Moving between municipalities:
attracting people through jobs

A research on job accessibility and its relation to interregional residential relocation

Lizet Genefaas

Bachelorthesis Geography, Planning and Environment (GPE)
Faculty of Management
Radboud University Nijmegen
June, 2017

Moving between municipalities: attracting people through jobs

A research on job accessibility and its relationship with interregional residential relocation

Lizet Genefaas

Bachelorthesis Geography, planning and environment (GPE)
Faculty of Management
Radboud University Nijmegen
June, 2017

Supervisor: Dr. Fariya Sharmeen
Student number: 4485262
Words: 19909

Summary

Concerns about the uneven spatial development of regions in the Netherlands have risen over the years. While some regions, like the Randstad, are economically growing and increasing in population, other regions are dealing with population decline and the undesired effects that come along with this. These regions are called shrinking regions and are located within the periphery regions of the Netherlands. To counteract the negative effects of these regions, the Dutch government invests in enhancing the quantity, quality, and accessibility of houses, services, and employment within these regions in order to attract people towards them and to stimulate the regional economy. However, it is questionable if investing in the enhancement of accessibility of employment leads to the desired effect, namely the attraction of people towards those regions.

The reason why it this is questionable, is because on the one hand theory of Feijten and Visser (2005) indicates that investing in the enhancement of job accessibility would be an effective way to attract people towards a region. This is because work related motives are seen as motives for moving between municipalities, also called interregional residential relocation. But on the other hand, theory of Rouwendal and Meijer (2001) suggests that this relationship isn't as strong as before. This would be due to changes in sort of jobs and employment. Since the relationship between job accessibility and interregional residential relocation in practice is unclear, this research will examine job accessibility and its relationship with interregional residential relocation in the Netherlands.

Therefore, the objective of this research is to provide insights in job accessibility and its relationship with interregional residential relocation in the Netherlands, in order to make recommendations to policy makers focused on attracting people towards shrinking regions. This is done by carrying out a quantitative research which conducts analyses contributing to answering the main research question: to what extent do insights in job accessibility and its relationship with interregional residential relocation indicate that investing in job accessibility is an effective way to attract people towards municipalities?

The answer of this research question indicates whether the approach of the Dutch government for solving shrinking region related problems seems effective. Insights in the relationship between job accessibility and interregional residential relocation are used to make recommendations to policy makers focused on solving shrinking region related problems and therefore this research is societal relevant. The scientific relevance of this research is its contribution to theory regarding job accessibility and its relationship with interregional residential relocation in practice.

Job accessibility and its relationship with interregional residential relocation were examined for six different values of job accessibility within 22 different municipalities. The data on job accessibility was provided by DAT.Mobility and contained data on job accessibility for:

- Transport by car within 30 minutes travelling time outside peak hours
- Transport by car within 45 minutes travelling time outside peak hours
- Transport by car within 30 minutes travelling time during peak hours
- Transport by car within 45 minutes travelling time during peak hours
- Transport by public transport within 30 minutes travelling time during peak hours
- Transport by public transport within 45 minutes travelling time during peak hours

The 22 examined municipalities were chosen based on their spatial location regarding their province and the zone in which they were located. These zones were the Randstad, the intermediary zone, the periphery, and shrinking regions located within the periphery. Data on interregional residential relocation was derived from CBS and this data contained the number of inhabitants of a municipality, the number of people who left the municipality and the number of people who entered the municipality. With this data, five analysis regarding job accessibility and its relationship with interregional residential relocation were conducted.

The first analysis compared the differences in job accessibility related to the total number of inhabitants per municipality. The results indicated a pattern where job accessibility would rise as the total number of inhabitants would rise as well. There were some deviations from this pattern. These could be explained by the spatial location of the municipalities. Municipalities located nearby a (natural) border have less jobs accessible than similar municipalities which are not located a border. Job accessibility was also influenced by the spatial location of municipalities in relation to the proximity of the Randstad. The Randstad has a high job accessibility and being near the Randstad means that a lot of jobs are nearby as well. Furthermore, the analysis showed that job accessibility in the Randstad is highest and job accessibility in shrinking regions is lowest. Job accessibility by car is way higher than job accessibility by public transport and the number of jobs which are accessible rises when the period of travelling is outside peak hours. This could be explained by the negative influence of congestion on mobility and eventually on accessibility.

The influence of congestion was also in play at the second analysis. The second analysis compared differences in highest and lowest values of job accessibility. In general, the differences in highest and lowest value of job accessibility diminished as travelling time would increase. Exceptions to this were caused by the proximity of (natural) borders and by the occurrence of congestion.
The differences between highest and lowest value of job accessibility were highest for job accessibility by public transport. This is explained by the spatial location of public transport stations. These stations are often located nearby places with a high population density so many people are able to use the stations and so locations nearby these public transport stations have a higher value of job accessibility than locations located further away from these locations.

Differences in differences between 30 minutes and 45 minutes travelling time were again biggest for public transport. This was examined in the third analysis which compared the differences in job accessibility between 30 minutes and 45 minutes travelling time. The high differences in job accessibility between 30 minutes and 45 minutes travelling time would be due to lesser jobs which can be reached within 30 minutes travelling time by public transport than by car. But, by extending the travelling time by 15 minutes, the increase in jobs which can be reached by public transport is bigger than the increase of jobs that can be reached by car. Municipalities which profit most from the extension of travelling time when travelling by car are municipalities which are located nearby the Randstad. Municipalities which profit least from the extension are the municipalities located nearby a (natural) border.

Overall, the first three analyses give an indication of job accessibility in the Netherlands. The analyses showed that a municipality's job accessibility is mostly influenced by a municipality's spatial location in relation to the proximity of (natural) borders and/or cities and by the occurrence of congestion. More specified insights in job accessibility in the Netherlands provided by the first three analyses are:

- Job accessibility rises as the total number of inhabitants per municipality increases
- Job accessibility by car is higher than job accessibility by public transport
- Job accessibility is higher outside peak hours than during peak hours
- Differences in highest and lowest value of job accessibility diminish as travelling time is extended from 30 minutes to 45 minutes
- Differences in highest and lowest value of job accessibility are bigger for job accessibility by public transport than by car
- Municipalities located nearby the Randstad or other big cities profit more from the extension of travelling time in comparison to municipalities which aren't located nearby the Randstad or other big cities

The fourth and fifth analysis were both conducted to provide insights in the relationship between job accessibility and interregional residential relocation. The fourth analysis compared job accessibility to the relative average of inhabitants per postcode zone. This analysis indicated that slightly more people than the average number of people live in postcode zones with a higher job accessibility than the average job accessibility in a municipality. This suggested that a very weak correlation between job accessibility and interregional residential relocation would be found in the fifth analysis.

The fifth analysis executed several correlation tests which sought for a correlation between job accessibility and the rate of interregional residential relocation per municipality, the rate of people moving into a municipality and the rate of people moving out of a municipality. This was done separately for municipalities located in the Randstad, the intermediary zone, the periphery, and shrinking regions and for all municipalities together. For the periphery, a correlation between job accessibility by travelling with public transport within 30 minutes travelling time during peak hours and the rate of interregional residential relocation of municipalities located in the periphery was found. However, this correlation would mean that less people would move to a municipality as job accessibility by public transport within 30 minutes travelling time during peak hours would increase. This was in contrast with this research' expectations and no explanations for this outcome were found.

Overall, the correlation tests found no correlations between job accessibility and the rate of interregional residential relocation per municipality, the rate of people moving into a municipality and the rate of people moving out of a municipality. This could be explained by influences of universities and the escalator effect and the assumption by Rouwendal and Meijer (2001) that the relationship between job accessibility and interregional residential relocation isn't as strong as before.

Because no correlation between job accessibility and interregional residential relocation was found, the answer to the research is formulated as follows:

The insights in job accessibility and its relation to interregional residential relocation indicate that investing in job accessibility is not an effective way to attract people towards municipalities. This is based on the results of the analyses which indicated that there is no positive correlation between job accessibility and interregional residential relocation. As the results indicate that people do not tend to move for job related motives, it is questionable if investing in job accessibility in shrinking regions leads to the desired effect, namely attracting people towards those regions.

Table of contents

Chapter 1: Introduction

1.1 Research context

Over the past few years, concerns about the uneven spatial development of regions within the Netherlands have risen. While the Randstad is dealing with great population growth, regions in the periphery are dealing with a population that is rapidly declining. For example, it is expected that the population of Amsterdam, Rotterdam, The Hague, and Utrecht have grown by the year of 2030 with 15% in comparison to 2015 and the population of the Randstad will be equal to one third of the total Dutch population (CBS, 2016). In contrary, one out of five municipalities located in Dutch periphery regions, like Drenthe, North East Groningen, the Achterhoek, Northern Limburg, and Dutch Flanders, will deal with population decline (CBS, 2016). It seems like the Randstad is growing at the expense of those periphery regions and this leads to different consequences for them: whereas the Randstad is economically growing and expending its service sector, periphery regions are increasingly dealing with a population that is ageing, has a low income, and is poorly educated (Bock et al., 2017).

The growth of the Randstad is a consequence of policies conducted by the Dutch government focused on the enhancement of economic development of already successful urban areas (Koelemaij & Wind, 2017). Policies on enhancing the development of periphery regions were lacking. Policy-makers have tried to justify this lack by arguing that periphery regions indirectly benefit from economic growth in the Randstad. However, scientific research rarely confirms this statement (Koelemaij & Wind, 2017). What research does confirm, is that the negative consequences for periphery regions are growing.

For instance, not only is the overall number of people living in periphery regions declining, the population that is left behind is relatively old too. This is because it is mostly the group of young adults who move away from periphery regions towards more urbanised regions (CBS, 2016; Kooiman, 2016; de Jong et al., 2016). Their motive for this is often the pursuit of new opportunities in education and work. What is problematic about young adults moving from periphery towards more urbanised regions, is that their region of origin will decline in population and as high educated, young people, leave the region, only older people and those who are low educated and often have a low-income, are left behind (Bock et al., 2017).

The combination of shrinkage and the ageing of the population leads to negative consequences for a region. Issues with the housing market, physical and social living environment, the amount and quality of services, and regional economy may occur (van Dam, de Groot & Verwest, 2006). Problems in the housing market are related to an oversupply of houses and may lead to vacancy. As a result, a decrease in house value occurs and landlords and housing corporations may suffer from financial problems (van der Wagt & Boon 2006; Magnusson & Turner 2003). The attractiveness of the physical living environment is also harmed by vacancy and may result into vandalism and decay, which may lead to a feeling of unsafety. In addition, the social living environment is harmed by a decrease of social cohesion and an increase of social segregation (van Dam, de Groot & Verwest, 2006).

The amount and quality of services are influenced by shrinkage and ageing as well. Research has indicated that the level of services within shrinking regions has declined in comparison to non-shrinking regions in The Netherlands (Vermeij, 2012). Especially the level of private services, as supermarkets, restaurants, and bars, is way lower than the level of these services in other, non-

shrinking, regions. Furthermore, the level of health care services, like a doctor or a physiotherapist, isn't as high as in more populated areas. At last, even though every child living in these regions still has access to a school nearby, it is likely to expect that this will change negatively in the future as well (Vermeij, 2012). The further development of the regional economy of shrinking regions is still insecure. It is possible for these regions that the economic development is slowed down by a decline in regional work force. However, this would be dependent on the level of work force participation and productivity and thus predictions on the development of the regional economy are hard to be made (van Dam, de Groot & Verwest, 2006).

Since processes of shrinkage lead to undesired effects for a region, policies are made to counteract regional population decline. In general, the Dutch government focuses on three main aspects to reduce shrinking regions, namely housing, services, and economy. Hereby, it is the Dutch government's goal to enhance the quantity, quality, and accessibility of houses, services, and employment within shrinking regions in order to attract people towards those regions and to stimulate the regional economy (Rijksoverheid, 2014).

This research will focus on this last aspect, the enhancement of accessibility of employment in order to attract people towards regions. It is expected that the more jobs are accessible to a region, the more people will move towards that region. This expectation is based on theory by Feijten and Visser (2005). Feijten and Visser (2005) indicate work related reasons as motives for people to move from one region to another. This is also referred to as interregional residential relocation (Feijten & Vissser, 2005). According to this theory, housing follows employment. However, due to changes in sort of jobs and employment it is suggested that this relationship isn't as strong as before (Rouwendal & Meijer, 2001). If this is the case, it is questionable if investing in employment in shrinking regions leads to the desired effect, namely the attraction of people towards those regions. For this reason, this research will examine job accessibility and its relationship with interregional residential relocation in the Netherlands.

1.2 Research objective

The research context pointed out that regional population decline leads to several undesired effects as problems with the housing market, the living environment, the level and quality of services, and possibly the regional economy. To counteract these problems, the Dutch government is willing to enhance the accessibility of jobs in periphery regions to attract people from other regions. Since the effectiveness of this approach depends on the relationship between job accessibility and interregional residential relocation, it is interesting to examine this relationship. Therefore, the objective of this research is formulated as follows:

To provide insights in job accessibility and its relationship with interregional residential relocation in the Netherlands, in order to make recommendations to policy makers focused on attracting people towards shrinking regions.

This is done by carrying out a quantitative research which conducts analyses for providing insights in job accessibility in the Netherlands and its relationship with interregional residential relocation. The execution of these analyses contributes to answering the main research question:

To what extent do insights in job accessibility and its relationship with interregional residential relocation indicate that investing in job accessibility is an effective way to attract people towards municipalities?

1.3 Societal relevance

The societal relevance of this research is its critical perspective on the current approach of the Dutch government for solving shrinking region related problems. This critical perspective can be used for making recommendations to policy makers in the same field. As named before, part of the approach for solving shrinking region related problems is enhancing the accessibility of employment in shrinking regions in order to attract people from different regions to the shrinking region. The effectiveness of this approach is questioned since theory suggests that job accessibility doesn't influence interregional residential relocation as much as before. By examining the relationship between job accessibility and interregional residential relocation in practice in the Netherlands, insights in this relationship can be given. These theoretical insights can be used for making recommendations to policy makers in practice focused on attracting people towards shrinking regions. Namely, if the insights indicate that there is a (strong) relationship between job accessibility and interregional residential relocation, this would suggest that the approach of the Dutch government for counteracting regional population decline is effective. However, if insights indicate that the relationship is weak or is lacking, this would suggest that the approach is not effective and policies for counteracting shrinking regions should be adjusted. This way, this research will contribute to solving shrinking region related problems.

1.4 Scientific relevance

The scientific relevance of this research is its contribution to theory regarding the relationship between job accessibility and interregional residential relocation. The relationship between the two concepts is unclear. On the one hand, theory suggests that job accessibility influences interregional residential relocation, as job related motives are motives for people to move (Feijten & Visser, 2005). On the other hand, it is expected that this relationship isn't as strong as before, since the sort of jobs and way of working has changed over the years (Rouwendal & Meijer, 2001). How the two concepts relate in practice, is still unknown. This research will examine the relationship between job accessibility and interregional residential relocation in the Netherlands and thus will contribute to developing theory on the relationship of the two concepts.

Chapter 2: Theoretical framework

The theoretical framework provides theoretical insights in accessibility and residential relocation in general. The theories have been used to place the phenomena of job accessibility and interregional residential relocation in a bigger context. First, theory on accessibility is discussed (2.1) and next is theory on residential relocation (2.2).

2.1 Accessibility

This paragraph elaborates theory on accessibility in general. The objectives of this paragraph are to clarify the concept of accessibility, to indicate the different components of it, and to introduce methods with which accessibility can be measured. The theoretical insights were used for conducting the data-analysis and interpreting the results.

2.1.1 The definition of accessibility

Accessibility is a broad concept that is hard to define. Over the years, different researches have used different definitions trying to define the concept. A well-known example of such a definition is Hansen's definition of accessibility, describing it as the potential for interaction (1959). According to Kwan and Weber (2003), accessibility refers the proximity of one location to other specified locations. However, Ulimwengu and Guo stress the proximity of activities instead of locations, defining accessibility as "the opportunity that an individual at a given location possesses to participate in a particular activity or set of activities" (2004, p. 1). In line with this, Bertolini, LeClerq, and Kapoen conceptualize accessibility as "the amount and the diversity of places of activity that can be reached within a given travel time and/or cost" (2005, pp. 209). These examples show that a single, all-including, definition of accessibility is hard to give. A reason for this is that accessibility consists of multiple components, to be more precise: four components (Geurs & van Wee, 2004).

2.1.2 Components of accessibility

Geurs and Van Wee (2004, p. 128) define accessibility as "the extent to which land-use and transport systems enable (groups of) individuals to reach activities or destinations by means of a (combination of) transport mode(s)". They indicate that accessibility consists out of four components: a land-use component, a transport component, a temporal component, and an individual component.

The land-use component reflects the land-use system, consisting out of three different components itself, namely: the amount, quality, and spatial distribution of opportunities; the demand for opportunities at origin locations; and the demand for and supply of opportunities. When speaking of opportunities, Geurs & Van Wee (2004) refer to the possibility of an individual to participate in an activity. The land-use component can be related to Handy's attractiveness factor of accessibility which stresses the importance of quality of possible destinations (2005).

The transport component describes the time and effort it takes for one person, using a specific mode of transportation, to reach a possible destination. This can be related to Handy's (2005) impedance factor of accessibility. The impedance factor reflects the time and costs for reaching a destination as well, or in other words: how difficult it is to reach a certain destination. Both the transportation component and the impedance factor are closely related to mobility. This may cause an unclear distinction between the concepts of accessibility and mobility, even though there is a great

difference between them (Handy, 2005). Mobility only refers to the potential of movement, whereas accessibility refers to the potential of interaction (Hansen, 1959). In that sense, good mobility doesn't always imply good accessibility and good accessibility doesn't always imply good mobility. When destinations are in short distance, but traffic is congested and thus mobility is bad, it is still possible to have good accessibility. The other way around, when traffic is not congested and mobility is well, but destinations are in far distance, it is still possible to have bad accessibility (Handy, 2005).

The temporal component of accessibility refers to the availability of possible destinations at different times of the day and the availability of individuals to participate in certain activities over the day (Geurs & Van Wee, 2004, p. 128). Last, the individual component reflects the needs of an individual. According to Handy (2005), accessibility is about meeting a person's needs by enabling visiting places where a person's needs can be fulfilled. For example: when a person is sick, the person needs to be able to visit a hospital; when a person needs groceries, the person needs to be able to go to the supermarket; when a person needs a job, the person needs to be able to visit a workplace. The needs of a person can be distinguished by age, income, educational level, household situation, abilities, and opportunities of an individual (Geurs & Van Wee, 2004).

The four components do not only influence the level of accessibility; they influence each other as well. For example, depending on the spatial distribution of activities (land-use component), the demand for transportation varies. If a destination is nearby, other efforts and other costs for transportation are in play than a destination that is located further away. The individual component might also influence the other components, since individual needs and abilities influence "the (valuation of) time, cost and effort of movement, types of relevant activities and the times in which one engages in specific activities" (Geurs & Van Wee, 2004, p. 128).

