LUND UNIVERSITY

Bachelor Thesis in Human Geography

Commuting to Skåne's Regional Centers

- A Quantitative Study of Opportunities and Possible Consequences for Students

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Abstract

Region Skåne has designated seven regional centers in Skåne: Malmö, Lund, Helsingborg, Landskrona, Hässleholm, Kristianstad and Ystad. These centers are to be, among other things, providers of key services. The aim of this thesis is to examine whether Skåne's students have equal opportunity, through public transport, to benefit from the regional centers' provision of gymnasium-level education.

This thesis uses time geography as a theoretical framework, and also relies on previous research into the importance and impact of public transport and commuting, especially on students. The research is done by employing a quantitative statistical method, conducted on self-compiled data, primarily compiled through use of Google Maps and the Skånetrafiken app.

The results of the study show that residents of different urban areas and municipalities are not in equal positions when it comes to commuting to regional centers, neither when it comes to travel time nor number of transfers, and that smaller localities generally have poorer public transport access to regional centers than larger localities. Thus, it is likely that students from different parts of the province may suffer to different extents from the possible negative consequences of a longer and more arduous commute.

Keywords: school commute, time geography, public transport, school choice, Skåne

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1. Introduction

Sweden is a highly urbanized country, with a large majority residing in urban areas (SCB 2015a). However, not everyone live in urban areas, and not all that do live in one of Sweden's larger cities. In Sweden's less central central areas there is growing anger concerning resource allocation, and the feeling that not all residents are considered equal, as not everyone has the same access to key societal functions (Landstedt 2017). One of these key societal functions that is becoming quite centralized is education. Education is considered quite crucial in Sweden, yet geographical access to education is not equal in all places (Rosvall, Rönnlund & Johansson 2018).

During the 2010/2011 school year a third of all Swedish students at the gymnasium level commuted to another municipality for school (Skolverket 2011). This is not necessarily unproblematic, as a longer commute has been connected to a lower life satisfaction (Westman et al 2017) as well as to poorer academic results (Tigre, Sampaio & Menezes 2017). Regardless of these issues, if one resides in a less central location and wants to pursue an education, a long commute may be one's only choice. This is one of several barriers, also including social, cultural and economic, that may impact rural students' pursuit of education more than their urban peers (Rosvall, Rönnlund & Johansson 2018). For example, if one has a long commute this may result in a lesser ability to achieve the amount of sleep that a teenager needs. Teenagers are generally assumed to need about 9 or more hours of sleep a night, but many students get far less than this (National Sleep Foundation 2006). This is not ideal, since sleep has been identified as being very important for good academic performance (ibid.). This may place further barriers on students living in less central locations to effectively and successfully attain an eduction.

All students have the right to, after completing their mandatory schooling, move on to the next step, which in Sweden is the gymnasium (which encompasses grades 10 through 12) (Skolverket 2011), but not all municipalities run gymnasiums. In the southern-most province of Skåne this issue is solved through collaboration between the municipalities, and all students from the province are allowed to freely apply to any school within the province, without having to stay within their home municipality (Skånegy 2018). Skåne has been noted as very poly-centric region, meaning that there are many urban areas fairly close to each other, and that there is a high degree of interaction between them (Region Skåne 2011). Further, seven regional centers have been identified in Skåne: Malmö, Lund, Helsingborg, Landskrona, Kristianstad, Hässleholm and Ystad (ibid.). These cities

have been identified as key to the province's development, and also as cities who should be providers of key societal functions, such as education (ibid.). The Region Skåne report which establishes this also notes that good public transport is key to maintain the poly-centric structure of the region (ibid.).

To summarize: Sweden is a highly urbanized country, yet that does not mean that all people live in the major cities. All Swedish students have the right to gymnasium education, yet not all live in a place where there exist gymnasium schools. Skåne is a poly-centric region with multiple centers, and public transport has been identified as key to making such a structure work. How these different aspects interact is the focus of this thesis. As in, what are the opportunities of Skåne´s students, who do not live in the province's largest cities, to commute by public transport to the regional centers to partake in gymnasium-level education?

1.1. Aim and research questions

In this paper I aim to examine whether there is equal opportunity for gymnasium students in Skåne to commute by public transport to a regional center. The purpose of this is to evaluate the accessibility of a gymnasium education for students living in different parts of Skåne, as well as to evaluate the theoretical effectiveness of the regional centers as providers of high school level education.

- How is the accessibility of gymnasiums in regional centers for students living in different areas of Skåne distributed?
  - Are there differences in travel time and transfers between municipalities?
  - Is there a relation between locality size and travel time and transfers?
  - Does access to train lead to a shorter and simpler commute?

1.2. Delimitations and key definitions

Some exclusions have been made from the analysis. Private gymnasiums have been excluded, as they are not directly run by the municipalities. I will also exclude gymnasiums for students with disabilities or elite sports gymnasiums, as they are not accessible to all students, and instead focus on the national programs. The urban areas studied are only those that are lacking public gymnasiums, and whose inhabitants can reach a regional center by train and/or bus. Any urban areas lacking a bus stop or train station are excluded, as this paper focuses on accessibility by public

transport. The commute time will be calculated to the regional center's main train station, as in all of the regional centers it is a central location and a commute hub. Commute time and experience to each specific gymnasium within a city would however of course vary a bit from this standardization. Bus routes which are only run if pre-ordered, not run both in the morning and in the afternoon or only run on weekends are excluded. Urban areas which cannot reach a regional center during the morning commute span of 7.30 to 8.30 during weekdays are excluded, as those routes cannot be used by commuting students. This thesis only includes urban areas, and excludes all rural bus stations. This is to simplify the analysis, since some rural bus stations seem to be located far from any residential houses, and therefore are likely not relevant for commuting students, and making the selection of which rural bus stations should and should not be included was deemed to arduous for and outside of the purpose of this thesis.

Urban area as it is used in this thesis refers to anything that is defined as either a locality (tätort) or smaller locality (småort) by Statistics Sweden. A locality is defined as an urban area with at least 200 inhabitants, and no more than 200 meters between houses. A smaller locality is defined as an urban area with at least 50 inhabitants and no more than 150 meters between houses.

When I refer to a municipality providing public gymnasium schooling in this thesis, that means that the municipality has at least one municipally-run gymnasium, which provides both vocational and college preparatory programs. If a municipality only provides vocational programs, for example, that municipality is not counted as providing public gymnasium schooling.

Public transport access is another key term that needs defining. When I refer to this I specifically mean travel time and number of transfers. So, an urban area which has good public transport access to a regional center has a shorter travel time and fewer needed transfers than an urban area with worse access.

2. Background and theory

2.1. Urbanization in Sweden

The share of Swedes who live in urban areas was 85% in 2010 (SCB 2015a). In a long term perspective of a hundred years, it is obvious that urbanization and concentration have been the general trends (Borgegård, Håkansson & Malmberg 1995), and during the last three decades,

Sweden's rural areas have undergone big demographic and economic changes, driven by decline in employment in traditional industries, and centralization of an increasingly service-based economy in urban areas (Hedlund et al 2017). Issues around population decline, out-migration of younger residents and the subsequent population-aging have plagued many communities in rural areas in later years (ibid.).

