEL.

PLUM - Ordinal Regression

Notes

Output Created		20-MAY-2019 20:51:53
Comments		
Input	Data	C:\Users\Lenovo- Gebruiker\Documents\SPSS file - thesis.sav
	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	52
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on all cases with valid data for all variables in the model.

Syntax		PLUM PublicTransport_Use BY Gender Residence_combined_2 WITH Age Count_Perception Count_Fares Count_Access Count_CarOwnership Count_LiftGiving Count_Quality /CRITERIA=CIN(95) DELTA(0) LCONVERGE(0) MXITER(100) MXSTEP(5) PCONVERGE(1.0E-6) SINGULAR(1.0E-8) /LINK=LOGIT /PRINT=FIT PARAMETER SUMMARY TPARALLEL.
Resources	Processor Time	00:00:00,08
	Elapsed Time	00:00:00,09

Warnings

There are 208 (80,0%) cells (i.e., dependent variable levels by observed combinations of predictor variable values) with zero frequencies.

Case Processing Summary

		N	Marginal Percentage
Use of Public Transport Services	<1	35	67,3%
	1-3	12	23,1%
	4-6	2	3,8%
	7-9	1	1,9%
	>10	2	3,8%

Gender	Male	25	48,1%
	Female	27	51,9%
place of residence 3	,00	7	13,5%
	2,00	15	28,8%
	3,00	10	19,2%
	6,00	20	38,5%
Valid		52	100,0%
Missing		0	
Total		52	

Model Fitting Information

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	96,872			
Final	80,986	15,886	11	,145

Link function: Logit.

Goodness-of-Fit

	Chi-Square	df	Sig.
Pearson	143,543	193	,997
Deviance	80,986	193	1,000

Link function: Logit.

Pseudo R-Square

Cox and Snell	,263
Nagelkerke	,312
McFadden	,164

Link function: Logit.

Parameter Estimates

		Estimate	Std. Error	Wald	df	Sig.
Threshold	[PublicTransport_Use = 0]	-7,144	8,500	,706	1	,401
	[PublicTransport_Use = 1]	-5,121	8,471	,365	1	,546
	[PublicTransport_Use = 2]	-4,379	8,470	,267	1	,605
	[PublicTransport_Use = 3]	-3,875	8,476	,209	1	,648
Location	Age	-,118	,110	1,168	1	,280
	Count_Perception	,333	,503	,438	1	,508
	Count_Fares	-,091	,422	,046	1	,830
	Count_Access	,063	,432	,021	1	,884
	Count_CarOwnership	-1,969	,745	6,981	1	,008
	Count_LiftGiving	1,151	,549	4,390	1	,036
	Count_Quality	,246	,540	,208	1	,648
	[Gender=0]	,829	,802	1,070	1	,301
	[Gender=1]	0 ^a	.	.	0	.
	[Residence_combined_2=,00]	-,362	1,096	,109	1	,741
	[Residence_combined_2=2,00]	,532	,876	,369	1	,543

[Residence_combined_2=3,00]	,759	1,079	,495	1	,482
[Residence_combined_2=6,00]	0 ^a	.	.	0	.

Parameter Estimates

		95% Confidence Interval	
		Lower Bound	Upper Bound
Threshold	[PublicTransport_Use = 0]	-23,805	9,516
	[PublicTransport_Use = 1]	-21,724	11,482
	[PublicTransport_Use = 2]	-20,981	12,222
	[PublicTransport_Use = 3]	-20,488	12,737
Location	Age	-,333	,096
	Count_Perception	-,652	1,318
	Count_Fares	-,918	,737
	Count_Access	-,783	,910
	Count_CarOwnership	-3,430	-,508
	Count_LiftGiving	,074	2,228
	Count_Quality	-,812	1,304
	[Gender=0]	-,742	2,401
	[Gender=1]	.	.
	[Residence_combined_2=,00]	-2,511	1,786
	[Residence_combined_2=2,00]	-1,185	2,249
	[Residence_combined_2=3,00]	-1,356	2,874
[Residence_combined_2=6,00]	.	.	

Link function: Logit.

a. This parameter is set to zero because it is redundant.

Test of Parallel Lines^a

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	80,986			
General	74,285 ^b	6,701 ^c	33	1,000

The null hypothesis states that the location parameters (slope coefficients) are the same across response categories.^a

a. Link function: Logit.

b. The log-likelihood value cannot be further increased after maximum number of step-halving.

c. The Chi-Square statistic is computed based on the log-likelihood value of the last iteration of the general model. Validity of the test is uncertain.

7.4 SPSS output – Linear regression

Below, the SPSS output of a performed linear regression is displayed. The only data which is important for this thesis are the VIF-values presented in the coefficients^a table. To meet the criterion of no multicollinearity these values must have a value somewhere between 1 and 10.

REGRESSION

/MISSING LISTWISE

/STATISTICS COEFF OUTS R ANOVA COLLIN TOL

/CRITERIA=PIN(.05) POUT(.10)

/NOORIGIN

/DEPENDENT PublicTransport_Use

/METHOD=ENTER Gender Age Count_Perception Count_Fares Count_Access
Count_CarOwnership

Count_LiftGiving Count_Quality Residence_combined_2.