2.1.3 Measuring accessibility

Since there are so many definitions of accessibility, all emphasizing slightly different characteristics, there are many different methods for measuring accessibility as well. The most suitable method for measuring accessibility depends on the perspective one has on accessibility. Geurs and Van Wee suggest four different perspectives on accessibility for measuring it. These perspectives are infrastructure-based, location-based, person-based, and utility-based (Geurs & Van Wee, 2004).

The infrastructure-based measures are mostly used in transport planning. The perspective focuses on the performance and the level of convenience of transport infrastructure. Examples of these sorts of measures are average speed and level of congestion. The location-based measures are often used in urban planning and geographical studies. The perspective focuses on spatially distributed activities or potential destinations. Examples of these sorts of measures are the number of jobs within a certain area. The person-based measures analyse accessibility on an individual level. The perspective focuses on individual's abilities and limitations for accessibility, for example: in which activities, can an individual participate at a given time? Last, the utility-based measures analyse the economic benefits or costs people have by accessing a certain activity, for example: transportation costs or loans (Geurs & Van Wee, 2004).

Depending on the perspective of accessibility, different methods for measuring accessibility are suggested. For this research, the location-based perspective on accessibility is used. Reason for this,

is because this research is interested in the number of jobs which are accessible from a given municipality. The location-based perspective focuses on the spatial distribution of activities and thus can be used for measuring the spatial distribution of jobs. In this case, distance and contour measures and potential accessibility measures should be used to measure accessibility (Geurs and Van Wee, 2004).

Distance measures measure the degree to which two points located on a surface are connected. This is also known as 'relative accessibility measure' (Ingram, 1971). Relative accessibility measured as a straight line between two points or possible destinations is seen as the easiest way for measuring accessibility by taking the land-use component into account. However, relative accessibility can be measured by infrastructure-based measures (related to the transport component like average travelling time and average speed) as well. Overall, distance measures are used to give an insight in the maximum travel time and distance from one point to another (Geurs & Van Wee, 2004). Similar to distance measures are contour measures, except contour measures analyse more than two possible destinations. According to Geurs and Van Wee (2004, pp. 133) contour measures count "the number of opportunities which can be reached within a given travel time, distance or cost (fixed costs), or measure of the (average or total) time or cost required to access a fixed number of opportunities (fixed opportunities)". Similar to Geurs and Van Wee, Handy (2005, p. 132) describes contour measures as "[the] number of destinations of interest within a certain time or distance of the origin point".

The use of distance and contour measures leads to different advantages and disadvantages. The advantages of the measures are that they are easy to interpret and relatively little data is needed for conducting the measures. Because of their little demand for data and their good interpretability, distance and contour measures are easily used by researchers and policy makers (Geurs and Van Wee, 2004). A disadvantage of the measures is its dependence on limits on travelling time that are set. These limits substantially influence the outcome of the measures since they determine how many destinations can be reached. As a result, the combined effects of the land-use and transport component are not taken into account, even though they are both separately included. Competition effects are neither taken into account. In the case of job accessibility: if 10 jobs are available to 15 people, the level of job accessibility in this situation is lower compared to a situation were 10 jobs are available to 5 people. Considering competition effects when measuring accessibility gives a better indication of it (Geurs and Van Wee, 2004). Last, the measures do not take individual components, like preferences and needs, into account. Considering the job accessibility case again: jobs that require high education and jobs that require less high education are considered equal, whereas not everybody has access to the high educated jobs. This may lead to a mistaken view on accessibility (Geurs and Van Wee, 2004).

Potential accessibility measures estimate the number of activities that can be reached from a given point within a given travelling time (Dijst, Geurs & Van Wee, 2002). Unlike the distance and contour measures, the potential accessibility measure takes into account the combined effects of the transport and land-use components by using a distance decay function (Geurs & Van Wee, 2004). As a result, destinations or opportunities that are located further away from the origin point are less influencing than destinations which are located nearby (Dijst, Geurs & Van Wee, 2002). This gives a better indication of accessibility than contour and distance measures do. Furthermore, the potential

accessibility measure can be easily estimated by existing data. However, interpreting the results of the potential accessibility measure is difficult and here as well are competition effects and preferences are not included (Geurs and Van Wee, 2004). There are approaches for potential accessibility measures where competition effects are included, but these approaches are seldom used because of their complexity and difficult interpretability (Geurs and Van Wee, 2004).

2.2 Residential relocation

The following paragraph elaborates theory on residential relocation by focusing on trends of and motives for residential relocation in the Netherlands. The theory is used to place phenomena related to residential relocation into context, making it easier to understand what movements are made, by whom these movements are made, and for what reasons these movements are made. The theoretical insights provided by this paragraph are also used for the data-analysis and interpreting the results.

2.2.1 Motives for residential relocation

Residential relocation is not a new or a special phenomenon in the Netherlands. Every year, around 10% of the Dutch population moves (CLO, 2016). The approximately 1,68 million people that move within the Netherlands do not all move in the same direction or for the same reasons. According to Feijten and Visser (2005) five main motives for residential relocation related to a particular sort of movement can be indicated. These motives are demographic changes, a desire for a new sort of house, a desire for change in neighbourhood, work, and education.

Demographic changes include changes in households, like getting children, getting married, getting divorced, and moving in together. A desire for a new sort of house and the desire for change in neighbourhood are related to one's preferences, for instance: the size of a house and the sort of neighbourhood the house is located. Residential relocation due to changes in work or education are related to the distance between one's house and workplace and/or educational institutions.

Demographic changes and changes in desire for house and neighbourhood often lead to residential relocation within short distance of the origin home. The residential relocation happens within the municipality of origin. However, residential relocation due to work or educational motives, often leads to movements over greater distance, crossing the borders of the origin municipality. This sort of residential relocation is also referred to as interregional residential relocation (Feijten & Visser, 2005).

2.2.2 Residential relocation trends within the Netherlands

The five main motives for residential relocation are related to a sort of movement: residential relocation within a municipality or interregional residential relocation. Patterns of certain people making certain movements make it possible to distinguish several trends related to residential relocation within the Netherlands. These trends are a general decline in residential relocation over the years, an increasing rate of interregional residential relocation of young adults, and a shift from suburbanisation towards urbanisation. The trends are clarified below.

The first trend that can be observed is a general decline in residential relocation over the years (Kooiman, 2016). An explanation for this is the ageing of the Dutch population. In 2008, almost 15% of the Dutch population was aged 65 or older. It is expected that this number will increase and that by the end of year of 2040, 26% of the Dutch population will be aged 65 or older (Central Bureau of Statistics, 2016). Because older people are less likely to move than younger people, the ageing of the Dutch population results in a decline in residential relocation in the Netherlands. This is illustrated by figure 1. Figure 1 shows that the group of people aged between 25-34 is the group that is most likely to move and that the chances to move decline as age increases.

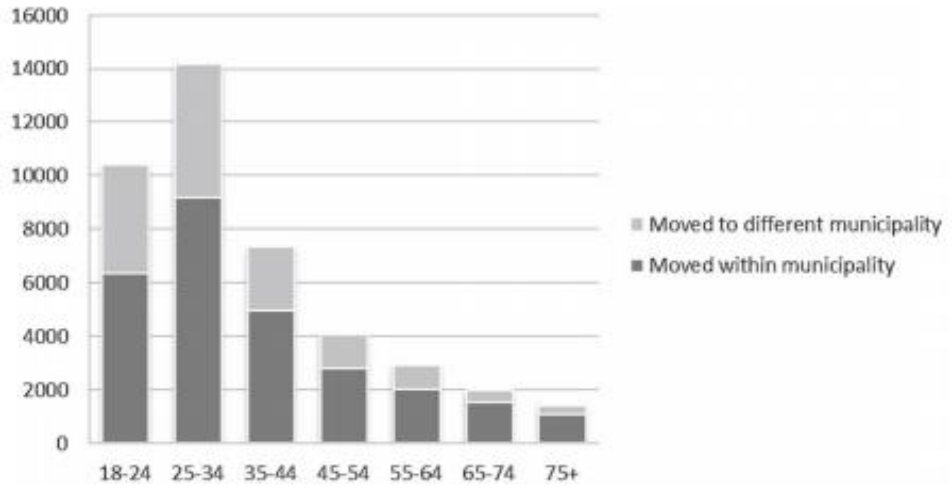


Fig. 1: Age at time of moving (Calculated by the authors from HRN data 2002-2012; de Jong et al., 2015)

The small group of older adults that does move, is more likely to leave big cities rather than to move to big cities (Fokkema, 1996; Serow, Friedrich & Haas, 1996). This is illustrated by figures 2 and 3. Figures 2 and 3 show the migration flows of elderly, respectively aged between 55-64 and 75+, from more urbanised areas to less urbanised areas. These migration flows can be explained by the fact that less populated areas are favoured by the elderly with the age of 55-64 because of their low housing costs, high education quality and little suburban road congestion (Plane, Henrie & Perry, 2005). For the group of elderly with the age of 75 or higher, the main motive for moving is to rejoin with their younger family members. Since the less populated areas are preferred by younger families, for the same reasons as named above, older families will follow them into these areas as well (Plane & Heins 2003; Plane & Jurjevich 2009; van der Pers, Kibele & Mulder, 2015).

However, not all the elderly are moving from urbanised areas to less urbanised areas. Figure 4 shows that elderly with the age of 65-74 are mostly moving from less urbanised areas to more urbanised areas. An observation that is in contrast with general expectations. De Jong, Brouwer and McCann (2015) speak of a new phenomenon that can be explained by a new generation of elderly, namely the retired baby boom generation. This generation might move to more urbanised areas because of the higher level of public services, like hospitals and speciality care facilities in those areas compared to low urbanised areas (Plane & Jurjevich, 2009). Next to that, Kresl and Ietri (2010) suggest that this generation is more interested in the city life, with all its private and public services, culture, and arts, instead of the more traditional sun and golf retirement locations.

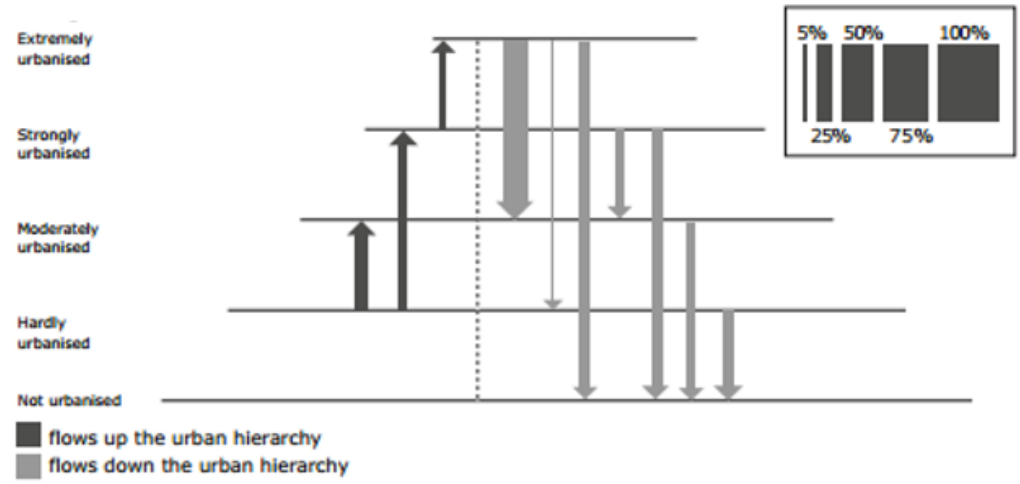


Fig. 2: Age specific (55-64) net migration exchanges between urban hierarchy levels (Calculated by the authors of HNR data 2002-2012; de Jong et al., 2015)

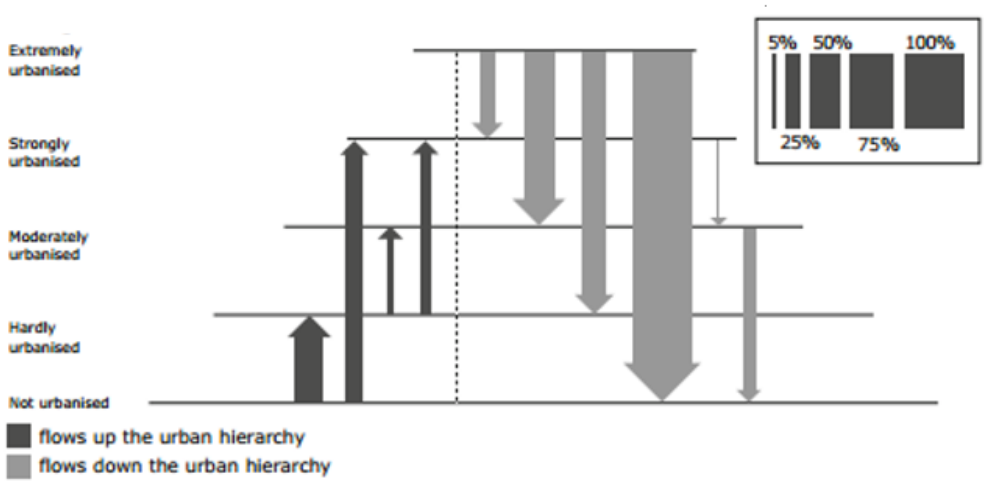


Fig. 3: Age specific (75+) net migration exchanges between urban hierarchy levels (Calculated by the authors of HNR data 2002-2012; de Jong et al., 2015)

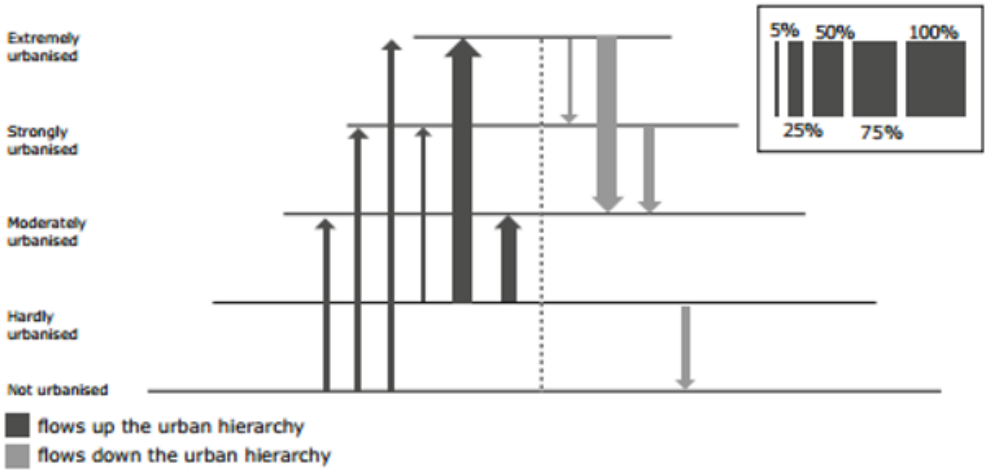


Fig. 4: Age specific (65-74) net migration exchanges between urban hierarchy levels (Calculated by the authors of HNR data 2002-2012; de Jong et al., 2015)

Overall, de Jong et al. (2016) suggest that the residential mobility and the residential mobility patterns of the baby boom generation will in the future differ from the previous elderly generation. They indicate three reasons for this. Firstly, the baby boom generation is higher educated and their income is higher than the previous generation. This makes it easier for the baby boom generation to move (Clark & Dieleman, 1996; Bureauvijftig, 2015). Secondly, the baby boom generation has a higher divorce rate than previous generations. This influences the residential mobility, because it is expected for divorced elderly to have a higher residential mobility rate than those who are still living together (Richards & Rankaduwa, 2008; Herbers, Mulder & Mòdenes, 2014). Last, because the baby boom generation has moved more in the past due to educational or job related reasons, it is expected that their level of place attachment is lower than the level of place attachment of previous generations (Andersson & Abramsson, 2012). This results in a baby boom generation which has a higher likelihood to move again (DaVanzo, 1981; Mulder, 1993).

The second trend related to residential relocation that can be observed within the Netherlands is the increasing rate of interregional residential relocation of young adults (Kooiman, 2016). Whereas the amount of residential relocation over short distances has declined, the amount of interregional relocation has remained the same. This trend can be explained by the higher level of residential mobility of young adults aged between 18-26. This higher level of residential mobility of young adults is related to the higher level of participation in tertiary education in the Netherlands (Kooiman, 2016). Young adults participating in tertiary education often move to cities were universities are located. By moving to those cities, they cross their municipality borders.

The high level of interregional residential relocation of young adults can be recognized in figure 2. Figure 2 not only shows that the level residential relocation is highest between the ages of 18-33, it reveals that the level of interregional residential relocation within those ages is highest as well. In addition to that, research indicated that in 2015 52% of those who moved interregional in the Netherlands were aged between 18 and 29 years old (Kooiman, 2016). Looking at the interregional migration flows, there can be seen that young adults often move from less urbanised areas towards more urbanised areas. This is especially the case for young adults aged between 18 and 24 (see figure 5) (De Jong et al., 2016). The movement from young adults to more urbanised areas can be explained by the fact that universities are often located in these sorts of areas (de Jong et al., 2015).

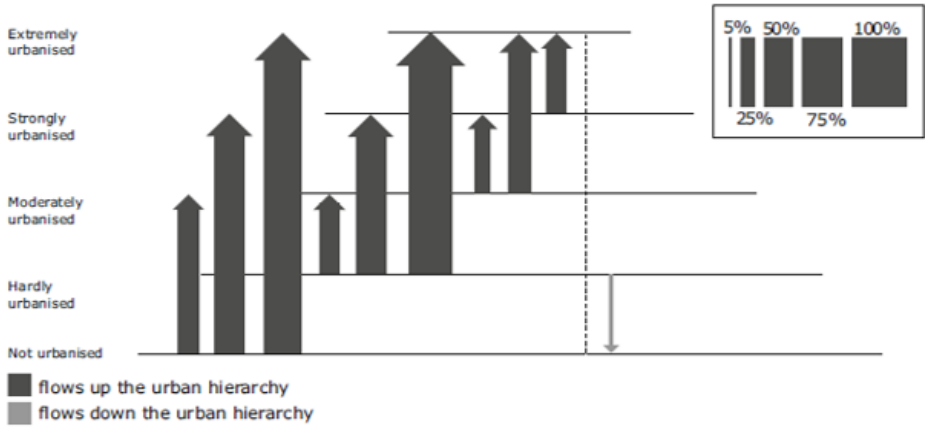


Fig. 5: Age specific (18-24) net migration exchanges between urban hierarchy levels (Calculated by the authors of HNR data 2002-2012; de Jong et al., 2015)

Young adults are also expected to move interregional due to job related reasons. However, according to Rouwendal and Meijer (2001) job related motives for interregional residential relocation are nowadays less significant than in the past. They indicate four reasons for this. Firstly, market distortions on the Dutch housing market may prevent people from living close to their work. Due to a.o. housing restrictions in rural areas and an insufficient supply of low-cost housing, people are less able to live nearby their work locations. Secondly, the flexibility of the labour market has increased. People change jobs more frequently, but these changes in jobs do not always lead to residential location changes. As a result, people might temporary live further away from their work. Thirdly, most households are now reliable on two incomes, meaning that two work locations influence the choice of residential location instead of one. Last, monetary and time costs for travelling between home and work are not taken into account. Reasons for this, are that monetary costs are often compensated by employers and that time costs become less important as people get more used to it (Rouwendal & Meijer, 2001).