Urbanization continues in Sweden, as the share of people living in towns and cities grows (SCB 2015b). However, Swedish urbanization does no longer primarily depend on people moving from the countryside to cities (ibid.). During 2000-2010 more people moved from large cities to the countryside than the other way around, and people who do move from rural to urban areas generally move to smaller cities with less than 100 000 inhabitants (ibid.). Urbanization continues as more children are born in urban areas than rural, immigrants generally take up residence in cities and one can be reclassified from living in a rural area to living in an urban one as urban areas grow geographically (ibid.). Emigration very slightly checks urbanization, as a large majority of those who emigrate are from urban areas (ibid.).

33 of Sweden's 290 municipalities have lost at least a fifth of their population since 1985 and many of the people leaving are young, which has consequences (Landstedt 2017). The population's average age increases, and as this happens the tax base and labor market shrink. There are also fewer consumers, which means that services like shops, restaurants et cetera, which make a location attractive, slowly disappear (ibid.). After a time even more basic functions such as schools, health care and gas stations can also disappear (ibid.). Even though commuting and communication may increase in our modern age (Borgegård, Håkansson & Malmberg 1995), this eliminating of basic services is often negatively received. Rural residents often react negatively as they feel disregarded and forgotten, making the point that equal access to schools, police etcetera should be guaranteed to all Swedish inhabitants, regardless of whether one lives in Stockholm or in a more rural area (Landstedt 2017).

One group that seems most likely to move to more urban areas is young women. Primary causes for this female exodus from more remote and economically weak regions that are often mentioned are labour market structures which offer fewer options to women than men, as well as poorer educational facilities than more urban regions (Johansson 2016). This out-migration seems to be the strongest among very young women in the ages between 18 and 24, which indicates that the out-

migration is strongly connected to the pursuit of education (ibid.). It has been noted though that there is a certain amount of return-flow when women reach their later 20s and early 30s. This seems to be connected to the preference for having and raising children in the area where one spent one's own childhood (ibid.).

2.2. Polycentrism in Skåne

The county council of Skåne, Region Skåne, published a report in 2011 presenting the ways in which Skåne is a poly-centric region (Region Skåne 2011). This means that Skåne has a high density of urban areas, short distances between urban areas and a high degree of interaction between urban areas (ibid.). Skåne has more urban areas in relation to the size of its area than any other county in Sweden, and it is the second-most densely populated region in Sweden (but the eighth most sparsely populated metropolitan area in Europe) (ibid.). However, the southwest region in Skåne is much more densely populated than the rest of the province (ibid.).

The report argues that it's a big strength for Skåne that different urban areas complement each other, as they can focus on specializing without having to offer the same range of services as all other urban areas, which can lead to more effective use of resources (Region Skåne 2011). To further develop this structure of urban areas complementing each other without competing is a key challenge which the report establishes, and they also claim that further poly-centric development can help equalize certain differences that still exist between urban and rural areas as well as between the east and west of Skåne (ibid.).

The report claims that it in Skåne is easy to commute across municipal lines, and to benefit from social services regardless of which municipality one lives in (Region Skåne 2011). These days people do not necessarily live, work and engage in leisure activities all in the same municipality, and this tendency is furthered by good accessibility, which the report claims Skåne has, while establishing that further developing infrastructural networks to connect Skåne further is a key challenge going forward (ibid.).

The report shows that the accessibility between urban areas is the largest for those areas connected by the train network, however the report also notes that the regional buses are also key (Region Skåne 2011). The share of trips in Skåne carried out by public transport is 14%, but the number varies wildly between different parts of the province. In rural areas of Skåne the share of trips that

are taken by public transport is only a few percent, but in the larger cities it is about 40% (ibid.). The report acknowledges that it is important to care for the public transport availability outside of the larger urban areas, especially since good public transport access may be a key point to get people more comfortable with the idea to move to more peripheral areas (ibid.).

Finally, the report points to seven regional centers that they claim are central to Skåne (Region Skåne 2011). These were selected based on the following criteria: having at least 14 000 inhabitants; having a diversity of sectors, with at least 200 different sectors present in the municipality; and a larger number of people commuting in than out (ibid.). A regional center should also be capable of offering basic services to inhabitants, such as education, health care and commerce (ibid.). Based on these criteria the report pinpoints Malmö, Lund, Helsingborg, Landskrona, Kristianstad, Hässleholm and Ystad as regional centers (ibid.). These will be central to this thesis.

2.3. School geography in Skåne

All Swedish municipalities are mandated to offer all students who finish their mandatory schooling the possibility to continue with further education at a ’gymnasium’, which covers grade 10 through 12. A municipality should, according to the school law, offer a multifaceted range of programs at the gymnasium level. This can be done individually by each municipality, or as collaboration between several municipalities. (Skolverket 2011) Municipalities in Skåne collaborate in such a way that all students within this area may apply freely to any school and program within the province (Skånegy 2018). If a student commutes it is generally the student’s home municipality who will cover the student’s travel costs, as long as the student has a commute of at least 6 kilometers (Skolverket 2011). Analyses of individuals’ tendency to commute to school indicate that travel time, accessible travel modes and economical circumstances are of great importance (ibid.). The longest acceptable travel time is generally thought to be approximately 45 minutes, and key factors in choosing one's travel mode are speed, flexibility and comfortability (ibid.).

2.4. Time geography

The main theoretical framework of this thesis is time geography, which was founded by Torsten Hägerstrand of Lund University in the 1970s. Time geography can be highly useful in many ways, for example as a way to visualize people’s everyday lives and therefore contribute to discussion around life circumstances (Scholten, Friberg & Sandén 2012), or for investigating travel, as it can

examine the contexts in everyday life in which people need to change places to carry out their planned activities (Næss et al 2018). These are among the reasons why I have chosen to base my theoretical framework on time geography. I will firstly take the time to establish and introduce this framework and its key terminology. First of all, according to time geography, people are constrained by time (Hägerstrand 1970). Furthermore, everyone has the same amount of time every day, and everyone has to use all the available time in the day (Ellegård 2019a). Finally, everyone is at all times physically located somewhere in the material world (ibid; Ellegård 2019b:75). Some of the most key concepts within time geography are constraint, principle of return, project, space-time path and space-time prism (Ellegård 2019a), all of which I will briefly present here.

To begin, the concept of *constraints* is used to describe what hinders humans from performing activities to achieve the goals of their projects (Ellegård 2019a). The first type of constraint are the *capability constraints*, which are based on biology and tools (Hägerstrand 1970), meaning that a certain amount of time each day has to be spent on physiological necessities such as sleeping and eating, and the distance an individual can cover within a time-span is limited based on which means of transportation one has available (Ma 2011). The second type of constraints are the *coupling constraints*, which concern where, when and for how long an individual has to join other individuals, tools and/or materials to produce, consume, transact, socialize et cetera (Hägerstrand 1970; Ma 2011). The third and final type of constraints are the *authority or steering constraints*, which concern the rules, laws, economic barriers, power relationships et cetera which determine who does or does not have access to specific domains (space-time entities) at specific times to do specific things (Hägerstrand 1970; Ma 2011). Authority constraints can also be seen to include public transport networks and schedules (Næss et al 2018). One can also regard the *principle of return* as a constraint, since it strongly influences which projects an individual can participate in and for how long. This principle means that an individual generally needs to return home at the end of each day, to sleep, eat et cetera, and then set out from home again the next day (Ellegård 2019b:70). Constraints are generally interrelated, and can influence each other (Ellegård 2019a). These constraints imply a considerable limitation of individuals' use of time and the spatial dispersal of possible activities (Næss et al 2018).