Regression

Notes

Output Created		21-MAY-2019 00:17:39
Comments		
Input	Data	C:\Users\Lenovo-Gebruiker\Documents\SPSS file - thesis.sav
	Active Dataset	DataSet1
	Filter	<none>
	Weight	<none>
	Split File	<none>
	N of Rows in Working Data File	52
Missing Value Handling	Definition of Missing	User-defined missing values are treated as missing.
	Cases Used	Statistics are based on cases with no missing values for any variable used.

Syntax		REGRESSION /MISSING LISTWISE /STATISTICS COEFF OUTS R ANOVA COLLIN TOL /CRITERIA=PIN(.05) POUT(.10) /NOORIGIN /DEPENDENT PublicTransport_Use /METHOD=ENTER Gender Age Count_Perception Count_Fares Count_Access Count_CarOwnership Count_LiftGiving Count_Quality Residence_combined_2.
Resources	Processor Time	00:00:00,08
	Elapsed Time	00:00:00,06
	Memory Required	4892 bytes
	Additional Memory Required for Residual Plots	0 bytes

Variables Entered/Removed^a

Model	Variables Entered	Variables Removed	Method

1	place of residence 3, Age (in years), Gender, Count Fares, Count Car-Ownership, Count Quality, Count Lift-Giving, Count Access, Count Perception ^b	. Enter
---	---	---------

a. Dependent Variable: Use of Public Transport Services

b. All requested variables entered.

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,588 ^a	,346	,205	,856

a. Predictors: (Constant), place of residence 3, Age (in years), Gender, Count Fares, Count Car-Ownership, Count Quality, Count Lift-Giving, Count Access, Count Perception

ANOVA^a

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	16,239	9	1,804	2,465	,023 ^b
	Residual	30,742	42	,732		
	Total	46,981	51			

a. Dependent Variable: Use of Public Transport Services

b. Predictors: (Constant), place of residence 3, Age (in years), Gender, Count Fares, Count Car-Ownership, Count Quality, Count Lift-Giving, Count Access, Count Perception

Coefficients^a

Model		Unstandardized Coefficients		Standardized	t	Sig.
		B	Std. Error	Coefficients Beta		
1	(Constant)	3,179	2,797		1,137	,262
	Gender	-,282	,269	-,148	-1,047	,301
	Age (in years)	-,041	,035	-,166	-1,170	,248
	Count Perception	,195	,178	,215	1,099	,278
	Count Fares	-,023	,144	-,026	-,161	,873
	Count Access	-,110	,137	-,148	-,801	,428
	Count Car-Ownership	-,643	,226	-,430	-2,842	,007
	Count Lift-Giving	,364	,160	,387	2,277	,028
	Count Quality	,268	,192	,241	1,395	,170
	place of residence 3	,041	,059	,093	,687	,496

Coefficients^a

Model		Collinearity Statistics	
		Tolerance	VIF
1	(Constant)		
	Gender	,779	1,283
	Age (in years)	,775	1,290
	Count Perception	,407	2,456
	Count Fares	,620	1,613
	Count Access	,455	2,197
	Count Car-Ownership	,682	1,466
	Count Lift-Giving	,539	1,857
	Count Quality	,523	1,914

place of residence 3	,850	1,176
----------------------	------	-------

a. Dependent Variable: Use of Public Transport Services

Collinearity Diagnostics^a

Model	Dimension	Eigenvalue	Condition Index	Variance Proportions		
				(Constant)	Gender	Age (in years)
1	1	8,233	1,000	,00	,00	,00
	2	,531	3,936	,00	,20	,00
	3	,420	4,429	,00	,36	,00
	4	,312	5,140	,00	,12	,00
	5	,214	6,201	,00	,20	,00
	6	,121	8,256	,00	,03	,00
	7	,079	10,223	,00	,00	,00
	8	,062	11,569	,00	,05	,00
	9	,029	16,964	,01	,03	,01
	10	,001	95,226	,99	,00	,99

Collinearity Diagnostics^a

Model	Dimension	Variance Proportions			
		Count Perception	Count Fares	Count Access	Count Car-Ownership
1	1	,00	,00	,00	,00
	2	,04	,01	,00	,01
	3	,00	,27	,02	,00
	4	,01	,13	,01	,07
	5	,22	,21	,06	,05
	6	,14	,03	,25	,04

7	,10	,10	,42	,04
8	,30	,05	,04	,72
9	,02	,20	,17	,00
10	,16	,00	,03	,07

Collinearity Diagnostics^a

Model	Dimension	Variance Proportions		
		Count Lift-Giving	Count Quality	place of residence 3
1	1	,00	,00	,00
	2	,00	,00	,15
	3	,00	,00	,03
	4	,04	,00	,25
	5	,02	,00	,06
	6	,29	,02	,18
	7	,25	,01	,12
	8	,28	,04	,11
	9	,01	,92	,09
	10	,10	,01	,02

a. Dependent Variable: Use of Public Transport Services