It should be noted that even though the rate of interregional residential relocation of young adults has increased, the rate of interregional residential relocation in general has remained the same. This is also related to the ageing of the Dutch population: as elderly move less and young adults move more, the overall rate of interregional residential relocation does not increase. A second note is that despite the decline in residential relocation over short distances, this form of residential relocation is still biggest. In 2015, 60% of the people who moved, moved within their origin municipality. From those who moved to another municipality, 60% moved within their province and 27% moved to a nearby province (CLO, 2016).

The third residential relocation trend that can be observed within the Netherlands is a shift from suburbanisation towards urbanisation (Kooiman, 2016). This trend strongly relates to increasing amount of interregional residential relocation of young adults. The British geographer Fielding recognized a pattern where young adults moved to cities for educational or job related motives and by the time they wanted to start a family, they would leave the city and move to less urbanised areas, often their origin hometown, where they could settle. Fielding calls this pattern the escalator effect (Kooiman, 2016). However, over the past 15 years a trend can be observed where young adults who are starting families will stay in the city. As a result, the amount of 18-24 year olds moving towards cities is increasing and the amount of 25-29 year olds returning to their region of origin is declining (Kooiman, 2016). This leads to negative consequences for less urbanised, often periphery regions, as the interregional residential relocation of young adults towards more urbanised areas happens at the expense of these regions. The periphery regions which used to deal with a positive migration rate, are nowadays dealing with more people leaving the region than entering the region (see figure 6). These processes lead to shrinkage and ageing populations in periphery regions as the Achterhoek, Zeeland, and Limburg (Kooiman, 2016).

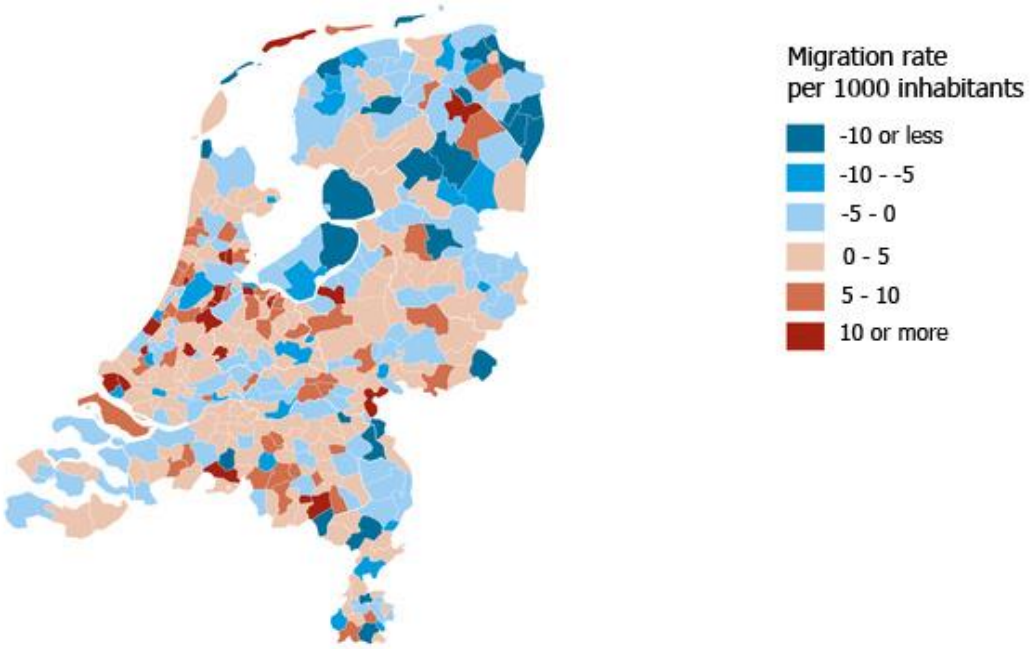


Fig. 6: Domestic migration rate per municipality (CBS, 2016; CLO, 2016)

Chapter 3: Methodology

This chapter explains the choices made for this research and the steps taken for the execution of this research. First, the chosen research strategy is explained (3.1). Next, the sort of research material is discussed in the operationalisation paragraph (3.2). Third, the chosen research areas are indicated (3.3). After that, the methods used for the data analysis are explained and expectations per analysis are written down (3.4). At last, a conclusion on the four paragraphs is drawn (3.5).

3.1 Research strategy

The choice for this research' strategy was based on literature on research strategies by Verschuren and Doorewaard (2007). Verschuren and Doorewaard (2007) indicate five different research strategies, namely the casestudy, the experiment, the survey, the grounded theory approach, and the desk research. The objective of this research is to provide insight in the relationship between job accessibility and interregional residential relocation, in order to make recommendations to policy makers focused on attracting people towards shrinking regions. The desk research as research strategy was found most suited for achieving this research' objective within the given time.

The desk research is a research strategy where literature and secondary data are used to provide new insights for the subject (Verschuren & Doorenwaard, 2007). There are three main characteristics of the desk research. Firstly, the research material isn't produced by the researcher him- or herself. Therefore, existing research material like literature, secondary data, and official statistic material is often used within this research strategy. Secondly, as a result from working with existing research material, there is no direct contact with the research subject. Last, the existing research material is used with a different perspective than it was created with (Verschuren & Doorewaard, 2007).

The methodology of this research meets with the three characteristics of desk research since existing data was used, there was no direct contact with the research subject, and the data was used with a different perspective than it was created with. The data on job accessibility that was used was provided by DAT.Mobility and was originally created by the company to provide insights in job accessibility in the Netherlands. The data on interregional residential relocation came from CBS and was originally created to provide insights in residential relocation in the Netherlands. This research combined the two datasets and provided insights in the relationship between the two concepts.

Within the desk research, two different variants are distinguished: the literature review and the secondary research (Verschuren & Doorewaard, 2007). The literature review is used to gain theoretical insights in a particular field of interest by using existing literature. The secondary research is used to rearrange and analyse and interpret existing data from a different point of view. It is possible to conduct secondary research in either a quantitative or a qualitative way. For both ways, it is necessary to use reliable sources and to be aware of the misleading effects that the data might give (Verschuren & Doorewaard, 2007).

This research will use the quantitative secondary research variant within the desk research as research strategy. Two main reasons for this are the need to use data on job accessibility and interregional residential relocation to achieve the research' objective and the limited time that is given to achieve this objective. Since the given time for conducting this research was limited, it was not possible to develop and make use of primary data. However, the existing data provided by DAT.Mobility and CBS made it possible to gain a great amount of data in a relatively short period of

time. This is also known as one of the advantages of desk research in general (Verschuren & Doorewaard, 2007). A disadvantage is that the researcher is dependent on the possibilities a dataset has. Since the dataset was created for different purposes than the researcher's purpose, it is possible that the dataset doesn't meet up with the requirements set by the researcher (Verschuren & Doorewaard, 2007). Fortunately, the dataset provided by DAT.Mobility did meet up with the requirements set for this research.

3.2 Operationalisation

This paragraph explains the material that was needed for conducting this research. Characteristics and the use of data on job accessibility and interregional residential relocation are given.

3.2.1 Data on job accessibility

Data on job accessibility was provided by the company DAT.Mobility. The dataset contains information on job accessibility in 2008 for all postcode zones located within the 22 municipalities which are examined for this research. These municipalities are described in paragraph 3.3. For this research, job accessibility was measured by potential accessibility measures. Thus, the number of jobs that can be reached from a certain postcode zone within a given travelling time using a particular mode of transportation was measured whereby the influence of jobs located nearby was higher than jobs located further away. In this case, the potential accessibility measures took the land use component, transport component, and temporal component of accessibility into account and provided a specific insight in job accessibility.

The potential accessibility measures were measured for two different modes of transportation: transportation by car and public transport. In addition, two different travelling times were set, namely 30 minutes and 45 minutes. Next to that, the period of time of travelling was taken into account as well by distinguishing travelling during peak hours and outside peak hours. For transportation by car, data for both periods of time was available. For public transport, only data for peak hours was available. In total, job accessibility was measured for six different values of job accessibility. An overview of the values is given in table 1 below.

Job accessibility values	**Name**
Transport by car within 30 minutes travelling time outside peak hours	COP30
Transport by car within 45 minutes travelling time outside peak hours	COP45
Transport by car within 30 minutes travelling time during peak hours	CP30
Transport by car within 45 minutes travelling time during peak hours	CP45
Transport by public transport within 30 minutes travelling time during peak hours	PTP30
Transport by public transport within 45 minutes travelling time during peak hours	PTP45

Table 1: Job accessibility values

The job accessibility per postcode zone per job accessibility value was provided by the dataset. However, information on job accessibility per municipality was needed as well. This was measured by taking the average of job accessibility of all postcode zones located in the municipality. Furthermore, the dataset of DAT.Mobility provided information of the number of people that lived within the zone that could be reached from a certain postcode zone using a particular mode of transportation within a given travelling time and period of time.

3.2.2 Data on interregional residential relocation

Data on interregional residential relocation was derived from the CBS Statline website. For this research, interregional residential relocation was measured as the number of people moving in and moving out of the municipality. In an ideal situation, data on the migration flows of people would be used for this. By using this data, insights in the places people move from and move to could be given and levels of job accessibility of those places could be compared for drawing conclusions. Unfortunately, this sort of data could not be attained or be assessed within the given time for this research. Therefore, instead of data that would provide insights in the places people move from and move to, data on the number of people who entered a municipality and who left a municipality was used. This data was combined with the total number of inhabitants per municipality to estimate the rate of interregional residential relocation per municipality and the rate of people moving into and out of the municipality. Since the data on job accessibility provided by DAT.Mobility came from 2008, data on interregional residential relocation coming from 2008 was used as well.

3.3 Research areas

This research examines the rate of interregional residential relocation and the level of job accessibility for 22 Dutch municipalities. The reason this research examines the rate of interregional residential relocation and the level of job accessibility on the municipal level, is that a variety of characteristics of municipalities can be examined and compared. In addition to that, data on interregional residential relocation was mostly available on the municipal level.
The municipalities were chosen based upon the province in which they are located and sort of economic zone in which they are located.

Three different economic zones based on job density within the Netherlands can be distinguished: the Randstad, the intermediary zone, and the periphery (Van Oort, 2004). The Randstad has the highest job density of all three zones and the periphery the lowest. The level of job density of the intermediary zone lays between the level of the Randstad and the periphery (van den Broek et al., 2008). The Randstad is an attractive location for people to move to and especially younger adults move from intermediary or periphery regions to the Randstad (Kooiman, 2016). The attractiveness of the Randstad is reflected in its population density: the Randstad has the most people living per square kilometre in the Netherlands and the periphery the least. In fact, the population density of the Randstad is almost six times as high as the periphery's population density (van den Broek et al., 2008). The low population density of the periphery is reflected by the number of shrinking regions that are located within the periphery. A list of nine shrinking regions in the Netherlands has been elaborated by the Dutch government (Rijksoverheid, 2015). This list also contains the names of the municipalities which are located within these regions. Based on this list, five municipalities were chosen to be examined as well.

The municipalities for which the relationship between job accessibility and interregional residential relocation was examined, are: Alkmaar, Almere, Amersfoort, Amsterdam, Assen, Den Bosch, Den Haag, Eindhoven, Emmen, Enschede, Groningen, Heerenveen, Heerlen, Hulst, Leeuwarden, Lelystad, Nijmegen, Rotterdam, Terneuzen, Utrecht, Veendam, and Zwolle. The location of the chosen municipalities per zone are shown in figure 7 (van den Broek et al., 2008; own elaboration, 2017)

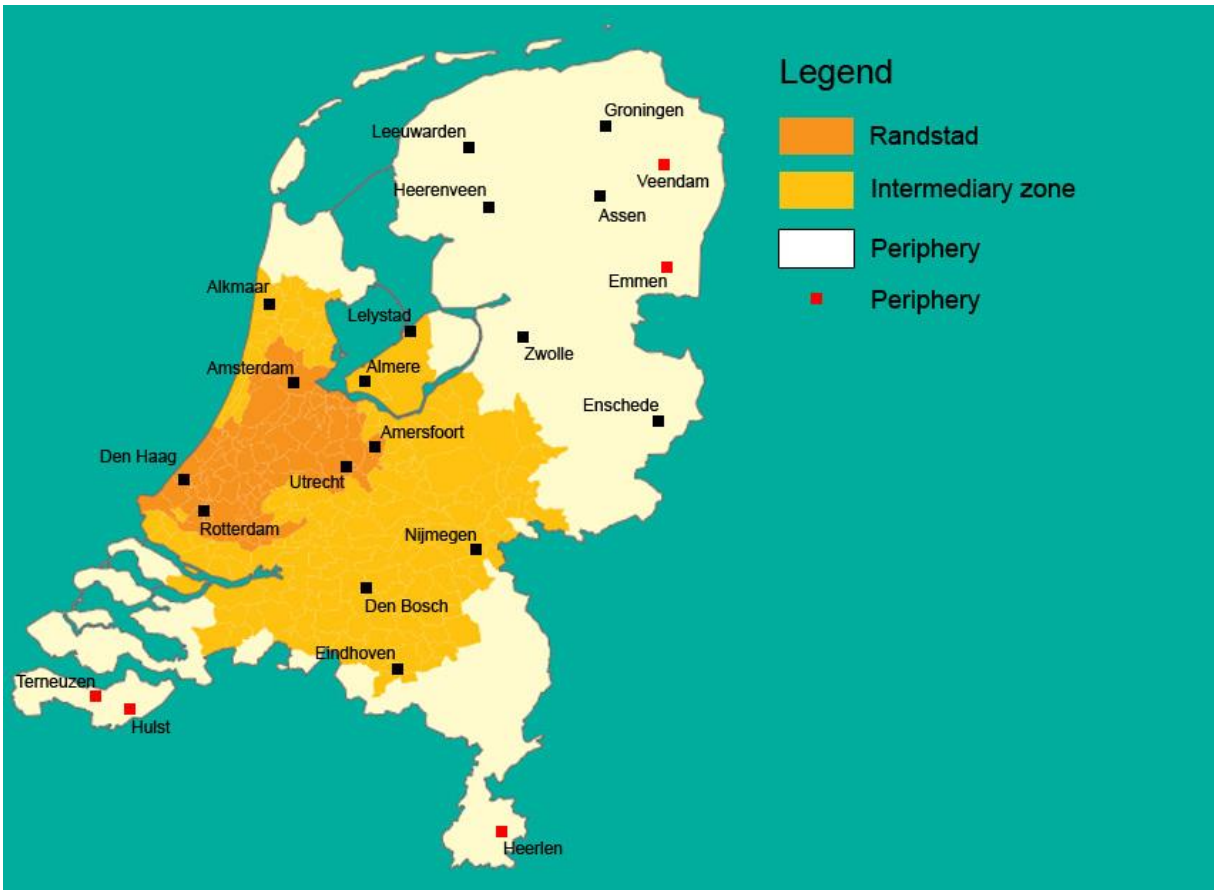


Fig. 7: Municipalities per zone (de Jong et al., 2008; own elaboration, 2017)

3.4 Data analysis

This paragraph describes the different analyses which were conducted. Per analysis is described why the analysis was conducted, how it was done, and which outcomes were expected. The former four analyses were based on analyses conducted by Westerveld (2016) for his thesis on job accessibility.

3.4.1 Comparison of job accessibility and total inhabitants per municipality

The first analysis that was done was the comparison of absolute numbers of job accessibility and total inhabitants per municipality. Per municipality, the average of job accessibility was estimated and these averages were displayed in a graph in relation to the total number of inhabitants per municipality. The absolute comparison was done to provide an overall insight of the job accessibility per municipality. It was expected that a municipality's average of job accessibility would raise as the total number of inhabitants of the municipality would raise as well. Another expectation was that the job accessibility by car was higher than the job accessibility by public transport.

3.4.2 Comparison of highest and lowest values of job accessibility

The second analysis which was conducted was the comparison of highest and lowest values of job accessibility. This was done by using the coefficient of variation. The coefficient of variation is used to compare differences in variation of different values of job accessibility. It provides an insight in the relative variation of the values (Doorn, Rhebergen & Touwen, 2006). Related to the coefficient of variation are the range, the mean, and the standard deviation. The range is the difference in the highest value and the lowest value in a distribution (Urdan, 2016), for example: the difference in

postcode zone with the lowest job accessibility and the highest job accessibility. The mean is calculated by adding up all values and dividing them by the total number of values. The standard deviation represents the deviation of the mean. However, since the means of the values vary, the standard deviation cannot be used to compare the differences (Doorn, Rhebergen & Touwen, 2006). Therefore, the standard deviation is divided by the mean and a relative number representing the deviation of the mean is the outcome. This number is the coefficient of variation. The higher the coefficient of variation is, the higher is the average deviation of the mean.

The coefficients of variation were calculated for all municipalities. This way, differences and similarities in variation in job accessibility for municipalities were indicated. The coefficients of variation were compared within municipalities, based on different modes of transport, travelling time, and period of time, and between municipalities. There were two expectations related to the coefficient of variation. The first expectation was that the coefficients of variation were higher for municipalities with a high number of inhabitants than with a low number of inhabitants. The second expectation was that the coefficient of variation would decline as the travelling time would increase.

3.4.3 Comparison of differences in 30 minutes and 45 minutes travelling time

The third analysis which was done explored the differences in job accessibility between 30 minutes and 45 minutes travelling time. Relative differences were used to compare the differences in travelling time so both differences within and between municipalities could be compared. The relative differences will be estimated by indexing the average job accessibility per value of job accessibility per municipality based on the index number of 45 minutes travelling time by car during peak hours. This choice is made based on the facts that the car is the most often used mode of transportation and over half of the Dutch population travels more than 30 minutes to their work location during peak hours (CBS, 2016; CBS, 2016).

After comparing the differences in job accessibility between the different travelling times, the total number of inhabitants per municipality were taken into account as well. Patterns between the municipality's population and differences in job accessibility per travelling time were sought. Hereby, it was expected that differences in job accessibility per travelling time were higher for travelling outside peak hours than during peak hours. It was also expected that municipalities located nearby big cities would have bigger differences in job accessibility per travelling than municipalities which were not. The third and last expectation was that differences in job accessibility per travelling were higher for municipalities with a high number of inhabitants than for municipalities with a low number of inhabitants.

3.4.4 Comparison of job accessibility and average inhabitants per postcode zone

Whereas the former three analyses had a more explorative character, the fourth and fifth analyses were more focused on the relationship between interregional residential relocation and job accessibility. This fourth analysis provided a first insight in this relationship. The analysis compared the job accessibility per post code zone to the number of people living in that post code zone. The comparison was done by using index numbers. The job accessibility per postcode zone within a municipality and per value of job accessibility was indexed based on the average job accessibility of that municipality and value of job accessibility. The index number that came out of this was multiplied by the number of inhabitants of that post code zone. This was done for all postcode zones within the municipality. All of the outcomes were added up and divided by the total number of

inhabitants of the municipality. This outcome was the final outcome and resulted in a number that was around 100. The calculation is displayed by the following formula (Westerveld, 2016):

$$y = \frac{Total\ of\ all\ postcode\ zones\ (Job\ accessibility * Inhabitants\ postcode\ zone)}{Total\ inhabitants\ municipality}$$

An outcome higher than 100 would mean that within that municipality and value of job accessibility, more people live in postcode zones with a high job accessibility than the average number of people within that municipality. The other way around: an outcome less than 100 would mean that within that municipality and value of job accessibility, less people live in postcode zones with a high job accessibility than the average number of people within that municipality.