The concept of *project* specifies the activities which individuals take part in in order to achieve certain goals. These can be individual projects, with goals set by and worked towards by the individual, or organizational projects, with goals set by the leader of the organization (Ellegård

2019a). Constraints impact the success of projects, and some projects may fail because the individual/-s is influenced by various kinds of constraints that are not possible to overcome (ibid.).

A *space-time path* is a concept which tracks an individual's sequence of activities at different locations over time (Ma 2011). The course this space-time path takes results from the interactions between projects and constraints (Neutens, Schwanen & Witlox 2011). Further, a *space-time prism* is a useful way to think about and potentially visualize an individual's opportunities to move in the space-time (Ellegård 2019b:70). This prism delimits an individual's action space under the applicable constraints, and shows that part of the total space-time which is within reach of an individual during the period of the day when they can be away from home (Ma 2011; Ellegård & Svedin 2012). The concept of space-time prism can be useful as accessibility can be measured by the opportunities constrained by the prism (Ellegård 2019b:72).

Within time geography children have been acknowledged as a group facing certain restrictions, as if their parents cannot assist in transport they are limited to a quite small space-time prism. This means that they are often more limited to the institutions near their home. (Hägerstrand 1970) This means they are quite vulnerable to their local surroundings, and depending on where they live, they may have low access to training, good education and different social connections. This can have a negative impact on their lives going forward. (ibid.; Andersson Malmberg & Östh 2012)

2.4.1. Critique

Time geography has encountered criticism over the years, some of which I will acknowledge here. Firstly, time geography has been criticized by humanists who argue that it is a reductionist theory which reduces humans to actors following certain paths determined primarily by constraints. These critics have called time geography little more than a graphic exercise. (Sui 2012) Secondly, time geography as a method has been criticized as being very data intensive, and requiring massive resources to establish the time geography of a certain individual, place or culture, and this has lead to time geography often having a very localized scale of analysis. Due to this time geography can be regarded as overly ambitious to a problematic extent. (ibid.) This critique is one I agree with in the context of this thesis, which is a reason why I have chosen to primarily use time geography as a framework for analysis and contextualization, not a method.

Thirdly, time geography became embedded in the structure vs agency debate of the late 70s to mid 80s, and was criticized from both sides as either too dependent on structure or on agency (Sui 2012). Fourthly and finally, time geography has received criticism from feminist scholars. These scholars have criticized time geography for being overly masculinist in its representation of social reality, as they perceive the theory as having developed from a privileged and hegemonic masculine perspective. This, they mean, has lead to time geography erasing the difference in the everyday as it relates to women. (ibid.; Scholten, Friberg & Sandén 2012)

2.5. Transport and time

Transport is a field highly suited for analysis by time geography, as it has both spatial and temporal characteristics. Furthermore, traveling with public transport is influenced both by space constraints and time budget, making also this smaller field suitable for a time geographical perspective. (Li 2014) While they interact and conduct activities individuals are faced with the scarce nature of space and time, and moving implies a trade-off between these two scarce resources. Movement is further conditioned by the constraints and opportunities present in the contexts in which it takes place. (Neutens, Schwanen & Witlox 2011)

Public transportation, having a less dense network of times than individually controlled means of transportation, and a time table, produces more complicated space-time paths for its travelers (Ellegård & Svedin 2012). Some planned space-time paths can be highly impractical if they do not coordinate with the public transportation's time table, and one risks missing the last departure home, putting one in a very inconvenient spot (Li 2014). If several people are to perform the same activities and one is reliant on public transportation while the other is not, one of them likely has to set aside more time for transportation. This risks making it impossible for that individual to manage the activities set before them. (Ellegård & Svedin 2012)

2.5.1. Information and communications technology

As technology and our world continues to develop, there is a need to adapt time geography, to keep it relevant (Ma 2011). An example of this is constraints, particularly capability constraints. Constraints can to some extent be relaxed by the use of informations and communications technologies (ICTs), since some activities are no longer restricted by location and opening hours, such as shopping and banking, which can now be done online (Neutens, Schwanen & Witlox 2011;

Ma 2011). ICTs also increase individuals' ability to multitask, as they can for example call, shop or email while on the train (Neutens, Schwanen & Witlox 2011). The growth in ICTs also allow social networks to gradually transit from physical space to virtual space (Ma 2011). People are now able to communicate without movement in the material world and can follow what goes on in far-away locations (Ellegård 2019b:75). These changes to our lives require adaption from time geography as a theory. Capability constraints, for example, have classically been considered to be mostly distance-oriented, but, as described, ICTs can relax these constraints, to some extent. This means that maybe new aspects should be considered when discussing capability constraints, such as access to internet and computer skills. (Ma 2011)

However, not all space-time constraints have been or can be relaxed or lifted through the use of ICTs. Some, like for example having to pick up your children from school at a certain time, have persisted, and certain new ones have come into existence, such as the fact that mobile phones are not always allowed, and the need to charge your device. (Neutens, Schwanen & Witlox 2011) It is also unclear to what extent ICTs replace travel, even when such a replacement is possible. In a study on young Swedes it was shown that those with heavy daily ICT use and large social networks travelled a lot compared to their peers. This indicates that people do not necessarily choose to replace physical transportation with ICTs, even when theoretically having the option. (Ellegård 2019:76)

2.6. Public transport

A transport system is meant to provide commuters with mobility, comfort and safety. Cars have been crucial in achieving this, and people's reliance on them has strongly contributed to the capacity issues experienced by certain road networks. (Chowdhury, Ceder & Schwalger 2015) This points to the importance of good public transport. User-friendly public transport is key to improving people's mobility and if one can get more individuals to choose public transport instead of traveling by car that is an important step to reaching the important goal of reducing the transport sector's contribution to greenhouse gas emissions. (ibid.)

If one lives in a less central location one generally must weigh choosing the best option against the travel that would be needed to reach that location. More central residents often do not have this problem, and can generally choose between more options, without having to take travel time and cost into account. (Næss et al 2018) This further means that less central residents often become

more car dependent, as they may not be able to rely on public transportation as a sufficiently time-efficient mode of transportation (ibid.). Of course this depends on the structure of where things are located (ibid.) and a less central living location and inadequate proximity to public transport provision can be compensated by a local availability of amenities (Fransen et al 2015).

Finally, a primary concern of much attention is the extent to which public transport provision enables the less privileged segments of the population, especially those without cars, to participate in activities considered normal in their society (Fransen et al 2015). Public transport is sometimes identified as a measure that can reduce inequality, if it can successfully improve access to opportunities, and therefore diminish the disadvantages of the most fragile segments of society (Martinez et al 2018).