By using this analysis, insights in the attractiveness of areas with high job accessibility can be given. This is relevant for researching the relationship between job accessibility and interregional residential relocation, since results of this analysis might indicate what to expect from this relationship. If the outcomes are higher than 100, it is likely to expect that places with a high job accessibility are attractive places to move to and thus the level of interregional residential relocation within this places is high. If the outcomes are less than 100, it is expected that the level of interregional residential relocation within this places is low. In general, it is expected that places with high job accessibility are attractive places to live, and thus outcomes will be higher than 100.

3.4.5 Correlation job accessibility and interregional residential relocation

The last analysis sought for a correlation between job accessibility and interregional residential relocation. Correlation is used in statistics to "denote an association between two continuous variables" (Daya, 2004). In this case, it was used to find out if there was any association between job accessibility of a municipality and that municipality's rate of interregional residential relocation. The level of association between the two variables is measured by the correlation coefficient. There are several correlation coefficients, but the one used most often is the Pearson product-moment correlation coefficient (Urdan, 2016). The correlation coefficient has two important characteristics, namely the direction of the correlation coefficient and the strength of the relationship.

The direction of the correlation coefficient can either be positive or negative. A positive correlation coefficient indicates that "the values on the two variables being analyzed move in the same direction, and they are associated with each other in a predictable manner" (Urdan, 2016, p. 165). This means that if the value of one variable goes up, the value of the other variable goes up as well. The positive direction of the correlation coefficient should not be confused with the assumption that values of variables can only increase in value. A positive direction of the correlation coefficient also means that if the value of a variable goes down, the value of the other variable goes down as well. In the case of this research this would mean that if job accessibility in a municipality goes up, the rate of interregional residential relocation goes up as well. On the contrary, a negative correlation coefficient means that "the values on the two variables being analyzed move in opposite directions" (Urdan, 2016, p. 166). So, if the value of one variable goes up, the value of the other variable goes down. Or the other way around, if the one goes down, the other goes up. Again, in case of this research this would mean that if the job accessibility in a municipality goes up, the rate of interregional residential relocation goes down. However, this research expects a positive correlation coefficient for the correlation between job accessibility and interregional residential relocation.

The strength of the correlation coefficient is represented by *r* and *r* varies from -1.00 to +1.00 (Urdan, 2016). A negative value of *r* represents a correlation between two variables with a negative direction. A positive value of *r* represents a correlation between two variables with a positive direction. If the value of *r* is 0.00, this means that no correlation between the two variables was found. The closer the value of *r* comes to -1.00 or +1.00, the stronger the correlation between the two variables is. However, correlation coefficients with the strength of -1.00 or +1.00 never occur, since this would imply a perfect relationship. The strength of the correlation related to the value of *r* is shown in figure 8 below.

Fig. 8: General guide to the strength of correlation coefficient (Urdan, 2016)

This research has used the Pearson correlation coefficient to measure the level of correlation between job accessibility and interregional residential relocation. The Pearson correlation coefficient can be measured for two variables measured on a continuous scale. This has been done for each municipality's value of job accessibility, rate of people who moved into the municipality, rate of people who moved out of the municipality, and rate of interregional residential relocation. Job accessibility was measured as the number of jobs that can be reached from a certain postcode zone within a given travelling time using a particular mode of transportation. The rate of people who moved into the municipality was calculated by dividing the number of people who moved into the municipality by the municipality's total number of inhabitants and multiplying this by 100. The same was done for calculating the rate of people who moved out of the municipality. Interregional residential relocation was measured as the rate of interregional residential relocation per municipality. This was done by subtracting the number of people who moved out of the municipality from the people who entered the municipality and multiplying this number by 100. The outcome was divided by the total number of inhabitants of the municipality.

Several correlation tests were conducted. The first series of correlation tests sought for a correlation between job accessibility and interregional residential relocation per zone in which the municipalities were located. These tests provided insights in the relationship between job accessibility and interregional residential relocation for the Randstad, the intermediary zone, the periphery, and shrinking regions. The next series of correlation tests sought for a correlation between job accessibility and interregional residential relocation in general. For all cases, it was expected that the relationship between job accessibility and interregional residential relocation would have a positive direction and a very weak strength. Thus, it was expected that as job accessibility would rise, the rate of interregional residential relocation would rise as well. And if job accessibility would decrease, the rate of interregional residential relocation would decrease as well. This was analysed for the rate of interregional residential relocation in general, but also specific for the rate of people moving in and moving out of the municipality.

Last, it should be noted that the correlation coefficient gives an indication of the association of two variables and not the level of causality between two variables (Urdan, 2016). So, if a positive correlation between two variables is found, this would not mean that the increase of value of the

one variable is caused by the increase of value by the other value. However, if a strong correlation is found, this might suggest that an analysis on causality between the two variables would be interesting for further research.

3.5 Conclusion

This chapter has elaborated the methodology for this research. The chosen research strategy for this research is desk research. Within the desk research, there has been chosen for the quantitative secondary research variant. The data on job accessibility that has been used was provided by DAT.Mobility. The data contained information about job accessibility for almost every postcode zone within the Netherlands for six different values of job accessibility:

- Transport by car within 30 minutes travelling time outside peak hours
- Transport by car within 45 minutes travelling time outside peak hours
- Transport by car within 30 minutes travelling time during peak hours
- Transport by car within 45 minutes travelling time during peak hours
- Transport by public transport within 30 minutes travelling time during peak hours
- Transport by public transport within 45 minutes travelling time during peak hours

Data on interregional residential relocation came from CBS and was measured by the number of people moving in and moving out of the municipality and the total number of inhabitants per municipality. Since data on job accessibility came from 2008, data on interregional residential relocation came from 2008 as well.

Job accessibility and its relationship with interregional residential relocation was examined for 22 municipalities, namely: Alkmaar, Almere, Amersfoort, Amsterdam, Assen, Den Bosch, Den Haag, Eindhoven, Emmen, Enschede, Groningen, Heerenveen, Heerlen, Hulst, Leeuwarden, Lelystad, Nijmegen, Rotterdam, Terneuzen, Utrecht, Veendam en Zwolle. These municipalities are located in three different zones within the Netherlands: the Randstad, the intermediary zone, and the periphery. Within the periphery, five municipalities are located in shrinking regions.

Five data analyses were conducted to examine job accessibility and its relationship with interregional residential relocation. Four of these analyses were based on analyses conducted by Westerveld (2016). These analyses were the absolute comparison of job accessibility and total inhabitants per municipality, the comparison of the coefficients of variation, the comparison differences in 30 minutes and 45 minutes travelling time, and the comparison of job accessibility and average inhabitants per postcode zone. The fifth analysis analysed the correlation between job accessibility and interregional residential relocation. Related to the analyses, there were several expectations:

- A municipality's average of job accessibility would raise as the total number of inhabitants of the municipality would raise as well
- Job accessibility by car is higher than the job accessibility by public transport
- Job accessibility varies more within municipalities with a high number of inhabitants than with a low number of inhabitants
- Job accessibility would vary less within a municipality as travelling time would increase
- Differences in job accessibility between 30 minutes and 45 minutes travelling time were higher outside peak hours than during peak hours

- Differences in job accessibility between 30 minutes and 45 minutes travelling time were higher for municipalities located nearby big cities than municipalities which are not
- Differences in job accessibility between 30 minutes and 45 minutes travelling time were higher for municipalities with a high number of inhabitants than for municipalities with a low number of inhabitants
- Postcode zones with high job accessibility would have a higher number of inhabitants than the average number of inhabitants per postcode zone
- The relation between job accessibility and the rate of interregional residential relocation per municipality would be a positive, but very weak correlation

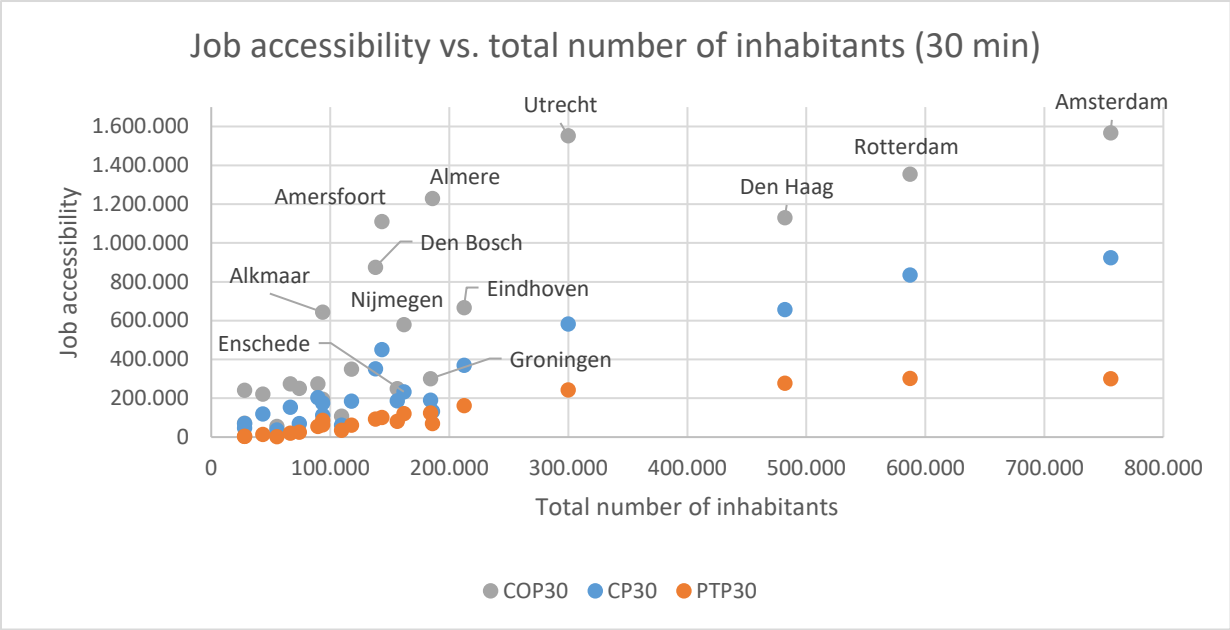
Chapter 4: Analysis

This chapter presents and interprets the results of the data analyses. All the analyses were conducted by using data on job accessibility provided by DAT.Mobility. The analyses have been conducted for the 22 municipalities named in the methodology chapter. The municipalities are located in three different zones in the Netherlands: the Randstad, the intermediary zone, and the periphery. Within the periphery, five municipalities located in shrinking regions were selected. The analyses analyse differences and similarities for the 22 municipalities itself and for the different zones they are located in. This is done by conducting general explorative analyses and analyses focused on describing the relationship between interregional residential relocation and job accessibility. The explorative analyses consist out of three elements. Firstly, the absolute numbers of job accessibility and total inhabitants per municipality are compared (4.1). Secondly, the relative numbers are considered. Differences in variety of job accessibility per municipality (4.2) and differences in job accessibility depending on travelling time varying from 30 till 45 minutes (4.3) are compared. Analyses focused on describing the relationship between interregional residential relocation and job accessibility consist out of two elements. The first analysis compares the level of job accessibility per postcode zone within a municipality to the number of inhabitants of the postcode zone (4.4). The second analysis examines whether there is a correlation between the rate of interregional residential relocation of a municipality and the level of job accessibility of the municipality (4.5). At last, conclusions based on the results of all the analyses are drawn (4.6).

4.1 Comparison of job accessibility and total inhabitants per municipality

The first analysis compares a municipality's job accessibility and the total number of inhabitants. There is a great variation in job accessibility per municipality which makes it hard to compare absolute numbers of job accessibility per municipality. However, by displaying a municipality's job accessibility in combination with its total number of inhabitants, patterns between the two variables can be found. Graph 1 shows the job accessibility in relation to the total number of inhabitants. This is done for three values of job accessibility within 30 minutes travelling time, namely: travelling by car during peak hours, travelling by car outside peak hours, and travelling by public transport during peak hours.

In general, the graph shows that as the total number of inhabitants rises, the job accessibility rises as well. This assumption suits best for job accessibility by public transport during peak hours and goes least for travelling by car outside peak hours. Exceptions to the general assumption can be explained by the spatial location of municipalities in which the inhabitants live. This is illustrated by two examples.



Graph 1: Job accessibility vs. total number of inhabitants

First, the job accessibility by car outside peak hours for around 300.000 inhabitants is higher than for 500.000 and 600.000 inhabitants. This can be explained by the spatial location of the municipality in which the inhabitants live. The municipality with 299.891 inhabitants is Utrecht. The municipalities with 481.864 and 587.134 are respectively Den Haag and Rotterdam. Utrecht is located in the centre of the Netherlands, Den Haag is located in the West of the Netherlands and has a natural border, the Noordzee, at its west side. It is likely to expect that this natural border is the explanation for the lower job accessibility of Den Haag in comparison to Utrecht, since no jobs are accessible in the west of Den Haag. This goes, in a lesser rate, for Rotterdam as well.

Second, the job accessibility for around 150.000 inhabitants differs very much. On the one hand, Amersfoort has 143.212 inhabitants and has 1.110.620 jobs accessible when travelling 30 minutes by car outside peak hours. In contrary, Enschede has around the same number of inhabitants (156.071), but only has 250.316 jobs accessible under the same circumstances. This is approximately a quarter of the amount of jobs which are accessible when travelling from Amersfoort. The difference in job accessibility can be explained for two reasons related to the spatial location of the municipalities. The first reason is that Amersfoort is located nearby the Randstad and thus has more accessible jobs in its proximity. Enschede is located in the periphery, in the East of the Netherlands and doesn't have this advantage. The central spatial location of Utrecht in comparison to Den Haag and Rotterdam is likely to have an influence on the differences in job accessibility between those municipalities as well. The second reason why differences in job accessibility between Enschede and Amersfoort might occur, is that Enschede is located nearby the border between the Netherlands and Germany. As only jobs within the Netherlands are taken into account for this research, the Dutch-German border has the same influence as the Noordzee: less jobs are accessible for municipalities which are located nearby one of these borders.

The same pattern can be recognized for Almere and Groningen. Almere has 185.746 inhabitants and the number of inhabitants of Groningen is 184.227. However, the former municipality has 1.230.014 jobs accessible within 30 minutes travelling time by car outside peak hours and the latter municipality only has 301.419. Again, Almere is located nearby the Randstad and Groningen is located in the periphery, in the North of the Netherlands. In addition to that, the job accessibility of

Groningen might be influenced by combination of the proximity of the border between the Netherlands and Germany and the nearness of the Noordzee.

When considering the results, three more assumptions can be made. Firstly, the job accessibility of municipalities located in the Randstad is highest and the job accessibility of municipalities in the shrinking regions is lowest. This can be explained by the spatial location of the municipalities as well. Secondly, more jobs are accessible when the car is used as mode for transportation in comparison to public transport. The dependence on destinations, travelling times, and routes set by the public transport system can be seen as an explanation for this. Secondly, job accessibility rises when one travels outside peak hours. This can be explained by congestion that occurs during peak hours. Due to congestion, mobility decreases and may negatively influence accessibility.

The assumptions made above also go for job accessibility within 45 minutes travelling time. The related graph can be found in attachment 1.

4.2 Comparison of highest and lowest values of job accessibility

The first analysis provided an insight in the relation between job accessibility and total number of inhabitants per municipality. This second analysis analyses the differences in lowest and highest number of job accessibility per municipality. However, these numbers are hard to compare since job accessibility per municipality differs. A difference of 100 jobs in job accessibility has a different meaning for a small municipality than for a big municipality. Therefore, this analysis analyses relative differences in job accessibility within municipalities and between municipalities.

The relative differences were compared by the coefficients of variation per municipality. The coefficients of variation express the deviation of the mean. The higher this coefficient is, the higher is the difference between the lowest value of job accessibility and the highest value of job accessibility within a municipality. The coefficients of variation per municipality are given in table 2 below. The results have also been displayed in graphs which can be found in attachment 2. The municipalities are ordered from highest number of inhabitants per municipality to lowest number of inhabitants per municipality.

	COP30	**COP45**	**CP30**	**CP45**	**PTP30**	**PTP45**
Amsterdam	12%	7%	16%	14%	31%	18%
Rotterdam	5%	10%	19%	8%	37%	26%
Den Haag	31%	11%	28%	14%	32%	17%
Utrecht	11%	4%	13%	11%	29%	32%
Eindhoven	12%	8%	19%	10%	23%	17%
Almere	15%	7%	28%	39%	31%	39%
Groningen	7%	9%	15%	11%	15%	11%
Nijmegen	11%	10%	27%	18%	22%	9%
Enschede	4%	8%	9%	10%	35%	15%
Amersfoort	12%	5%	16%	17%	34%	31%
Den Bosch	13%	8%	20%	10%	40%	24%
Zwolle	14%	12%	14%	12%	44%	23%
Emmen	23%	30%	25%	24%	130%	75%
Leeuwarden	16%	20%	19%	12%	12%	13%

Alkmaar	29%	10%	14%	11%	9%	15%
Heerlen	4%	5%	16%	23%	30%	20%
Lelystad	20%	11%	21%	12%	39%	30%
Assen	6%	10%	35%	11%	60%	40%
Terneuzen	37%	13%	7%	31%	79%	149%
Heerenveen	21%	8%	29%	5%	68%	64%
Veendam	7%	5%	14%	19%	55%	61%
Hulst	33%	15%	39%	31%	284%	242%

Table 2: Coefficients of variation per municipality

First, the coefficients of variation are interpreted per value of job accessibility. Starting with travelling by car outside peak hours, there can be seen that as travelling time increases the coefficient of variation decreases. The exceptions for this are Rotterdam, Groningen, Enschede, Emmen, Leeuwarden, Heerlen, and Assen. Except for Assen, these municipalities have a thing in common: they are located nearby a (natural) border. Groningen, Rotterdam, and Leeuwarden are located nearby the Noordzee. Enschede, Emmen, and Heerlen are located nearby the border between the Netherlands and Germany. These borders negatively influences job accessibility: less jobs are accessible for municipalities which are located nearby one of these borders. This means that as travelling time increases, the number of jobs which are accessible in these areas doesn't increase as well. Inhabitants living nearby the border profit less from the extension of travelling time than other inhabitants. This is the reason why the variation in highest and lowest value of job accessibility remains high or gets even higher in these municipalities. Assen is not as near to a border as the other municipalities are. Why the coefficient of variant of Assen increases as travelling time increases, remains unclear.

Second, the coefficients of variation of job accessibility by car during peak hours show a similar pattern compared to the coefficients of variation of job accessibility by car outside peak hours: as travelling time increases the coefficient of variation decreases. This time, Almere, Enschede, Amersfoort, Heerlen, Terneuzen, and Veendam are exceptions for this pattern. Enschede, Heerlen, and Veendam might differ from the pattern because of their proximity to the border between the Netherlands and Germany as stated above. Almere is located nearby Amersfoort, Amsterdam, and Utrecht. During peak hours it is hardly possible to reach those cities within 30 minutes. However, within 45 minutes travelling time some inhabitants might be able to reach those cities, but some are not. For this reason, high differences in job accessibility within 45 minutes travelling time during peak hours may occur. These differences don't occur outside peak hours, because the influence of congestion is low and more jobs are accessible within 30 minutes travelling time. The same explanation might go for Amersfoort and Terneuzen (located nearby Middelburg). But, since Amersfoort has a more central spatial location, the explanation is not as strong. This can be recognized by the smaller differences in job accessibility between 30 minutes and 45 minutes travelling time during peak hours in comparison to Almere and Terneuzen. Terneuzen shows the highest differences in job accessibility between 30 minutes and 45 minutes travelling time. Besides the proximity of Middelburg, the nearness of (natural) borders might be an explanation for this.