If the availability and quality of public transport is not equal in different areas it can become a reinforcer of segregation. The inequality in access to certain materials and resources that can come from not having available high-quality public transport can produce further inequalities. (Martinez et al 2018)

If people cannot afford or effectively use public transport they may be restricted to activities that can be reached by foot or possibly bike (De Lima, Maia & Lucas 2017). These people may not be isolated in far-away places, yet they can become restricted from participating in socio-economic activities such as work, and can experience social exclusion, as they cannot take part in normal activities in their society. Social exclusion due to restrictions to mobility may negatively impact ones psychological and social well-being. (ibid.; Martinez et al 2018) Public transport is often seen as accessible to all, yet it may to some become a luxury item (De Lima, Maia & Lucas 2017).

These previously described issues can be referred to transport poverty, which refers to anyone affected by at least one of the following four circumstances: transport affordability (economic costs), mobility poverty (lack of options to perform trips), accessibility poverty (access to the opportunities in acceptable times) and exposure to externalities such as pollution (Martinez et al 2018).

There are many factors one may take into account when evaluating availability and quality of public transport. One such factor is the need to make transfers, and how positively inclined people are to

do this. Some may avoid routes where they need to transfer, even if it would be a faster route (Li 2014). It has been found that public transport users are generally negatively disposed towards making transfers, but can be more willing to do so if they consider the alternate route attractive, as in time-efficient and cost effective (Chowdhury, Ceder & Schwalger 2015), which is of course a subjective judgement made by each individual, and hard to predict. When evaluating public transport one should try to consider the attractiveness of the total travel time, including the transfer duration (ibid.).

2.7. School commute

2.7.1. Satisfaction

It has been noted that satisfaction with daily travel influences one's emotional well-being and life satisfaction. Further it has been found that, generally, more active modes of commuting have more positive effects. (Friman et al 2017) For children specifically it has been found that commuting to school by school bus or in an active way such as walking or cycling was experienced as having a higher quality than going by car (Westman et al 2017). A possible explanation for this is the physical activity associated with an active mode of travel and with walking to and from the bus stop, as physical activity generally seems connected to higher life-satisfaction (ibid.). Also, children who engaged in social activities with friends during their commute experienced more excitement than those children who did not. Engaging in solitary activities could be connected to higher levels of stress and worry. Being sociable and interacting with peers seem to be enjoyable activities that the school journey can facilitate. (ibid.)

Regarding length of the commute, a shorter journey was experienced as having higher quality and resulted in more positive feelings (Westman et al 2017). Children who travelled longer did have some tendency to perform better in word-fluency, if they used their travel time to use smart phones (ibid.). However using a smart phone during ones commute is a solitary activity, which, as previously noted, was connected to less positive feelings. The use of a smartphone during commute does not seem connected to positive emotions, and may only be a way of counteracting boredom during the travel. (ibid.)

2.7.2. Impact

In what way and for how long a student commutes can have an impact on their school results. It has for example been found that girls who commute to school using an active mode had about 4% higher high school grades than their peers who used a motorized transportation method (Westman et al 2017). This can for example be due to the beneficial effects of physical activity on cognitive performance (ibid.). It has also been found that the duration of commuting has a negative causal effect on academic achievement (Tigre, Sampaio & Menezes 2017). The additional time spent commuting could be otherwise allocated to studying or to other activities positively related with academic achievement such as physical activities, leisure or sleeping, which makes the connection between longer commute and poorer academic results a fairly natural one (ibid.).

2.7.3. School agglomeration

For things to stay economically viable, rural schools with few students occasionally have to be eliminated and merged (Xianzou 2013). This is one version of school agglomeration, which can have several effects on students. Students living in areas with poorer accessibility through public transport especially suffer if their local school is eliminated (Moreno-Monroy, Lovelace & Ramos 2018). If the local school is eliminated during a school agglomeration process, this will generally lead to increased commuting times for students residing in the area. This means students may have to switch from an active and free mode of travel such as walking or biking to a paid-by-mode such as busing. If no subsidy is implemented low-income students who may have issues affording the increased travel costs will feel the effect most. If students have issues reaching their school if public transport accessibility is poor, or they cannot afford public transport, this can lead to further negative effects such as worse attendance, higher drop-out likelihood and worse performance.

2.7.4. School choice

School choice is sometimes brought up as a concept that could be important for promoting pattern of social mobility and breaking down social barriers (Ferrari & Green 2013). However this isn’t necessarily the case. School choice isn’t always possible to manage this, while also possible bringing increased carbon emissions and congestion, since it leads people to commute ’excessively’ (ibid.).

School choice can, instead of promoting social mobility, have the effect of depleting schools in disadvantaged areas of its few less disadvantaged students, as they choose to go to schools in different areas (Andersson, Malmberg & Östh 2012).. This can be seen through the noted fact that lower performing schools generally recruit from a smaller geographic area, while better performing schools recruit from larger areas (ibid.). School choice can therefore be shown to reduce, not promote, equity in the school system (ibid.).

Not all households necessarily have equal ability to fully exercise school choice. Variations in different households' capacities to absorb the potentially increased transport costs could likely have strong socioeconomic and ethnic dimensions, and this can impose limits to the possible social leveling school choice could theoretically bring about, as not everyone has the ability to fully take advantage of the possibility of that choice (Ferrari & Green 2013).

Location and school quality are key factors that influence whether or not a school is chosen, and the extent to which these factors contribute depends on the local context as well as the household's circumstances (He & Giuliano 2018). It has been noted that parents of longer commuting students tend to place more weight on expected academic gains than on travel costs when choosing schools, since they predominantly choose where to enroll their children based on information about academic standards instead of proximity or ease of enrolling their children (Tigre, Sampaio & Menezes 2017). Of course, one should also note that these parents will be ones who have the economic capabilities to enroll their child wherever they please, which not all parents have.

Finally, school choice can be noted as generally leading to longer school commute distances, and therefore reduces the levels of walking and walking to school, as when the distance becomes longer students are more likely to choose a non-active and more time-effective mode of transport (Wilson et al 2010). One can see that if the nearby school is very good, students will generally attend it, and therefore are likely to walk, while if the school is of lesser quality they will attend a different school. and then do not walk (Ferrari & Green 2013).

Not all students are living in the same circumstances, and this can be noted in the context of school choice. Disadvantaged groups of students can have less of an economic opportunity to travel further to possibly better schools (Andersson, Malmberg & Östh 2012). It has been noted that students whose families are on social assistance travel shorter distances to school, as do foreign-born

students, except for those who have highly educated parents (ibid.). Generally it seems that students with more educated parents do travel further than their peers (ibid.). This points to the idea that a short school commute is not necessarily just a convenience, but may be the result of economic constraints (ibid.). Households that are willing and able to pay may choose to live close to high quality schools, and therefore shorter their children's commute times, but not all households have this economic capital, and therefore have to choose whether their child will attend the close-by low quality school, or attempting to manage the cost of commuting to a more distant school (He & Giuliano 2018).

2.7.5. Rural students

A student's commute to school is influenced by their school relative to their home, as well as the local availability of public transportation (Andersson, Malmberg & Östh 2012). If a student lives far from school they will have to travel long distances to school, which may make them feel or be less safe in the process, as they're having to leave home quite early and return fairly late, depending on the distance to be covered (Xianzou 2013).

The distance to schools is likely the longest for more rural students, and it has been noted that social, cultural and economic resources may be extra important for rural young people as compared to their urban peers when it comes to the choice of attending upper secondary school (Rosvall, Rönnlund & Johansson 2018). These social resources may be siblings or friends setting the example and paving the way by attending a certain upper secondary school; the important cultural resources were noted to be things such as institutional recognition, for example in the form of academic credentials; and finally economic resources were also found to play a role, as more privileged students could simply apply for any program they wanted, while less privileged students may need to consider potential accommodation issues to a further extent (ibid.).

Successful social and economic integration into Swedish society seems to increasingly demand more education than the compulsory years, but these higher levels of education are increasingly becoming centralized (Rosvall, Rönnlund & Johansson 2018). This does not pose issues for urban young people residing in larger towns and cities, but it may pose dilemmas for the more rural youth as they are transitioning into further education (ibid.).

2.8. Sleep

Overall adolescents in 6th-12th grade get less sleep than needed. 45% of these adolescents get an insufficient amount of sleep on school night (less than 8 hours); 31% get a borderline amount of sleep (8 to less than 9 hours); and only 20% get an optimal amount (9 hours or more) (National Sleep Foundation 2006). These numbers get worse as adolescents age, with 62% of 9th-12th graders getting an insufficient amount of sleep, and only 9% getting the optimal amount (ibid.).

78% of adolescents said they need at least 8 hours of sleep to feel their best during the day, but only 51% report getting at least that much on school nights (National Sleep Foundation 2006). The proportion of adolescents who get less sleep than they think they need to feel their best during the day increases as adolescents age, going from 43% in 6th grade to 72% in 12th grade (ibid.).

Adolescents who get an insufficient amount of sleep on school nights are much more likely than their peers to experience consequences the following day, such as feeling too tired or sleepy, being cranky or irritable, falling asleep in school and having a depressed mood (National Sleep Foundation 2006). 28% of high school students reported having fallen asleep at least once a week within the last two weeks and 22% of them reported falling asleep while doing homework or studying (ibid.). 14% of high school students also reported that they had arrived late or had missed because they overslept at least once a week within the past two weeks (ibid.).

A number of factors influence the tendency for teenagers to get insufficient amounts of sleep, including puberty, lifestyle choices and academic demands (American Academy of Pediatrics 2014). A key factor may also be early school start times which are not considered well adapted to the circadian rhythm of adolescents (ibid.). The American Academy of Pediatrics recognizes insufficient sleep in adolescents as an important public health issue that significantly affects the health and safety, as well as the academic success, of American middle and high school students (ibid.).

2.9 Summary

Sweden is a highly urbanized country, and this is even more true of the southernmost province, Skåne. Skåne has a high number of urban areas, and the poly-centric nature of the region is, according to the county council (Region Skåne 2011), key to the region's success, as different urban areas can focus on their different areas of expertise, and compliment each other. Part of the

suggested function of the regional centers is as providers of education. About a third of Swedish students commute across municipal lines to a gymnasium (Skolverket 2011), which makes public transport very important.

Public transport is generally important, especially to help less privileged sections of the population, as they may not have the economic resources to afford a car, to take part in the ”normal and natural” activities of their society (Fransen et al 2015), to which education can certainly be counted. Children and teenagers can generally be considered to be more reliant on public transport as their lack of ability to drive themselves limits the time-space prism they are able to move within. Students commutes' are limited by the capability constraint that they generally cannot drive, the coupling constraint of having to be at school at certain times and the authority constraints of public transport routes and time tables. These constraints can limit which gymnasiums are possible for a student to attend, limiting their supposedly free school choice and their ability to work towards completing the project of obtaining a gymnasium education, and, of course, determine the length and ease, as it concerns transfers, of the commute. Even if these constraints do not severely limit the schools a student can theoretically attend, the impact they can have on the student's commute can have further consequences. For example, a longer commute to school has been connected both to poorer grades (Tigre, Sampaio & Menezes 2017) and to resulting in less positive feelings (Westman et al 2017). A longer commute can also lead to a necessity to wake up earlier, which could mean less sleep, which can lead to negative effects, both academically and mentally (National Sleep Foundation 2006). To conclude, the constraints which impact gymnasium students can have real impacts on students' academic records, mental state and their ability to exercise their school choice, and this may impact certain students more than others, as negative impacts are related to the length of the commute.

3. Material and Method

The method used is a quantitative statistical one, because of the quantitative and relational nature of the research questions. Alternative methods could be a more qualitative approach or a travel diary and space-time path-visualization approach, as is generally associated with time geography. Why these were not chosen will be discussed in section 3.2. The material used needed to be self-

compiled, as no previous compilation of this data was available. How the data collection was conducted will follow in section 3.1.

3.1. Material

The data used was self-compiled from secondary sources, and the collection process started by the noting of all bus and train stops where trains and regional buses depart from, by studying time tables. Bus stops which only local buses (which generally only operate within one urban area) depart from where not included, both to simplify the process and shorten the time needed for data collection. This is not an issue in smaller localities, as they generally do not have local buses, and I would also argue it is not a significant issue for larger localities, since those urban areas that do have access to local buses also have good access to regional buses. Excluding bus stops for local buses may slightly lower the average travel times for certain localities, if it has any impact at all, since local buses generally stop in more places within a locality than regional buses.

Secondly, the bus stops and train stations that were noted down were classified into the urban area and municipality they are located in. This was done by using route maps and different online maps, mainly Google Maps. This was done as carefully as possible, but some human error may have occurred. An alternative strategy to this could be using GIS technology, but this would have required the bus stops being hand placed on the map, which would have taken longer, relied on the same online maps and produced a map which I did not require for the analysis, and therefore was not a feasible choice. Of course, this means that the localization of the stops is reliant on the quality of Google Maps' information when it comes to where bus stops are located and where municipal lines are drawn. To verify this I compared the Google Maps results with Skånetrafiken's route maps and several different maps showing Skåne's municipalities, and found no concerning differences.

As bus stops and train stations were classified they were noted as being located in a locality (and which), smaller locality (and which) or outside any locality. For a gathering of houses seen on the map to be noted as a locality of either size Statistics Sweden's list of localities from 2017 and list of smaller localities from 2015 were used, both of which are the most recent. If the bus stop was not clearly located within a locality listed on these lists it was classified as outside a locality. A certain amount of judgement was employed here to decide whether or not the stop is within the locality, and I decided to err on the side of caution, meaning that a few bus stops may have been classified as outside of localities, when they are potentially right inside the boarder. This is due to the previously

described circumstances concerning the use of Google Maps as a main source. As previously noted in the delimitations, the bus stops located outside of localities where then excluded from further analysis.