Overall, the coefficients of variation are higher for job accessibility by car during peak hours in comparison to job accessibility by car outside peak hours. This can be explained by the influence of congestion. In a situation without congestion, job accessibility would increase along with travelling

time. Because travelling time increases, jobs which were first not accessible within 30 minutes travelling time from particular location are now indeed accessible. This would mean that the coefficient of variation would decline, since the differences in job accessibility diminish. But, as congestion occurs, the influence of travelling time decreases. It is likely that less jobs are accessible during peak hours than outside peak hours. As a result, differences in job accessibility within 30 and 45 minutes travelling time during peak hours are not as high as those differences outside peak hours. Therefore, the coefficients of variation during peak hours remain high. Differences in job accessibility between 30 and 45 minutes travelling time are further analysed in the next paragraph (4.3).

Last, the coefficients of variation of job accessibility by public transport show a slight relation with the number of inhabitants of a municipality. Overall, the coefficients of variation decline as travelling time increases. Next to that, the coefficients of job accessibility by public transport are way higher than by car. This could be explained by the location of public transport stations. These stations are often located at places where there is a high population density. Because not everybody within a municipality is located nearby such a station, differences in job accessibility by public transport occur. Especially municipalities located in shrinking regions, in this case Emmen, Terneuzen, Hulst, and Veendam, have high coefficients of variation for job accessibility by public transport. Because public transport is often less developed in less populated areas than in areas with a high population density, the slight relation between the coefficients of variation of job accessibility by public transport and the number of inhabitants per municipality can be explained. That is, as the number of inhabitants per municipality decreases the coefficient of variation increases.

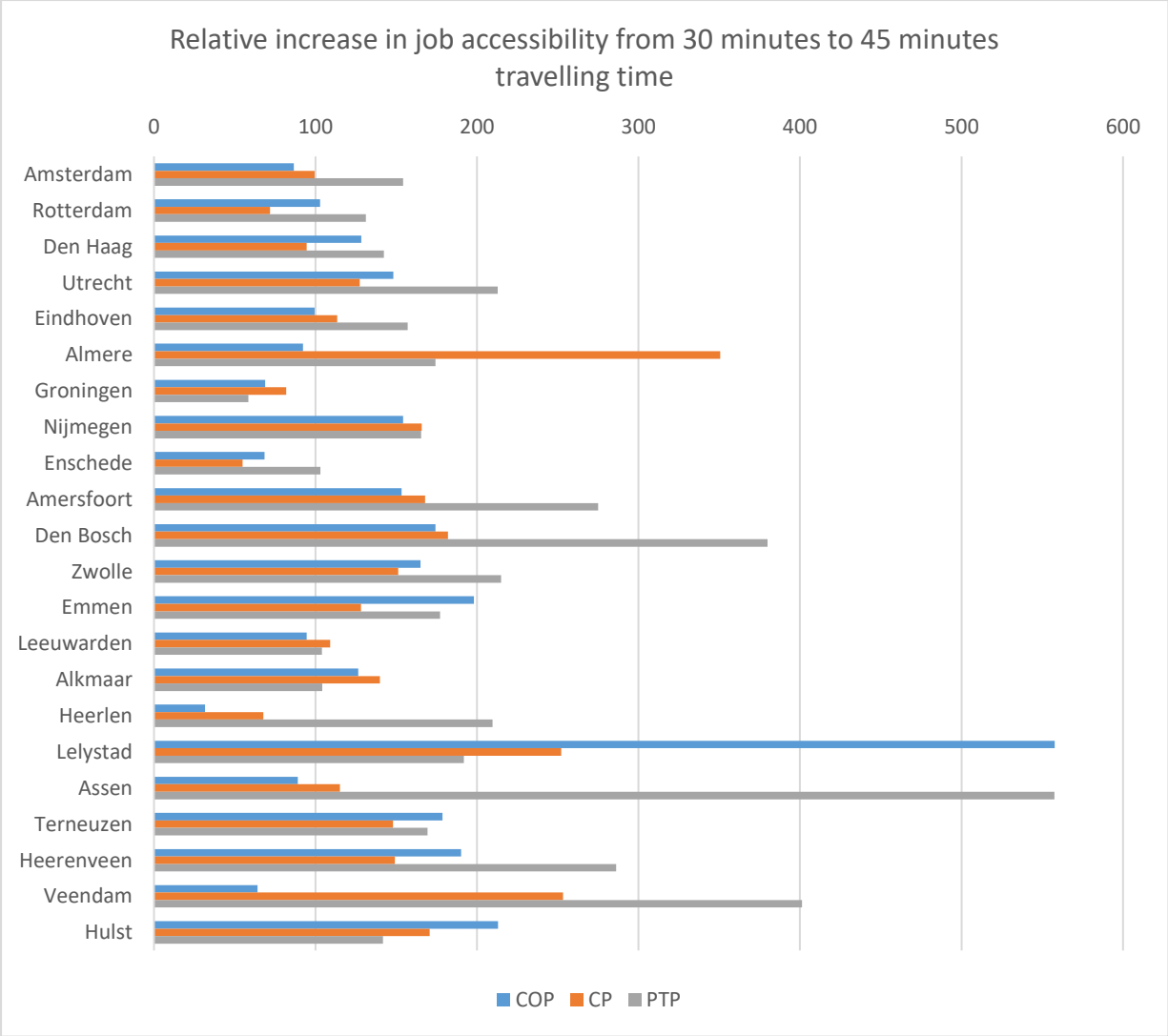
4.3 Comparison in job accessibility between 30 minutes and 45 minutes travelling time

The comparison of highest and lowest values of job accessibility already indicated that differences in job accessibility decrease as travelling time increases. This third analysis will further examine this by comparing relative differences in average job accessibility per travelling time for all municipalities.

The relative differences in average job accessibility were calculated using the average job accessibility of travelling by car within 45 minutes travelling time during peak hours as index number. All other averages have been indexed based on this number. The relative differences between 30 minutes and 45 minutes travelling time were estimated and these outcomes can be found in attachment 3. The outcomes are also visualised in graph 2. Graph 2 shows the relative increase in job accessibility from 30 minutes to 45 minutes travelling time. The municipalities are ordered from highest to lowest number of inhabitants.

In general, relative differences in job accessibility between 30 minutes and 45 minutes travelling time are highest by travelling with public transport. This might suggest that job accessibility by public transport is more influenced by travelling time in comparison to job accessibility by car. It is likely to expect that relatively few jobs can be reached within 30 minutes travelling time using public transport in comparison to travelling by car. However, as travelling time is extended by 15 minutes, the increase in job accessibility would be higher for travelling by public transport than by car.

Differences in travelling time during peak hours and outside peak hours don’t indicate a significant pattern. Next to that, there seems to be no relationship between the number of inhabitants of a municipality and the relative differences of job accessibility between 30 minutes and 45 minutes travelling time. Furthermore, municipalities located nearby the Randstad or other big cities profit most from the extension of travelling time by car. Two significant examples are Almere and Lelystad.



Graph 2: Relative increase in job accessibility from 30 minutes to 45 minutes travelling time

The graph shows that Almere profits most from the extension of travelling time by travelling by car during peak hours. This might be related to the explanation for differences in job accessibility between 30 minutes and 45 travelling time, given in the previous paragraph. If Amsterdam, Amersfoort and Utrecht can't be reached within 30 minutes travelling time during peak hour, but they can be reached within 45 minutes travelling time during peak hour, this would explain the high profit from extension of travelling time. In this case, the profit from extension of travelling time is higher during peak hours than outside peak hours. An explanation for this is the occurrence of congestion during peak hours. Due to congestion, less jobs are accessible within 30 minutes travelling time during peak hours than outside peak hours. Thus, within 30 minutes travelling time outside peak hours, more jobs can be reached. If more jobs can be reached within 30 minutes travelling time, the difference with the number of jobs which can be reached within 45 minutes travelling time becomes smaller and so will the profit from extension of travelling time.

The municipality which profits most from the extension of travelling time by travelling by car outside peak hours, is Lelystad. Lelystad is located nearby Almere, Amsterdam, Amersfoort, Utrecht, and

Zwolle. Its spatial location would be an explanation for the significant relative difference in job accessibility between 30 minutes and 45 minutes travelling time. Within 45 minutes travelling time during peak hours, most of the cities named above can't be reached. This also goes for 30 minutes travelling time outside peak hours. But, within 45 minutes travelling time outside peak hours, it is likely to expect that these destinations can be reached. As a result, Lelystad profits most from the extension of travelling time outside peak hours.

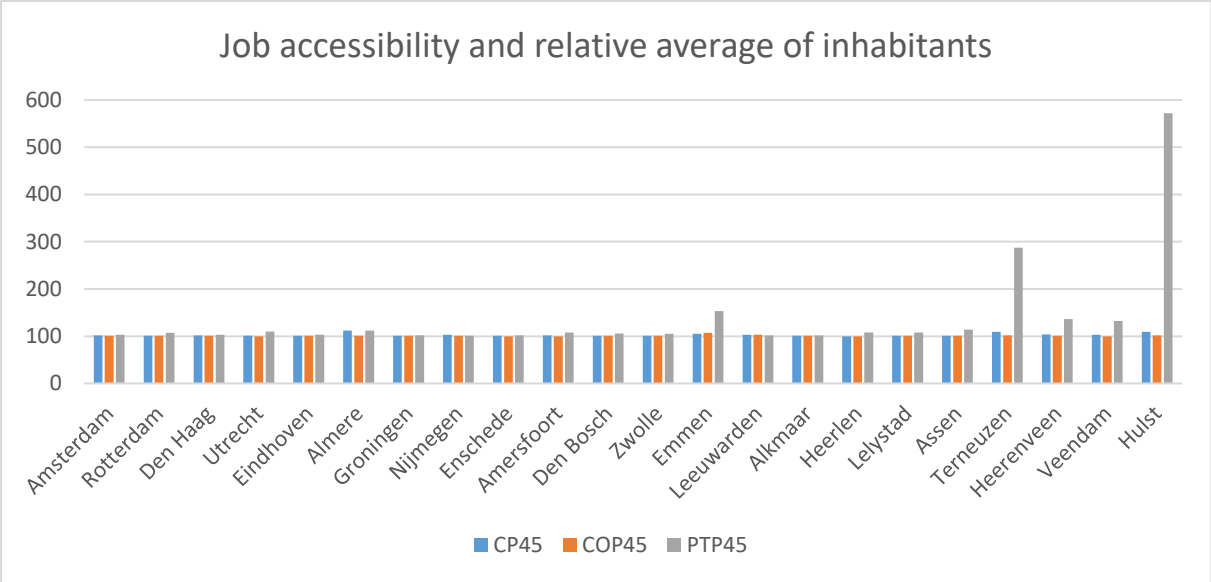
Municipalities with the smallest differences in relative increase in job accessibility from 30 minutes to 45 minutes travelling time are Groningen, Enschede, and Heerlen. These municipalities don't reveal pattern in total number of inhabitants and differences in relative increase in job accessibility from 30 minutes to 45 minutes travelling time. However, these municipalities do have two things in common: they are all located in the periphery and are all located nearby a (natural) border. As mentioned before, the proximity of a (natural) border has a negative effect on job accessibility and diminishes the influence of extension of travelling time. In addition to that, since Groningen, Enschede, and Heerlen aren't located nearby big cities such as Amsterdam, Utrecht, Rotterdam, and Den Haag, they profit less from an extension of travelling time in comparison to municipalities which are located nearby these cities.

4.4 Comparison of job accessibility and relative average inhabitants per postcode zone

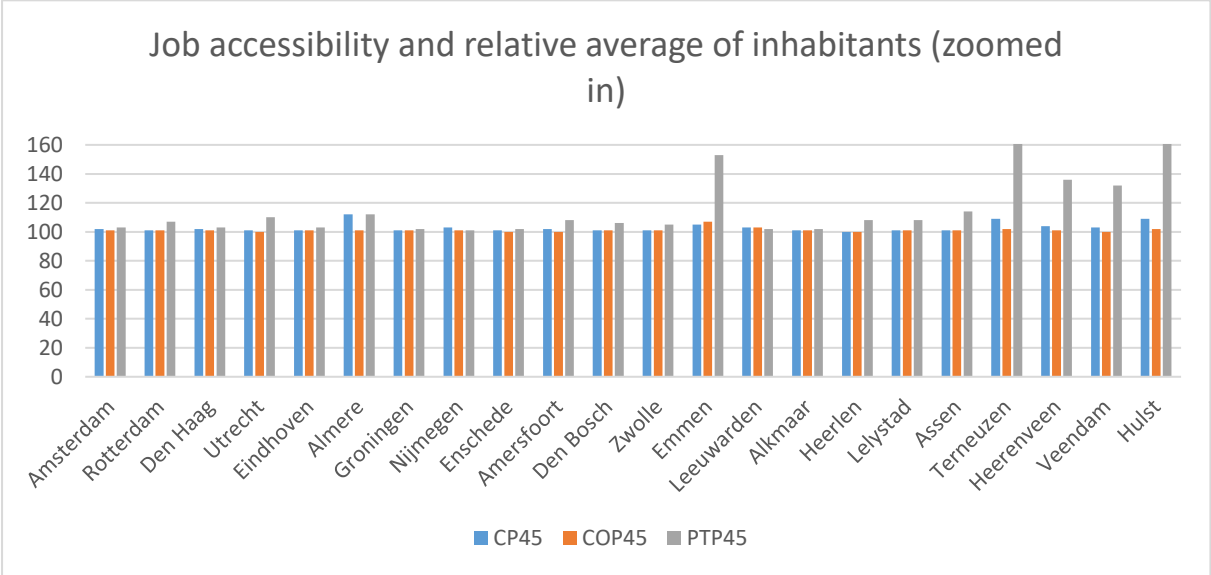
The former three analyses have focused on the similarities of and differences in job accessibility for all 22 municipalities. These analyses had an explorative character. This analysis is more related to the research question and provides a first insight in the relation between interregional residential relocation and job accessibility. According to theory from Feijten and Visser (2005), people move for work related motives. This would suggest that places with high job accessibility have more inhabitants than places with low job accessibility. However, theory of Rouwendal and Meijer (2001) suggests that this relationship isn't as strong as before and thus this wouldn't be the case.

The aim of this analysis is to find out if places with high job accessibility have a higher number of inhabitants than places with low job accessibility. The result of the analysis might give a suggestion about the relationship between interregional residential relocation and job accessibility. The analysis was conducted by using a method inspired by Grengs (2010) and also been used by Westerveld (2016).

According to the method, the job accessibility per postcode zone within a municipality and per value of job accessibility was indexed based on the average job accessibility of that municipality and value of job accessibility. The index number that came out was multiplied by the number of inhabitants of that post code zone and this was done for all postcode zones within the municipality. The outcomes were added up and divided by the total number of inhabitants of the municipality. The outcome resulted in a number that was around 100. An outcome higher than 100 would mean that within that municipality and value of job accessibility, more people live in postcode zones with a high job accessibility than the average number of people within that municipality. The outcome per municipality for 45 minutes travelling time can be found in attachment 3 and are also shown in graph 3 and 4 below.



Graph 3: Job accessibility and relative average of inhabitants



Graph 4: Job accessibility and relative average of inhabitants (zoomed in)

As can be seen in the graphs, there are no significant differences in average number of inhabitants in relation to job accessibility for travelling by car. Almere, Hulst and Terneuzen show the biggest differences. These differences vary from 11% (Almere) to 7% (Hulst & Terneuzen). For all three cases, relatively more inhabitants live in places with high job accessibility for travelling 45 minutes by car during peak hours than outside peak hours. A possible explanation for this, is that locations with high job accessibility during peak hours are more attractive places to live than locations with the same level of job accessibility outside peak hours. As most people travel to work during peak hours, the job accessibility during peak hours might be more relevant to them than the job accessibility outside peak hours.

Unlike job accessibility for travelling by car, job accessibility for travelling with public transport shows high differences. These differences can be explained by the same argument as indicated in paragraph 4.2: public transport stations are often located nearby locations with a high number of inhabitants.

Especially for municipalities located in or nearby shrinking regions, in this case Emmen, Hulst, Terneuzen, and Veendam, this effect is extra strong.

Similar results were found for 30 minutes travelling time (see attachment 3 and 4). Differences in average number of inhabitants in relation to job accessibility for travelling by car were slightly bigger than was the case for 45 minutes travelling time. Also, job accessibility by public transport showed slightly higher differences for 30 minutes travelling time compared to 45 minutes travelling time.

Overall, for both values (30 minutes and 45 minutes travelling time), all outcomes were higher than 100. However, mostly only a little higher than 100. For that reason, it is expected that the relationship between interregional residential relocation and job accessibility is weak. This relation will be examined in the last analysis.

4.5 Correlation between job accessibility and interregional residential relocation

The fifth and last analysis examines the relationship between job accessibility and interregional residential relocation. This is done by executing several correlation tests. The correlation tests examine whether a correlation between a municipality's job accessibility and rate of interregional residential relocation can be found, which direction the correlation coefficient has, and how strong the correlation is. This is done separately for all municipalities within the Randstad, the intermediary zone, the periphery, and shrinking regions and for all municipalities in general. The correlation tests seek for a correlation between every value of job accessibility within the Randstad, the intermediary zone, the periphery, shrinking regions, and all municipalities together and the rate of interregional residential relocation of those specific zones and in total.

The rate of interregional residential relocation per municipality is calculated by subtracting the number of people who left the municipality from the people who entered the municipality and dividing that number by the total number of that municipality's inhabitants. In addition to that, the rate of people moving in and moving out have been separately taken into account as well. These rates are calculated by dividing the number of people who moved into or moved out of the municipality by that municipality's total number of inhabitants and multiplying the outcome by 100. The results can be found in attachment 5.

The first correlation test which was executed sought for a correlation between the different values of job accessibility of municipalities located within the Randstad and the rate of interregional residential relocation, the rate of people moving into the municipalities located in the Randstad and the rate of people moving out of the municipalities located in Randstad. The municipalities located in the Randstad are Amersfoort, Amsterdam, Den Haag, Rotterdam, and Utrecht. The correlation test found two correlations between the job accessibility of 45 minutes travelling time by car outside peak hours and the rate of people moving into and out of the municipalities located in the Randstad (table 3 and attachment 6).