After the bus stops were noted and classified, travel times and need for transfers was explored by using the public transport provider Skånetrafiken's app. Using the app was both due to it being a much more time-efficient option than establishing routes by hand, since to find the transfers needed through studying time tables would have been an extremely drawn-out process. While doing this the time tables which began to apply on December 9th, 2018 were used. The choice to include both travel time and transfers (and including the time needed for transfers in total travel time) in the analysis was inspired by Salonen and Toivonen (2013) who argue that this is a key aspect of public transport, which should not be ignored. Salonen and Toivonen's (2013) paper was also clear in that one should not assume an equal travel speed on all routes, and this is a pro when it comes to using the app for travel time calculation instead of network analysis, as many years of using this app has taught me that, during normal traffic conditions, it is generally very accurate. Of course, this is a personal anecdote, and a separate evaluation of Skånetrafiken's app's accuracy could, and possibly should, be conducted. For each urban area the closest (measured in travel time) regional center was identified, and the mean travel time and mode number of transfers needed were noted. Travel time was prioritized over number of transfers as the regional center was identified, to maintain this thesis' focus on space-time use. Further, if a regional center was closer in travel time, but did not provide any departures allowing an individual to reach the regional center within the span of 7:30-8:30 in the morning, that regional center was excluded. If no regional center could be reached from the urban area within that span, that urban area was excluded from analysis.

The mean was used for travel time instead of shortest possible travel time, to better account for all residents in a location, since not everyone may have easy access to the most effective departure point. Departures where transfers meant walking several hundred meters were excluded when calculating the mean travel time, unless these were the only options, and the walking time was no more than 5 minutes. This is because this paper focuses on accessibility from certain departure points, and if one needs to walk a fair distance, that does not clearly constitute access through public transport. Mode was used for the number of transfers instead of mean to not allow for one departure with a large amount of transfers to impact the representative number to a large extent, and instead let the number presented be most representative for most people's experiences.

3.2. Method

After the data had been collected, as described above, it was analyzed in a quantitative statistical way, by using the program SPSS. I decided on this style of of analysis as it is well suited to the type of data I have, and it is also highly suited to my research questions, which are, to a large extent, of a quantitative nature. One alternative analysis approach could have been a qualitative one, though this would have been more suited to a thesis which focuses on the experience of commuters. This is also an interesting topic, yet not the one I have chosen here, and therefore I have not leaned towards qualitative methods.

The specific analyses used are correlation analysis, regression analysis, two-sample t-tests and one-way ANOVA, depending on the relevant variables' characteristics. These analyses all enable us to understand relationships between different variables, such as a correlation between travel time and number of transfers or whether there is a difference in travel time between localities of different sizes. This enables us to better understand the circumstances for commuters in Skåne. Further, frequencies and descriptive statistics will also be presented, as they should be when using statistical analysis as your method of choice. The results of all these previously mentioned measures will be presented in the following section.

Since this thesis uses time geography as its theoretical framework, one could argue that it should also make use of the analysis methods generally connected to this theory. However, I have not chosen to follow that path in this thesis. The classic analysis choice within time geography is the use of space-time diaries which are then used to create space-time paths. As I intended to evaluate the large-scale situation when it comes to commuting to Skåne's regional centers, using space-time diaries where people note their travel habits would have needed a very large number of informants, which, at the bachelor thesis level, did not seem feasible. Therefore, to not have a problematically small sample or have to limit the area of analysis to a much smaller part of Skåne, I instead opted for the more general statistical approach, while keeping time geography only as the theoretical framework.

4. Results

In this section the results of the data collection and the following analyses are presented. The analyses which are used are correlation analysis, regression analysis, one-way ANOVA and two sample t-test. The statistical significance level is considered at the generally used $p \leq 0.05$.

4.1. Data introduction

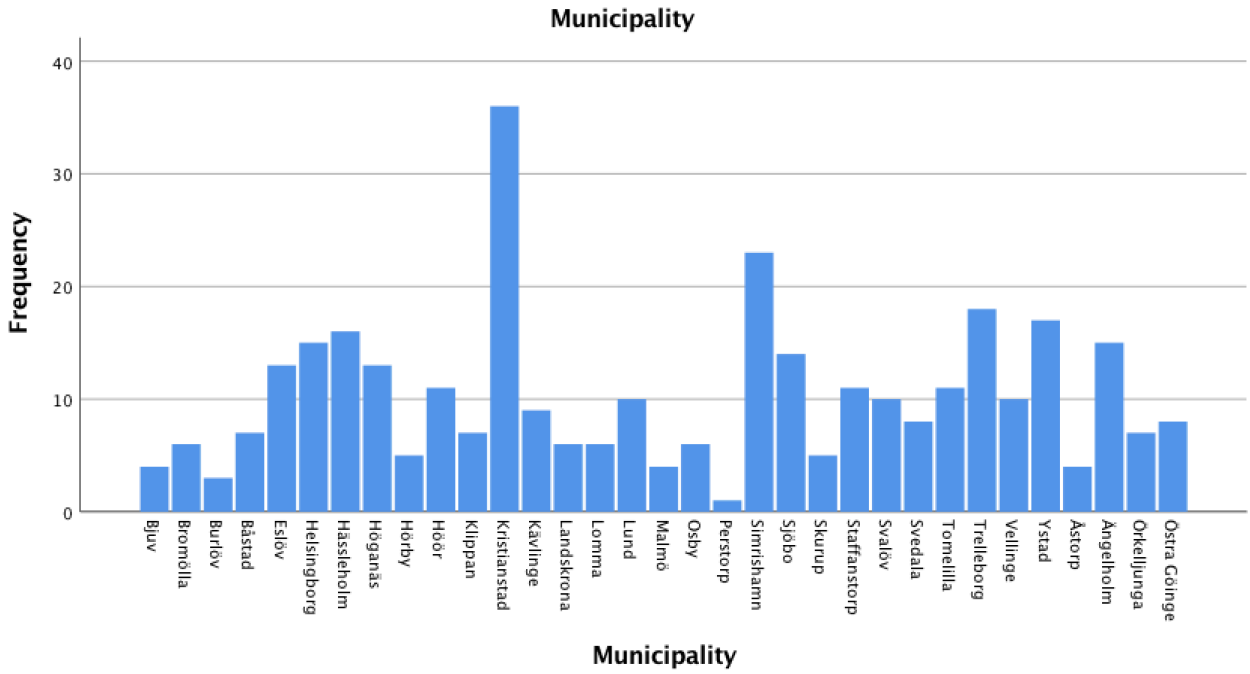

Figure 4.1.1. Frequency bar chart showing the frequency of represented municipalities

Kristianstad can be seen as standing out as the municipality where the largest number of urban areas with access through public transport to a regional center are located.

Table 4.1.1. Frequency table showing the frequency of represented municipalities

Municipality

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Bjuv	4	1,2	1,2	1,2
	Bromölla	6	1,8	1,8	2,9
	Burlöv	3	,9	,9	3,8
	Båstad	7	2,1	2,1	5,9
	Eslöv	13	3,8	3,8	9,7
	Helsingborg	15	4,4	4,4	14,2
	Hässleholm	16	4,7	4,7	18,9
	Höganäs	13	3,8	3,8	22,7
	Hörby	5	1,5	1,5	24,2
	Höör	11	3,2	3,2	27,4
	Klippan	7	2,1	2,1	29,5
	Kristianstad	36	10,6	10,6	40,1
	Kävlinge	9	2,7	2,7	42,8
	Landskrona	6	1,8	1,8	44,5
	Lomma	6	1,8	1,8	46,3
	Lund	10	2,9	2,9	49,3
	Malmö	4	1,2	1,2	50,4
	Osby	6	1,8	1,8	52,2
	Perstorp	1	,3	,3	52,5
	Simrishamn	23	6,8	6,8	59,3
	Sjöbo	14	4,1	4,1	63,4
	Skurup	5	1,5	1,5	64,9
	Staffanstorp	11	3,2	3,2	68,1
	Svalöv	10	2,9	2,9	71,1
	Svedala	8	2,4	2,4	73,5
	Tomelilla	11	3,2	3,2	76,7
	Trelleborg	18	5,3	5,3	82,0
	Vellinge	10	2,9	2,9	85,0
	Ystad	17	5,0	5,0	90,0
	Åstorp	4	1,2	1,2	91,2
	Ängelholm	15	4,4	4,4	95,6
	Örkelljunga	7	2,1	2,1	97,6
	Östra Göinge	8	2,4	2,4	100,0
	Total	339	100,0	100,0	

Kristianstad is the most represented municipality within the data, with 10.6% of the urban areas being located there. Simrishamn is second with 6.8%, and Trelleborg is third with 5.3% of urban areas being located there. The least represented municipality is Perstorp, with 0.3% and only one urban area which has access to a regional center through public transport. This is not entirely unexpected since Kristianstad has the largest number of urban areas (if not the most populous) in Skåne, and Perstorp has among the fewest, only having one locality, for example.

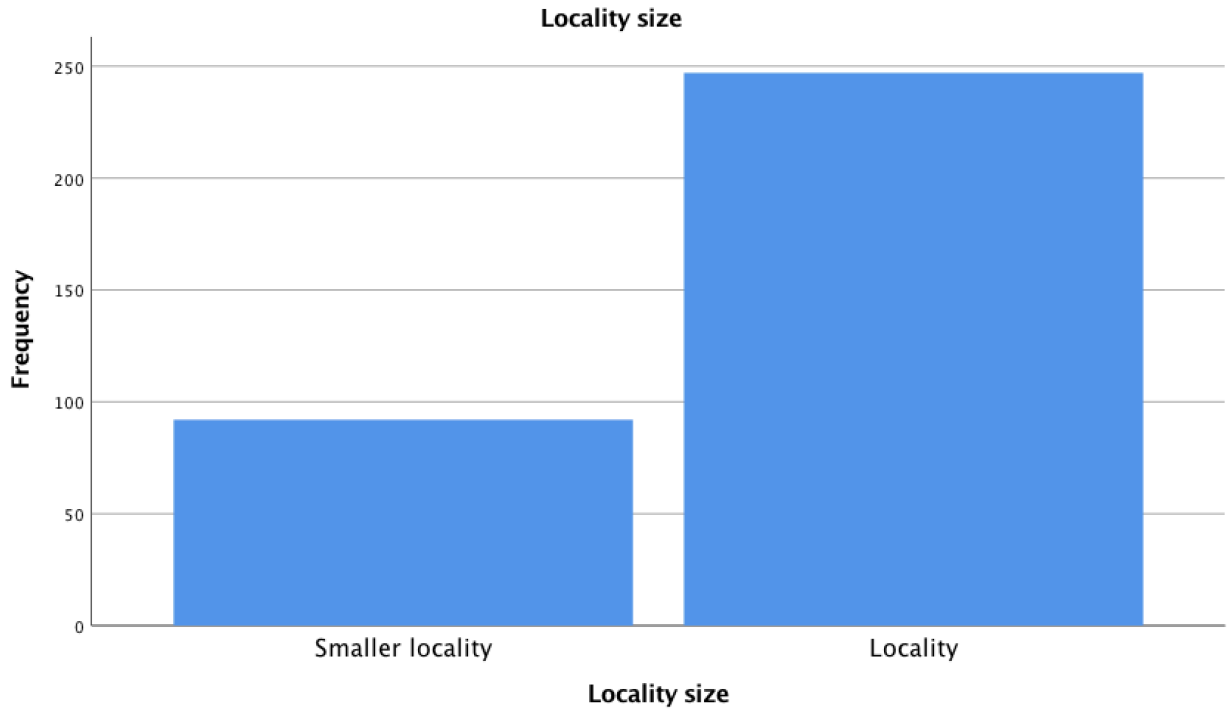

Figure 4.1.2. Frequency bar chart showing the frequency of the different locality sizes

This figure shows that localities are more represented within the data than smaller localities are.

Table 4.1.2. Frequency table showing the frequency of the different locality sizes

Locality size

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Smaller locality	92	27,1	27,1	27,1
	Locality	247	72,9	72,9	100,0
	Total	339	100,0	100,0	

This table shows that 72.9% of urban areas with access to a regional center through public transport are of the larger locality variety, while 27.1% are of the less populous smaller locality variety. This is noteworthy because most of Skåne's municipalities have about the same number, if not more, of smaller localities as they do localities.