		Rate of interregional residential relocation	**Rate of people moving into the municipality**	**Rate of people moving out of the municipality**
COP 45	Pearson correlation (r)	,820	,976	,932
	Significance	,089	,004	,021

Table 3: Results correlation test Randstad

The results given in the table above show that the significance of the correlation found between job accessibility of 45 minutes travelling time outside peak hours and the rate of interregional residential relocation of municipalities located in the Randstad, is above 0,05 and thus not significant. The other two correlations found are both below the 0,05-significance level and are thus significant. The direction of the coefficient of correlation is in both cases positive and the strength of the correlation is in both cases strong to very strong. Even though both correlations found have a strong strength and are significant, they have little meaning when interpreting the results. Namely, the correlation between job accessibility and rate of people moving into the municipality means that as job accessibility rises, more people would move into that municipality. However, the other correlation indicates that as job accessibility rises, the more people would leave the municipality as well. Thus, it can be concluded that job accessibility has a positive influence on people moving into and moving out of the municipality. These influences are counteracting and that makes it understandable why no correlation between job accessibility and rate of interregional residential relocation was found.

The second correlation test which was executed sought for a correlation between the different values of job accessibility of municipalities located within the intermediary zone and the rate of interregional residential relocation, the rate of people moving into the municipalities located in the intermediary zone and the rate of people moving out of the municipalities located in the intermediary zone. The municipalities located in the intermediary zone are Alkmaar, Almere, Den Bosch, Eindhoven, Lelystad, and Nijmegen. Unlike the correlations found in the correlation test between job accessibility and interregional residential relocation in the Randstad, no correlations were found in the correlation test between job accessibility and interregional residential relocation in the intermediary zone. The results can be found in attachment 7.

The third correlation test sought for a correlation between the different values of job accessibility of municipalities located within the periphery and the rate of interregional residential relocation, the rate of people moving into the municipalities located in the periphery and the rate of people moving out of the municipalities located in the periphery. The municipalities located in the periphery are Assen, Enschede, Groningen, Heerenveen, Leeuwarden, and Zwolle. The correlation test found a correlation between job accessibility by travelling with public transport within 30 minutes travelling time during peak hours and the rate of interregional residential relocation of municipalities located in the periphery. The results are given in table 4 below and in attachment 8.

		Rate of interregional residential relocation
PTP30	Pearson correlation (r)	-,858
	Significance	,029

Table 4: Results correlation test periphery

The direction of the correlation found is negative and its strength is strong to very strong. This means that as job accessibility by public transport within 30 minutes travelling time within municipalities of the periphery rises, the rate of interregional residential relocation within municipalities of the periphery decreases. Thus, as accessibility increases, the number of people moving towards it decreases. This is in contrast with this research' expectations and an explanation for this result is unclear.

The fourth correlation test sought for a correlation between the different values of job accessibility of municipalities located within shrinking regions and the rate of interregional residential relocation,

the rate of people moving into the municipalities located in shrinking regions and the rate of people moving out of the municipalities located in shrinking regions. The municipalities located in shrinking regions are Emmen, Heerlen, Hust, Veendam, and Terneuzen. The correlation test has found four correlations, namely between the job accessibility of 30 minutes travelling time by car outside peak hours and the rate of people moving into and out of the municipalities located in shrinking regions, and between the job accessibility of 45 minutes travelling time by car during peak hours and the rate of people moving into and out of the municipalities located in the Randstad. The results are given in table 5 below and in attachment 9.

		Rate of interregional residential relocation	**Rate of people moving into the municipality**	**Rate of people moving out of the municipality**
COP 30	Pearson correlation (r)	-,720	,993	,995
	Significance	,170	,001	,000
CP 45	Pearson correlation (r)	-,824	,967	,985
	Significance	,086	,007	,002

Table 5: Results correlation test shrinking regions

The results are similar to the correlations found in the correlation test between job accessibility and interregional residential relocation of the Randstad. All correlations have a positive direction and have a very strong strength. However, they counteract each other and thus the results have little meaning.

The last correlation test which was executed sought for the same correlations as the correlation tests done before, only this correlation test took all the municipalities into account instead of only the municipalities located in a specific zone. The correlation test indicated that no correlations between job accessibility, the rate of interregional residential relocation of a municipality, and the rate of people moving into and moving out of the municipality were found. The results of the correlation test can be found in attachment 10.

The former analysis already predicted that a very weak relationship between interregional residential relocation and job accessibility might be found. It turns out that no correlations at all were found between job accessibility and the rate of interregional residential relocation of a municipality for all six values of job accessibility. Based on the theoretical framework, explanations for this are indicated.

Zooming in on the rate of interregional residential relocation (attachment 5), there can be seen that Assen is the municipality with the highest rate of interregional residential relocation and Alkmaar has the lowest rate of interregional residential relocation. No patterns of total number of inhabitants per municipality and rate of interregional residential relocation can be found. It was expected for municipalities located in the periphery and shrinking regions to have a low rate of interregional residential relocation. This expectation turns out to be wrong, as Heerlen, Terneuzen and Enschede have a higher interregional residential relocation rate than Den Haag and Hulst and Veendam have a higher interregional residential relocation rate than Nijmegen and Den Bosch.

According to theory, interregional residential relocation is mostly related to work related and education related motives (Feijten & Visser, 2005). Young adults often move to more urbanised areas

in their pursuit for new opportunities in jobs or education. In relation to this, Fielding indicated the escalator effect: young adults moving towards the city for work or education and leaving the city by the time they want to start a family. If this is the case, the rate of interregional residential relocation of a municipality will remain low even though people move towards that municipality for job related motives. So, the escalator effect might be of influence on the results. However, Kooiman (2016) indicated a trend where young adults stay in the city and not return to their hometown. This would suggest that the escalator effect is diminishing and that the rate of interregional residential relocation of municipalities with high job accessibility or municipalities where a university is located is high. But, since the rates of interregional residential relocation show that this is not the case (for example in Groningen, Eindhoven, Nijmegen), it might be suggested that the trend observed by Kooiman (2016) wasn't as influencing in 2008 as it is now.

Overall, it should be noted the influence of universities located in municipalities isn't taken into account in this research. However, this might be influencing the rate of interregional residential relocation of a municipality as educational motives are indicated as motives for interregional residential relocation (Feijten & Visser, 2005). The influence of universities on the rate of interregional residential relocation in universities would therefore be an interesting subject for further research.

Another explanation based on the theoretical framework, is that the number of elderly which are moving hasn't increased that much yet. De Jong et al. (2015) observe a trend where the retired baby boom generation moves more than the former generation of elderly and the baby boom generation mainly moves from less urbanised areas towards more urbanised areas. This would suggest as well that the rate of interregional residential relocation in urbanised areas as the Randstad is high and in less urbanised areas as the periphery is low. However, this trend might not be influencing that much yet. In addition, a numerous group of elderly prefer less urbanised regions above more urbanised regions. This will result in a high interregional residential relocation rate for municipalities located in periphery region and a low interregional residential relocation rate for municipalities located nearby the Randstad. Unfortunately, no data was available within the given time for examining the movements of elderly. This might be a subject for further research as well.

The last explanation has already been indicated and can be seen as the most logic explanation for the lack of correlation between job accessibility and the rate of interregional residential relocation per municipality. This explanation has been given by Rouwendal and Meijer (2001) who state that job related motives for interregional residential relocation are nowadays less significant than in the past. Reasons for this are distortions in the housing market, the increased flexibility of the housing market, the increase of two incomes per household, and the diminishing influence of monetary and time costs for travelling to work.

4.6 Conclusion

Five analyses have been conducted and the most important results are described in this paragraph. The results are used to answer the research question. This is done in the next chapter.

The first analysis which was conducted was the comparison of job accessibility and total number of inhabitants per municipality. It was expected that the average of job accessibility would raise as the total number of inhabitants of the municipality would raise as well. This turned out to be true, especially for the job accessibility by using public transport. Some municipalities showed deviations from this main expectation. These deviations could be explained by the spatial location of the

municipalities. Another expectation that was supported by this analysis, was that the job accessibility of public transport was lower than the job accessibility by car.

The second analysis compared the highest and lowest values of job accessibility by using the coefficient of variation. The higher this coefficient, the higher the differences in highest and lowest values of job accessibility. It was expected that the biggest differences in highest and lowest values of job accessibility would occur in municipalities with a high number of total inhabitants. This expectation was not supported by the results of the analysis. No patterns in differences in highest and lowest values of job accessibility and total number of inhabitants could be indicated, except for a slight relationship between job accessibility by public transport and the number of inhabitants per municipality. This could be explained by the location of public transport stations. A second expectation was that differences in highest and lowest value of job accessibility would diminish as travelling time increased. This expectation was supported by the results. There were a few exceptions for this expectation, but these could be explained by their spatial location as well.

The third analysis compared differences in job accessibility for 30 minutes and 45 minutes travelling time. There were three expectations for the outcomes. These included the expectations that differences in job accessibility between 30 minutes and 45 minutes travelling time were higher outside peak hours than during peak hours, were higher for municipalities located nearby big cities than municipalities which are not, and were higher for municipalities with a high number of inhabitants than for municipalities with a low number of inhabitants. Only the expectation that differences in job accessibility between 30 minutes and 45 minutes travelling time were higher for municipalities located nearby big cities than municipalities which are not could be accepted. This was mainly the case for Almere and Lelystad. Furthermore, the analysis indicated that differences between 30 minutes and 45 minutes travelling time were highest for travelling by public transport.

The fourth analysis compared the relative average number of inhabitants to the job accessibility per postcode zone. The aim of this analysis was to indicate whether locations with a high job accessibility had more inhabitants than locations with a low job accessibility. The results could be used to predict the outcome of the last analysis. The expectation was that postcode zones with high job accessibility would have a higher number of inhabitants than the average number of inhabitants per postcode zone. This expectation was mostly supported by job accessibility by public transport. Overall, all results indicated that postcode zones with high job accessibility had relatively more inhabitants than postcode zones with low job accessibility. However, the relation between job accessibility and relative average of inhabitants was little. Therefore, it might be expected that locations with high job accessibility are only slightly more attractive places to live than places with low job accessibility. For this reason, a very weak correlation between job accessibility and interregional residential relocation was expected to be found in the next analysis.

The last analysis which was conducted consisted out of a series correlation tests between all values of job accessibility of all municipalities and specific zones, the rate of interregional residential relocation of a municipality, and the rate of people moving into and out of the municipality. Based on the former analysis, it was expected that a very weak correlation between the values of job accessibility and interregional residential relocation would be found. However, in case of the periphery a strong, negative correlation between job accessibility by public transport within 30 minutes travelling time during peak hours and interregional residential relocation was found. This was in contrast with this research' expectations and no explanations for this result could be given. At last, the general correlation test between job accessibility and interregional residential relocation of all municipalities found no correlations. This was somewhat in line with the expectations. The results

were used to formulate an answer to the research question. This answer to the research question can be found in the next chapter.

Chapter 5: Conclusion

The last chapter of this research describes the conclusions which were drawn based on this research. This is done by taking the research objective into account and formulating an answer to the research question (5.1). Afterwards, a reflection on this research is given by describing the choices made for this research and indicating points of weakness and of strength of this research (5.2). At last, recommendations for further research are done (5.3).

5.1 Conclusions

The objective of this research was to provide insights in job accessibility and its relationship with interregional residential relocation in the Netherlands in order to make recommendations to policy makers focused on attracting people towards shrinking regions. This has been done by carrying out a quantitative research which conducted three analyses for providing insights in job accessibility in the Netherlands and two analyses focused on the relationship between job accessibility and interregional residential relocation. The results of the five analyses were used to formulate an answer to the research question:

To what extent do insights in job accessibility and its relation to interregional residential relocation indicate that investing in job accessibility is an effective way to attract people towards municipalities?

The theoretical framework indicated that accessibility is a concept that is hard to define, because it exists out of four components (Geurs & Van Wee, 2004). This research took the land use component, transport component, and temporal component of accessibility into account by defining job accessibility as: “the number of jobs that can be reached from a certain postcode zone within a given travelling time using a particular mode of transportation”. The company DAT.Mobility provided data on job accessibility which was needed for this research for six different values of job accessibility:

- Transport by car within 30 minutes travelling time outside peak hours
- Transport by car within 45 minutes travelling time outside peak hours
- Transport by car within 30 minutes travelling time during peak hours
- Transport by car within 45 minutes travelling time during peak hours
- Transport by public transport within 30 minutes travelling time during peak hours
- Transport by public transport within 45 minutes travelling time during peak hours

The data on job accessibility was available for the 22 municipalities which were examined in this research. These municipalities were located in three different zones in the Netherlands: the Randstad, the intermediary zone, and the periphery. Within the periphery, five municipalities located in a shrinking region were examined. Job accessibility for the 22 different municipalities and for the six different values of job accessibility have been compared and patterns related to job accessibility were sought. This was done by conducting three explorative analyses which contributed to formulating an answer to the first part of the research question: what are the insights in job accessibility in the Netherlands?

The first analysis which has been done compared the differences in job accessibility related to the total number of inhabitants per municipality. The analysis showed that job accessibility rises as the total number of inhabitants per municipality increases. This is especially the case for job accessibility by public transport. The relationship between job accessibility and total number of inhabitants per municipality was weaker for job accessibility by car. Especially the difference in job accessibility between Utrecht and Den Haag and Rotterdam was remarkable. Den Haag and Rotterdam have around 150.000 to 300.00 more inhabitants than Utrecht, but still have lower job accessibility. A possible explanation for this is the spatial location of Den Haag and Rotterdam near the Noordzee, a natural border for job accessibility, and Utrecht's central spatial location. Other deviations from the relationship between job accessibility and total number of inhabitants per municipality can also be explained by the spatial location of municipalities. Municipalities located nearby the Randstad or other big cities, have a relatively high job accessibility compared to similar municipalities located further away from these big cities or the Randstad. Municipalities located nearby the border between the Netherlands and Germany are affected by the negative influence of this border on job accessibility. Since this research only takes jobs located in the Netherlands into account, the Dutch-German border has the same influence as the Noordzee: less jobs are accessible for municipalities which are located nearby one of these borders.

The first analysis also showed that job accessibility in the Randstad is highest and job accessibility in shrinking regions is lowest. Furthermore, job accessibility by car is way higher than job accessibility by public transport. Also, the number of jobs which are accessible rises when the period of travelling is outside peak hours. This could be explained by the negative influence of congestion on mobility and eventually on accessibility.

The influence of congestion might also explain why differences in highest and lowest values of job accessibility are higher for job accessibility by car during peak hours than outside peak hours. This is part of the second analysis. As congestion occurs, the effect of the extension of travelling time from 30 minutes to 45 minutes diminishes. Whereas in a situation without congestion 15 minutes extra travelling time would result in being able to reach more jobs, in a situation where congestion occurs not as much jobs can be reached within these 15 minutes. The differences in travelling time have been further examined in the third analysis.

The aim of the second analysis was to compare differences in highest and lowest values of job accessibility. This has been done by comparing the coefficients of variation per municipality and per value of job accessibility. The coefficient of variation can be calculated by dividing the standard deviation by the mean. The outcome, the coefficient of variation, shows the average deviation of the mean. The higher this number is, the bigger are the differences between highest value and lowest value of job accessibility.

By comparing the coefficients of variation of the municipalities per value of job accessibility, several patterns were indicated. In general, the coefficient of variation would diminish as travelling time would increase. This is the case for both modes of transportation and both periods of travel. However, the difference in coefficient of variation between 30 minutes and 45 minutes travelling time is smaller for travelling by car during peak hours than outside peak hours. This was explained by the influence of congestion. For some municipalities, the difference between highest value and lowest value of job accessibility between 30 minutes and 45 minutes travelling time decreases more than other municipalities. This was explained by the spatial location of the municipalities. Municipalities which are located near a (natural) border and in the periphery, like Emmen, Enschede, and Groningen, don't profit as much of the extension of travelling time as Utrecht and Alkmaar.

Relatively less jobs are available for the former municipalities within 45 minutes travelling time and therefore differences in highest and lowest values of job accessibility won't diminish.

Another observation from this analysis are the coefficients of variation of public transport are higher in comparison to coefficients of variation of transport by car. This is explained by the spatial location of public transport stations. These stations are often located nearby places with a high population density so many people are able to use the stations. Locations nearby these public transport stations have a higher value of job accessibility than locations located further away from these locations. This would explain the big differences in highest and lowest values of job accessibility for public transport.

The third analysis compared the differences in job accessibility between 30 minutes and 45 minutes travelling time. The former analysis already indicated that some municipalities profit less of this extension of travelling time than others. To compare the differences in job accessibility between 30 minutes and 45 minutes travelling time, the values of job accessibility were indexed on the value of job accessibility by car within 45 minutes travelling time during peak hour. This value of job accessibility was chosen as index number, because this was seen as the most often used mode, period, and time of transportation (CBS, 2016; CBS, 2016).

Differences in job accessibility between 30 minutes and 45 minutes travelling time were biggest for job accessibility by public transport. An explanation for this is that within 30 minutes travelling time per car already a large number of jobs can be reached. The extension of travelling time with 15 minutes doesn't have the same influence as is the case for public transport. Using public transport, it is likely that less jobs can be reached within 30 minutes travelling time than by car. But, by extending the travelling time by 15 minutes, the increase in jobs which can be reached is bigger than the increase of jobs that can be reached by car.

The two municipalities which profit most from extending travelling time from 30 to 45 minutes, are Almere during peak hours and Lelystad outside peak hours. Both municipalities are located in Flevoland and nearby each other, but Almere is nearer the Randstad than Lelystad is. However, it is likely to expect that both municipalities profit from the presence of the Randstad. In this case, it is expected that differences in job accessibility between 30 minutes and 45 minutes travelling time are caused by the distance between the municipalities and the Randstad. As the Randstad can't be reached within 30 minutes travelling time but can be reached within 45 minutes travelling time, this would cause great differences in job accessibility between both travelling times. Municipalities which aren't located near big cities, don't profit as much of the extension of travelling time as municipalities which are located near those cities. This is especially the case for municipalities which are located in periphery regions as Groningen, Enschede, Leeuwarden, and Heerlen.

In general, it is expected that job accessibility is mostly influenced by a municipality's spatial location in relation to the proximity of (natural) borders and/or cities and by the occurrence of congestion. This occurrence of congestion is related to the impedance factor of accessibility as mentioned by Handy (2005) or the transport component as mentioned by Geurs and Van Wee (2004). Based on the three analysis which examined job accessibility for the 22 municipalities, the following insights were provided:

- Job accessibility rises as the total number of inhabitants per municipality increases
- Job accessibility by car is higher than job accessibility by public transport
- Job accessibility is higher outside peak hours than during peak hours

- Differences in highest and lowest value of job accessibility diminish as travelling time is extended from 30 minutes to 45 minutes. This occurs in a lesser rate for job accessibility during peak hours
- Differences in highest and lowest value of job accessibility are bigger for job accessibility by public transport than by car
- Municipalities located nearby the Randstad or other big cities profit more from the extension of travelling time in comparison to municipalities which aren't located nearby the Randstad or other big cities

The fourth and fifth analysis were both conducted to provide insights in the relationship between job accessibility and interregional residential relocation. The analyses were used to formulate an answer to the second part of the research question: what are the insights in the relationship between job accessibility and interregional residential relocation?

The fourth analysis compared job accessibility to the relative average of inhabitants per postcode zone. The purpose of this analysis was to find out whether postcode zones with high job accessibility had a total number of inhabitants higher than the average number of inhabitants per postcode zone. If this was the case, this would mean that postcode zones with high job accessibility would be more attractive locations to move to than postcode zones with low job accessibility. Results of this analysis are used to make predictions for the fifth analysis which will examine the relationship between job accessibility and interregional residential relocation.

The analysis was conducted by indexing job accessibility per postcode zone within a municipality and per value of job accessibility based on the average job accessibility of that municipality and value of job accessibility. The index number that came out was multiplied by the number of inhabitants of that post code zone and this was done for all postcode zones within the municipality. The outcomes were all added up and divided by the total number of inhabitants of the municipality. The outcome resulted in a number that was around 100. An outcome above 100 would mean that within the municipality and value of job accessibility, more people live in postcode zones with a high job accessibility than the average number of people within that municipality.

All outcomes of the analysis were above 100. However, for job accessibility by car the outcomes were only slightly above 100. For job accessibility by public transport, there were big differences in the outcomes. Most outcomes were around 100 as well, except for the outcomes of Emmen, Heerenveen, Hulst, Terneuzen, and Veendam for 30 minutes and 45 minutes travelling time, and Zwolle for 45 minutes travelling time. These municipalites have in common that they are located in periphery regions and have a relatively low number of total inhabitants per municipality. As public transport stations are often located nearby locations with high population density and this effect is stronger for municipalities with a low number of inhabitants compared to municipalities with a high number of inhabitants, this is a logic outcome.

Because the outcomes, except for public transport in periphery regions, were only slightly above 100, it was concluded that locations with high job accessibility have just a little higher number of inhabitants than the average number of inhabitants for that location. This might indicate that the relation between interregional residential relocation and job accessibility is very weak. Namely, if people would move for job related reasons, the outcomes would have been higher than they are in this case.

To examine the relationship between job accessibility and interregional residential relocation, several correlation tests were executed for the fifth analysis. These correlation test sought for a correlation

between job accessibility and the rate of interregional residential relocation per municipality, the rate of people moving into a municipality and the rate of people moving out of a municipality. This was done separately for municipalities located in the Randstad, the intermediary zone, the periphery, and shrinking regions and for all municipalities together.

The rate of interregional residential relocation was calculated by subtracting the number of people who left the municipality from the number of people who entered the municipality and dividing the outcome by the total number of inhabitants of the municipality. The rate of people moving into and moving out of the municipality was calculated by dividing the number of people moving into or moving out of the municipality by the municipality's total number of inhabitants and multiplying the outcome by 100.

The correlation tests for the Randstad and shrinking regions showed three similar results: three times a correlation was found between job accessibility and the rate of people moving into and out of a municipality. These correlations had a positive direction and a strong strength. However, when interpreting these results, the results turn out to have little meaning. The two correlations should be interpreted as follows: firstly, as the job accessibility of a municipality rises, the rate of people moving into the municipality rises as well. Secondly, as the job accessibility of a municipality rises, the rate of people moving out of the municipality rises as well. These results counteract each other and therefore have little value when examining the relationship between job accessibility and interregional residential relocation.

A correlation that was found and was suitable for examining the relationship between job accessibility and interregional residential relocation, was the correlation between job accessibility by travelling with public transport within 30 minutes travelling time during peak hours and the rate of interregional residential relocation of municipalities located in the periphery. However, the correlation differed from the expectations of this research. Namely, the correlation had a negative direction, meaning that as job accessibility by public transport decreases, the rate of interregional residential relocation in a municipality located in the periphery rises. This result was in contrast with this research' main expectation that the rate of interregional residential relocation would rise as job accessibility would rise as well. An explanation for this unexpected result can't be given.

The last correlation test sought for correlations between job accessibility and the rate of interregional residential relocation for all six values of job accessibility, the rate of people moving into a municipality and the rate of people moving out of a municipality for all municipalities in total. The outcomes of the correlation tests revealed that no correlations were found. Thus, the insights in the relationship between job accessibility and interregional residential relocation indicate that there is no correlation between the two, except for job accessibility by travelling with public transport within 30 minutes travelling time during peak hours and the rate of interregional residential relocation in the periphery. This outcome was not predicted and an explanation for this outcome is missing. The lack of correlation between job accessibility and interregional residential relocation for all municipalities wasn't an expected outcome neither, even though only a very weak correlation was expected to be found. The outcome of this correlation test can be explained by several reasons.

First, as educational related motives are indicated by Feijten & Visser (2005) as motives for interregional residential relocation as well, it is likely that interregional residential relocation is also influenced by the presence of universities in a municipality. In addition to this, the escalator effect of Fielding is indicated as an influence on interregional residential relocation too. That is, young adults move towards more urbanized regions for job related or education related motives, but leave these regions as well when they want to start a family. The influence of the escalator effect on a

municipality's rate of interregional residential relocation is that it will remain low, even though people do move towards that municipality for job related reasons. However, both the influence of universities and the influence of the escalator effect have not been taken into account in this research. This might explain the lack of correlation between job accessibility and interregional residential relocation of the municipalities.

Second, interregional residential relocation by elderly is motivated for different reasons than job related motives or educational related motives. De Jong et al. (2015) indicate a trend where the retired baby boom generation moves more and moves to different destinations than the former generation of elderly. These influences aren't taken into account. However, it should be noted that even if these influences were taken into account, the influence would be very little since the rate of elderly moving interregional is very low.

The last explanation for the lack of correlation between job accessibility and interregional residential relocation is that job accessibility and interregional residential relocation aren't related that much as before. This would be due to distortions in the housing market, the increased flexibility of the housing market, the increase of two incomes per household, and the diminishing influence of monetary and time costs for travelling to work (Rouwendal & Meijer, 2001). This explanation, in combination with the disregarded influences of universities and the escalator effect, is the most likely explanation for the lack of correlation between job accessibility and interregional residential relocation.

With these insights, an answer to the research question can be formulated. This answer is formulated as follows:

The insights in job accessibility and its relation to interregional residential relocation indicate that investing in job accessibility is not an effective way to attract people towards municipalities. This is based on the results of the analyses which indicated that there is no positive correlation between job accessibility and interregional residential relocation. As the results indicate that people do not tend to move for job related motives, it is questionable if investing in job accessibility in shrinking regions leads to the desired effect, namely attracting people towards those regions. However, it should be noted that influences on interregional residential relocation, other than job accessibility, have not been taken into account. Therefore, further research on this topic is recommended and this is discussed in paragraph 5.3.

5.2 Reflection

This research has examined job accessibility and its relationship with interregional residential relocation in the Netherlands. This has been done by comparing data on job accessibility and interregional residential relocation per municipality and per zone in which the municipalities were located. The data on job accessibility that has been used has been provided by the company DAT.Mobility and data on interregional residential relocation came from CBS. The advantage of these sources is that they are both reliable therefore the data is reliable as well. The only disadvantage of the used data, is that the data was not recent. Unfortunately, there was no recent data on job accessibility available and the data used came from 2008. Nevertheless, the data could still be used for conducting the analyses and it might be interesting to compare the used data with new data on job accessibility in relation to interregional residential relocation in the future.

For conducting these analyses, several choices were made. One of these choices was the selection of municipalities to be examined. This choice was made based on the spatial location of the municipalities regarding the province and the zone in which they were located. This way, the

research takes different sorts of municipalities into account and differences and similarities between the municipalities could be indicated. However, other characteristics, besides total number of inhabitants per municipality, weren't taken into account. The disregarded influence of universities and the escalator effect have already been mentioned in the conclusion. Since this research mainly focused on job accessibility, the influence of universities and the escalator effect have been neglected even though the influence might be significant. Other characteristics of municipalities which may influence residential relocation, like housing prices, the living environment, and level of urbanization, have not been taken into account as well. This raises the question if different results would have come out of the analyses if these influences were not disregarded.

Last, this research has chosen for a series of correlation tests to examine the relation between job accessibility and interregional residential relocation. The choice for a correlation test was based on the availability of data. As only data was available on interregional residential relocation in general, and not specified to flows of movement, places of origin and places of destination couldn't be compared. If the job accessibility of these places could be compared, a better view on interregional residential relocation in relation to job accessibility could be given. Zooming in on flows of interregional residential relocation would therefore be an interesting subject for further research. This will be specified in the next paragraph.

5.3 Recommendations for further research

The former paragraph already indicated some recommendations for further research. For example, to take into account the influences of universities, the escalator effect, and other characteristics of a municipality as the living environment and housing prices. This could also be done by examining municipalities which are more alike. For example, only examine the relationship between job accessibility and interregional residential relocation for municipalities located in shrinking regions. Another recommendation would be to use data which is more up to date than data that has been used for this research. It is possible that the same analyses provide different insights by using relatively new data.

The most important recommendation for further research would be to examine flows of migration between municipalities and compare these with the municipalities' job accessibility. Comparing the job accessibility of the municipality of origin to the municipality of destination would give a better insight in the relationship between job accessibility and interregional residential relocation than has been provided now. The number of people moving into and moving out of a municipality provides less information than knowing where these people came from and where these people move to. It would be even better to combine this with a qualitative research which examines the motivations for people to move. This way, influences other than job accessibility can be taken into account as well.

References

1. Abramsson, M. & Andersson, E. (2012). Residential mobility patterns of elderly. Leaving the house for an apartment. *Hous Stud 27(5)*, 582–604.
2. Bock, B., Schouten, B., Eikenaar, E., Kramer, J., Van Der Maas, H., & Prevoo, D. (2017, March 14). Kloof tussen Randstad en Randland wordt steeds dieper. Retrieved from http://www.volkskrant.nl/opinie/kloof-tussen-randstad-en-randland-wordt-steeds-dieper~a4473841/.
3. Bertolini, L., Le Clercq, F., & Kapoen, L. (2005). Sustainable accessibility: a conceptual framework to integrate transport and land use plan-making. Two test-applications in the Netherlands and a reflection on the way forward. https://doi.org/10.1016/j.tranpol.2005.01.006.
4. Broek, L. van den, Jong, A. de, Duin, C. van, Huis, M. van, Boschman, S., & Agtmaal-Wobma, E. van (2008). Regionale bevolkings-, allochtonen- en huishoudensprognose 2007-2025. Retrieved from http://www.rivm.nl/bibliotheek/digitaaldepot/20081111_prognoses_20072025.pdf
5. Bureauvijftig. (2015). Woonmonitor 2015: landelijk onderzoek naar wensen en behoeften van ouderen ten aanzien van wonen. Utrecht: Bureauvijftig.
6. CBS. (2016, June 23). Hoogopgeleide man maakt de meeste woon-werkkilometers. Retrieved from https://www.cbs.nl/nl-nl/nieuws/2016/25/hoogopgeleide-man-maakt-de-meeste-woon-werkkilometers.
7. CBS. (2016, September 12). PBL/CBS prognose: Groei steden zet door. Retrieved from https://www.cbs.nl/nl-nl/nieuws/2016/37/pbl-cbs-prognose-groei-steden-zet-door.
8. Clark, W. A. V., & Dieleman, F. M. (1996). *Households and housing: Choice and outcomes in the housing market.* New Brunswick, N.J: Center for Urban Policy Research.
9. Compendium voor de Leefomgeving. (2016, September 13). Verhuizingen, 2015. Retrieved from http://www.clo.nl/indicatoren/nl2112-verhuizingen.
10. Dam, F. van, Groot, C. de, & Verwest, F. (2006). Krimp en ruimte. Bevolkingsafname, ruimtelijke gevolgen en beleid. Retrieved from http://www.rivm.nl/bibliotheek/digitaaldepot/Krimp_en_ruimte.pdf.
11. DaVanzo, J. (1981). Repeat migration, information costs and location-specific capital. *Popul Environ 4(1),* 45-73.
12. Dijst, M.J., Geurs, K.T. & van Wee, B. (2002). *Bereikbaarheid: perspectieven, indicatoren en toepassingen. Verkeer en vervoer in hoofdlijnen*. Bussum: Coutinho, p155-174.
13. Doorn, P. K., Rhebergen, M. P., & Touwen, L. J. (2006). Statistiek voor Historici. Retrieved from http://www.let.leidenuniv.nl/history/RES/stat/html/les7.html#varc.
14. Feijten, P., & Visser, P. (2005). Binnenlandse migratie: verhuismotieven en verhuisafstand. *Bevolkingstrends, Centraal Bureau Voor de Statistiek*, (2e kwartaal), 75–81.
15. Fokkema, C. M. (1996). *Residential moving behaviour of the elderly: an explanatory analysis for the Netherlands*, Dissertation. VU University Amsterdam.
16. Geurs, K. T., & Van Wee, B. (2004). Accessibility evaluation of land-use and transport strategies: review and research directions. *Journal of Transport Geography*, 12, 127–140. https://doi.org/10.1016/j.jtrangeo.2003.10.005.
17. Grengs, J. (2010). Job accessibility and the modal mismatch in Detroit. *Journal of Transport Geography, 18,* 42-54.

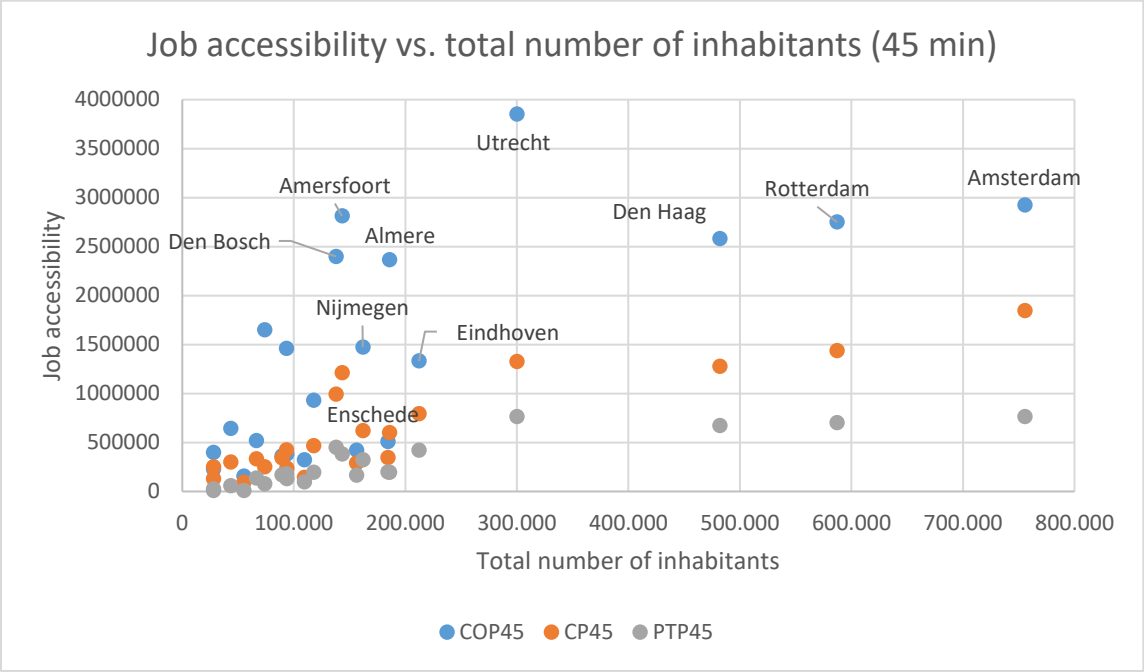
18. Handy, S. (2005). Planning for Accessibility: in Theory and in Practice. *Access to Destinations*.
19. Hansen, W. G. (1959). How Accessibility Shapes Land Use. *Journal of the American Institute of Planners*, *25*(2), 73–76. https://doi.org/10.1080/01944365908978307.
20. Herbers, D.J., Mulder, C.H. & Mòdenes, J.A. (2014). Moving out of home ownership in later life: the influence of the family and housing careers. *Hous Stud 29(7),* 910–936
21. Ingram, D.R., (1971). The concept of accessibility: a search for an operational form. Regional Studies 5, 101–107.
22. Jong, P. A. de, Brouwer, A. E. & McCann, P. (2016). Moving up and down the urban hierarchy: age-artculated interregional migration flows in the Netherlands. *Ann Reg Sci, 57,* 145-164.
23. Koelemaij, J., & Wind, B. (2017, March 13). Fixatie op de grote stad schaadt de provincie. Retrieved from https://www.trouw.nl/opinie/fixatie-op-de-grote-stad-schaadt-de-provincie~a45ac836/.
24. Kooiman, N. (2016). *Invloed van binnenlandse verhuizingen op de regionale spreiding van vergrijzing, 1995-2015*. Bevolingstrends CBS.
25. Kresl, P.K. & Ietri, D. (2010). *The aging population and the competitiveness of cities. Benefits to the urban economy*. Retrieved from https://www.scopus.com/inward/record.uri?eid=2-s2.0-84881688187&partnerID=40&md5=4055438bd7b21c58e8aa0bb8d9922e74.
26. Kwan, M.P. and J. Weber. (2003). Individual Accessibility Revisited: Implications for Geographical Analysis in the Twenty-first Century. *Geographical Analysis, 35*, 4.
27. Magnusson, L. & Turner, B. (2003), 'Countryside abandoned? Suburbanization and mobility in Sweden', *European Journal of Housing Policy, 3,* 35-60.
28. Mulder, C. (1993). Migration dynamics. A life course approach, Dissertation. University of Amsterdam.
29. Oort, F. van (2004). Urban growth and innovation. Spatially bounded externalitiesin theNetherlands, Aldershot: Ashgate.
30. Pers, M. van der, Kibele, E. & Mulder, C.H. (2015). Intergenerational proximity and the residential relocation of older people to care institutions and elsewhere. *Ageing Soc, 35(7)*, 1429–1456.
31. Plane, D.A. & Heins, F. (2003). Age articulation of U.S. inter-metropolitan migration. *Ann Reg Sci, 37*, pp. 107–130.
32. Plane, D.A., Henrie, C.J. & Perry, M.J. (2005). Migration up and down the urban hierarchy and across the lifecourse. *Proc Natl Acad Sci, 102*, 15313–15318.
33. Plane DA, Jurjevich JR (2009) Ties that no longer bind? The patterns and repercussions of age-articulated migration. *Prof Geogr, 61(1)*, 4–20.
34. Richards, J.L., Rankaduwa, W. (2008). Housing Canada's Oldest-Old: correlates of their residential status. *JHous Elder, 22*, 376–403.
35. Rijksoverheid. (2014). Aanpak bevolkingsdaling. Retrieved from https://www.rijksoverheid.nl/onderwerpen/bevolkingskrimp/inhoud/aanpak-bevolkingsdaling.
36. Rijksoverheid. (2015). Indeling gemeenten krimpregio's en anticipeerregio's. Retrieved from https://www.rijksoverheid.nl/onderwerpen/bevolkingskrimp/documenten/publicaties/2015/06/29/indeling-gemeenten-krimpregio-s-en-anticipeerregio-s.
37. Rouwendal, J., & Meijer, E. (2001). Preferences for housing, jobs, and commuting: A mixed logit analysis. *Journal of Regional Science, 41(3),* 475–505.

38. Serow, W. J., Friedrich, K. & Haas, W. H. (1996). Residential relocation and regional redistribution of elderly in the USA and Germany. *Journal of Cross-Cultural Gerontology, 11,* 293–306.
39. Ulimwengu, J. M., & Guo, X. (2004). Modeling Spatial Accessibility within Discrete Choice Framework. Retrieved from http://ageconsearch.umn.edu/bitstream/20170/1/sp04ul01.pdf.
40. Urdan, T. C. (2010). *Statistics in plain English*. New York: Routledge.
41. Vermeij, L. (2012). Dorpsvoorzieningen in tijden van krimp. *Rooijlijn*, *45*:6, 410–415.
42. Verschuren, P., & H. Doorewaard. (2007). *Het ontwerpen van een onderzoek*. Den Haag: Uitgeverij LEMMA.
43. Wagt., M. van der & C., Boon, (2006). 'Krimp: een nieuwe toekomst voor de woningmarkt', *Tijdschrift voor de Volkshuisvesting 12(2),* 26-29.

Attachments

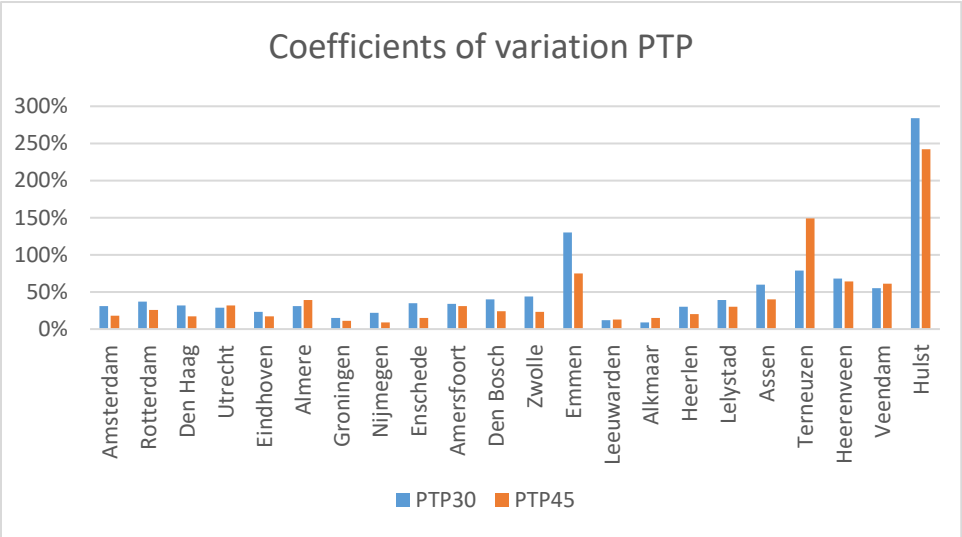
Attachment 1: Job accessibility compared to total number of inhabitants

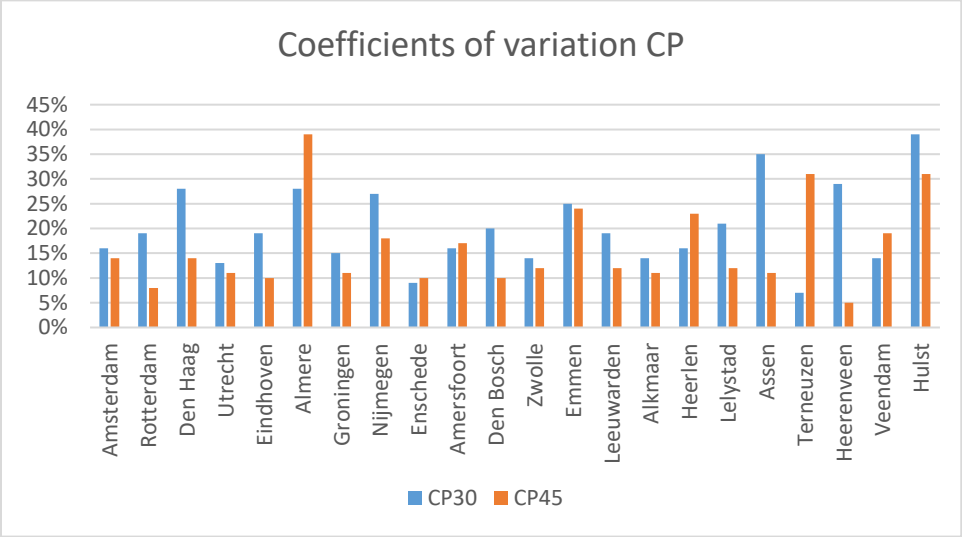
The graph displays the total number of inhabitants in relation to job accessibility

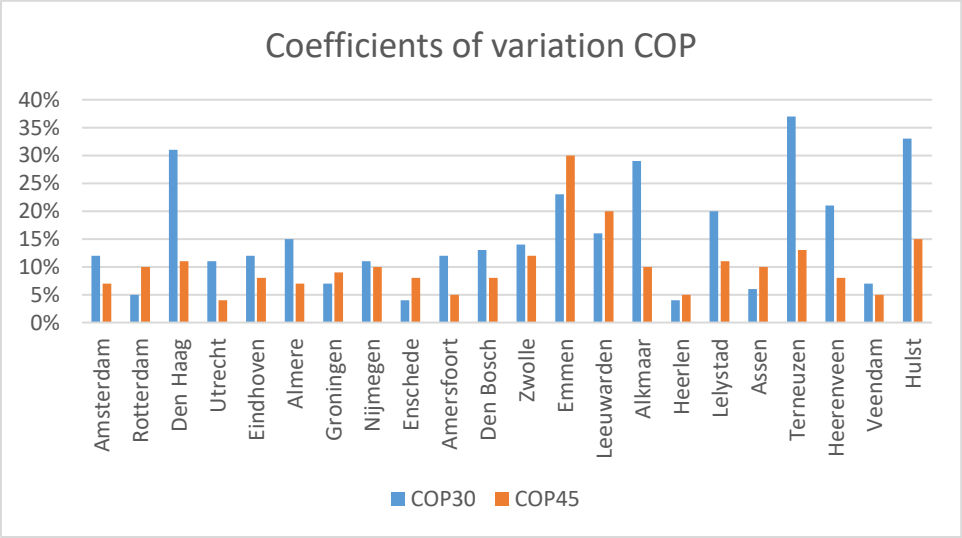


Attachment 2: Differences in highest and lowest value of job accessibility

The graphs display the coefficients of variation. The higher the coefficient, the higher the differences are within the municipality between the highest and lowest values of job accessibility. The municipalities are ordered from highest number to lowest number of inhabitants.







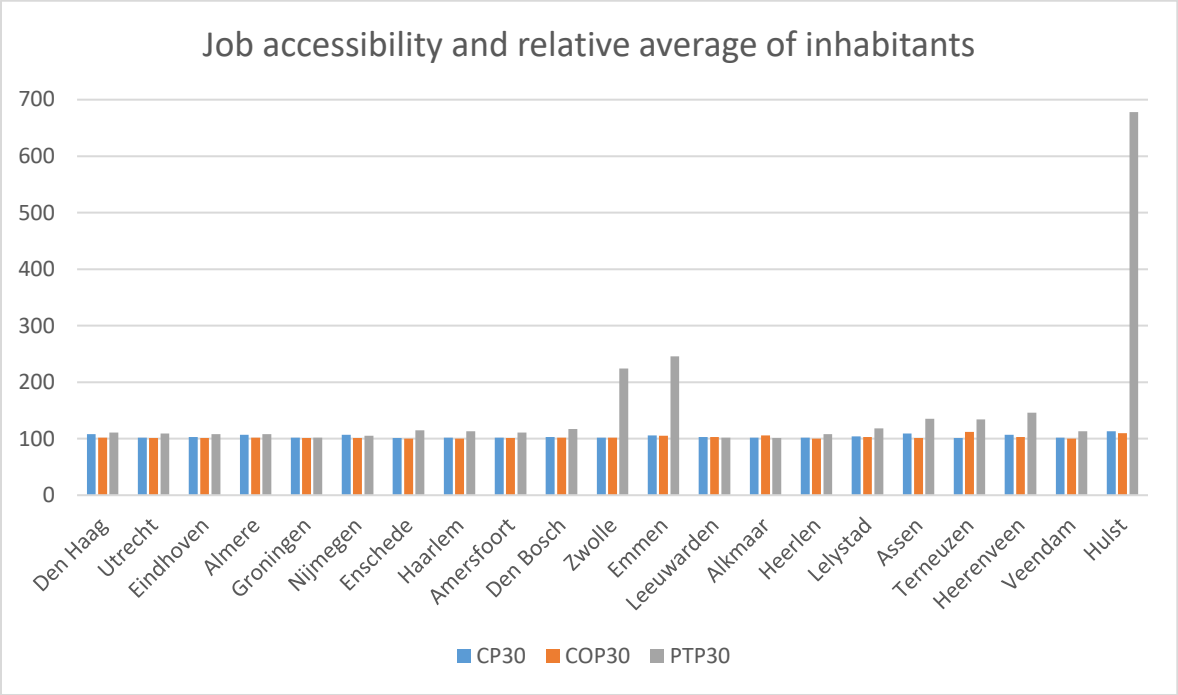
Attachment 3: Job accessibility and relative average of inhabitants 1

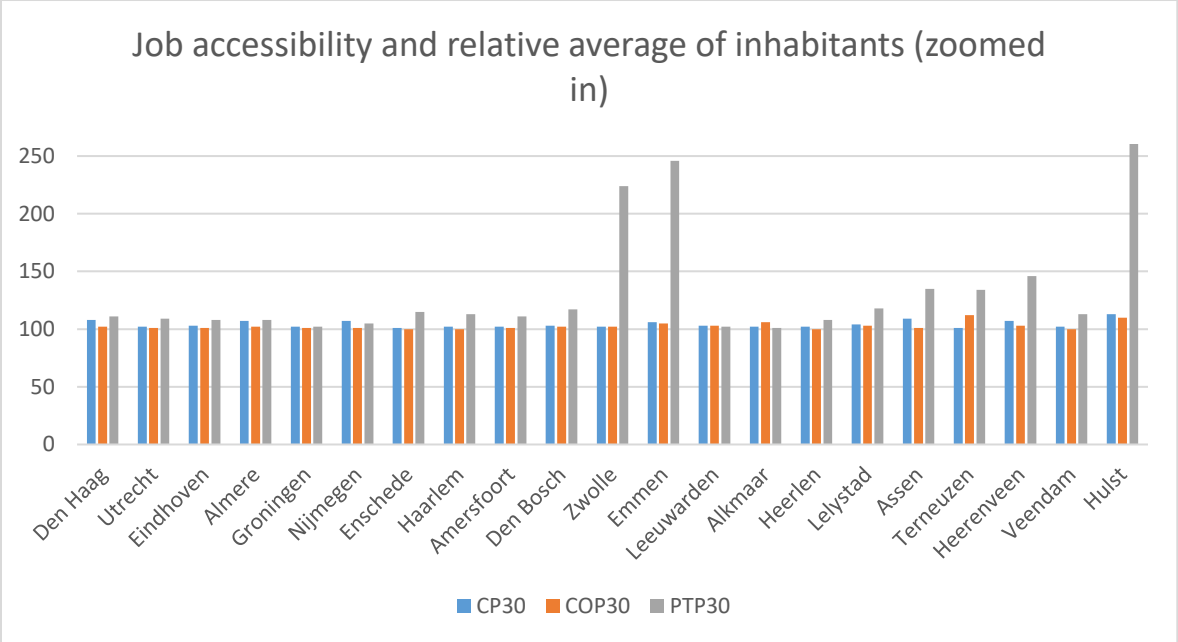
The table shows the relative average of inhabitants in relation with job accessibility. A number higher than 100 means that relatively more inhabitants live in places with high job accessibility.

	CP30	CP45	COP30	COP45	PTP30	PTP45
AMSTERDAM	103	102	101	101	112	103
ROTTERDAM	103	101	100	101	114	107
DEN HAAG	108	102	102	101	111	103
UTRECHT	102	101	101	100	109	110
EINDHOVEN	103	101	101	101	108	103
ALMERE	107	112	102	101	108	112
GRONINGEN	102	101	101	101	102	102
NIJMEGEN	107	103	101	101	105	101
ENSCHEDE	101	101	100	100	115	102
AMERSFOORT	102	102	101	100	111	108
DEN BOSCH	103	101	102	101	117	106
ZWOLLE	102	101	102	101	224	105
EMMEN	106	105	105	107	246	153
LEEUWARDEN	103	103	103	103	102	102
ALKMAAR	102	101	106	101	101	102
HEERLEN	102	100	100	100	108	108
LELYSTAD	104	101	103	101	118	108
ASSEN	109	101	101	101	135	114
TERNEUZEN	101	109	112	102	134	287
HEERENVEEN	107	104	103	101	146	136
VEENDAM	102	103	100	100	113	132
HULST	113	109	110	102	678	572

Attachment 4: Job accessibility and relative average of inhabitants 2

The results of the table given in attachment 3 are transformed into the graphs below.





Attachment 5: Rates of interregional residential relocation

The calculated rates of interregional residential relocation, rate of people who moved into the municipality and people who moved out of the municipality. The rate of interregional residential relocation per municipality is calculated by subtracting the number of people who left the municipality from the people who entered the municipality and dividing that number by the total number of that municipality's inhabitants. The rate of people moving in and moving out of the municipality are calculated by dividing the number of people who moved into or moved out of the municipality by that municipality's total number of inhabitants and multiplying the outcome by 100.

Municipality	Total number of inhabitants	Number of people who moved into the municipality	Number of people who moved out of the municipality	Rate of interregional residential relocation	Rate of people who moved into the municipality	Rate of people who moved out of the municipality
Alkmaar	93.416	3.754	4.822	-1,14	4,02	5,16
Almere	185.746	7.617	6.998	0,33	4,10	3,77
Amersfoort	143.212	6.215	5.890	0,23	4,34	4,11
Amsterdam	755.605	30.795	29.950	0,11	4,08	3,96
Assen	66.369	3.137	2.407	1,10	4,73	3,63
Den Bosch	137.775	5.855	5.162	0,50	4,25	3,75
Den Haag	481.864	18.597	20.293	-0,35	3,86	4,21
Eindhoven	212.269	9.199	9.235	-0,02	4,33	4,35
Emmen	109.441	3.122	3.010	0,10	2,85	2,75
Enschede	156.071	5.490	5.273	0,14	3,52	3,38
Groningen	184.227	12.563	12.485	0,04	6,82	6,78
Heerenveen	43.334	1.977	1.691	0,66	4,56	3,90
Heerlen	89.356	4.030	4.230	-0,22	4,51	4,73
Hulst	27.886	673	697	-0,09	2,41	2,50
Leeuwarden	93.498	5.278	5.075	0,22	5,65	5,43
Lelystad	73.848	2.990	2.872	0,16	4,05	3,89
Nijmegen	161.817	8.793	9.125	-0,21	5,43	5,64
Rotterdam	587.134	22.407	22.744	-0,06	3,82	3,87
Terneuzen	55.149	1.411	1.334	0,14	2,56	2,42
Utrecht	299.891	18.717	17.408	0,44	6,24	5,80
Veendam	27.995	1.159	1.172	-0,05	4,14	4,19
Zwolle	117.703	5.386	4.941	0,38	4,58	4,20

Attachment 6: Correlation test Randstad

The results of the correlation test for the Randstad.

		Rate of interregional residential relocation	Rate of people moving into the municipality	Rate of people moving out of the municipality
COP30	Pearson Correlation	,524	,487	,419
	Sig. (2-tailed)	,365	,405	,483
COP45	Pearson Correlation	,820	,976	,932
	Sig. (2-tailed)	,089	,004	,021
CP30	Pearson Correlation	-,315	-,419	-,417
	Sig. (2-tailed)	,606	,483	,485
CP45	Pearson Correlation	,027	-,222	-,296
	Sig. (2-tailed)	,966	,720	,628
PTP30	Pearson Correlation	-,419	-,185	-,080
	Sig. (2-tailed)	,482	,766	,898
PTP45	Pearson Correlation	-,066	,222	,304
	Sig. (2-tailed)	,916	,719	,619

Attachment 7: Correlation test intermediary zone

The results of the correlation test for the intermediary zone.

		Rate of interregional residential relocation	Rate of people moving into the municipality	Rate of people moving out of the municipality
COP30	Pearson Correlation	,298	-,144	-,316
	Sig. (2-tailed)	,566	,785	,542
COP45	Pearson Correlation	,660	-,302	-,686
	Sig. (2-tailed)	,154	,561	,132
CP30	Pearson Correlation	,169	,247	,043
	Sig. (2-tailed)	,749	,637	,936
CP45	Pearson Correlation	,443	,202	-,189
	Sig. (2-tailed)	,378	,701	,720
PTP30	Pearson Correlation	-,129	,461	,404
	Sig. (2-tailed)	,808	,357	,426
PTP45	Pearson Correlation	,297	,364	,027
	Sig. (2-tailed)	,568	,478	,959

Attachment 8: Correlation test periphery

The results of the correlation test for the periphery.

		Rate of interregional residential relocation	Rate of people moving into the municipality	Rate of people moving out of the municipality
COP30	Pearson Correlation	-,024	,071	,069
	Sig. (2-tailed)	,964	,893	,897
COP45	Pearson Correlation	,182	-,165	-,198
	Sig. (2-tailed)	,730	,754	,706
CP30	Pearson Correlation	-,347	-,028	,081
	Sig. (2-tailed)	,500	,958	,878
CP45	Pearson Correlation	,086	-,030	-,052
	Sig. (2-tailed)	,871	,955	,922
PTP30	Pearson Correlation	-,858	,514	,705
	Sig. (2-tailed)	,029	,297	,118
PTP45	Pearson Correlation	-,497	,252	,369
	Sig. (2-tailed)	,316	,630	,471

Attachment 9: Correlation test shrinking regions

The results of the correlation test for the shrinking regions.

		Rate of interregional residential relocation	Rate of people moving into the municipality	Rate of people moving out of the municipality
COP30	Pearson Correlation	-,720	,993	,995
	Sig. (2-tailed)	,170	,001	,000
COP45	Pearson Correlation	-,519	,828	,818
	Sig. (2-tailed)	,371	,084	,091
CP30	Pearson Correlation	-,792	,804	,834
	Sig. (2-tailed)	,110	,101	,079
CP45	Pearson Correlation	-,824	,967	,985
	Sig. (2-tailed)	,086	,007	,002
PTP30	Pearson Correlation	-,466	,547	,557
	Sig. (2-tailed)	,429	,341	,329
PTP45	Pearson Correlation	-,521	,621	,632
	Sig. (2-tailed)	,368	,264	,253

Attachment 10: Correlation test for all municipalities

The results of the correlation test for all municipalities.

		Rate of interregional residential relocation	Rate of people moving into the municipality	Rate of people moving out of the municipality
COP30	Pearson Correlation	-,045	,205	,220
	Sig. (2-tailed)	,843	,361	,325
COP45	Pearson Correlation	-,006	,218	,218
	Sig. (2-tailed)	,980	,330	,330
CP30	Pearson Correlation	-,080	,136	,165
	Sig. (2-tailed)	,724	,547	,463
CP45	Pearson Correlation	-,020	,173	,178
	Sig. (2-tailed)	,929	,442	,428
PTP30	Pearson Correlation	-,203	,244	,322
	Sig. (2-tailed)	,365	,275	,145
PTP45	Pearson Correlation	-,057	,254	,273
	Sig. (2-tailed)	,803	,254	,218