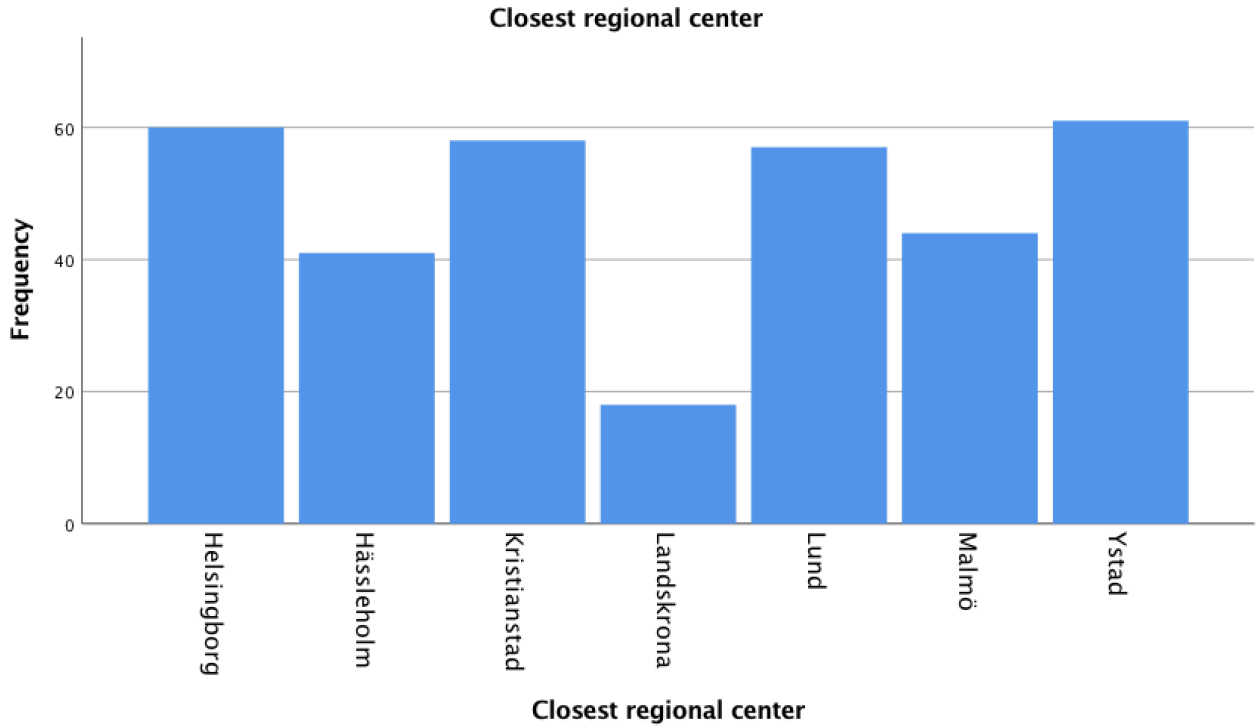

Figure 4.1.3. Frequency bar chart showing the frequency of the closest regional center

This figure shows that Ystad, Helsingborg, Kristianstad and Lund are the regional centers which are closest (measured in time) to the largest number of urban areas. Ystad appears to be the most popular destination, and Landskrona lags the furthest behind.

Table 4.1.3. Frequency table showing the frequency of the closest regional center

Closest regional center

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Helsingborg	60	17,7	17,7	17,7
	Hässleholm	41	12,1	12,1	29,8
	Kristianstad	58	17,1	17,1	46,9
	Landskrona	18	5,3	5,3	52,2
	Lund	57	16,8	16,8	69,0
	Malmö	44	13,0	13,0	82,0
	Ystad	61	18,0	18,0	100,0
	Total	339	100,0	100,0	

This table shows that Ystad is the closest regional center to 18.0% of urban areas with public transport access to a regional center. Helsingborg follows with 17.7%, Kristianstad with 17.1%, Lund with 16.8%, Malmö with 13.0%, Hässleholm with 12.1% and finally Landskrona with 5.3% of urban areas. A possible reason for Landskrona lagging behind is geographical. Urban areas located close to Landskrona will also be located fairly closely to Lund and Helsingborg, who may ”siphon off” some possible commuters. Hässleholm and Malmö may also ”suffer” from this, since they are fairly close to Kristianstad and Lund, respectively. Ystad on the other hand is located further from the other regional centers, and it may be therefore it covers more urban areas.

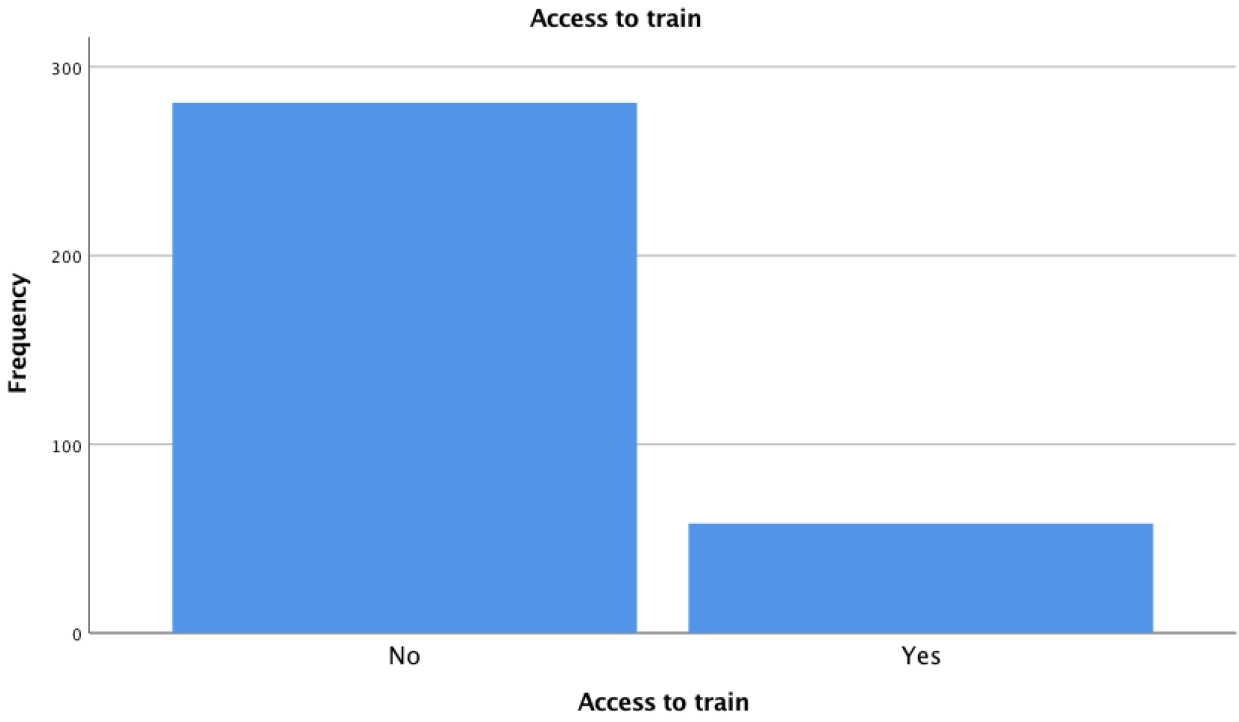

Figure 4.1.4. Frequency bar chart showing the frequency of urban areas having train access

This figure shows that an urban area which has access to a regional center through public transport is more likely to not have train access than to have it.

Table 4.1.4. Frequency table showing the frequency of urban areas having train access

Access to train

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	281	82,9	82,9	82,9
	Yes	58	17,1	17,1	100,0
	Total	339	100,0	100,0	

In this table it can be seen that 82.9% of urban areas represented in the data do not have access to the train network, while 17.1% of urban areas do. This is generally not surprising, since the bus

network is more extensive, as may be expected, since further developing the train network is much more expensive and labor intensive than extending the bus coverage.

Figure 4.1.5. Frequency bar chart showing the frequency of different modal numbers of transfers for urban areas

This figure shows that the largest number of urban areas have a modal number of transfers of 0, followed closely by 1, and that having a modal number transfers of 2 is very uncommon among urban areas with public transport access to regional centers.

Table 4.1.5. Frequency table showing the frequency of different modal numbers of transfers for urban areas

Number of transfers (mode)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	0	178	52,5	52,5	52,5
	1	156	46,0	46,0	98,5
	2	5	1,5	1,5	100,0
	Total	339	100,0	100,0	

In this table one can see that the modal number of transfers is 0 for 52.5% of the urban areas included in the analysis, the modal number is 1 for 46.0% and 2 for 1.5% of the urban areas. This can be seen as slightly surprising, and may speak to the public transport network in Skåne being fairly well-developed, meaning that commuters generally do not need to transfer more than once to reach a regional center. However, the caveat is the urban areas which have been omitted from this analysis, due to their lack of public transport access.

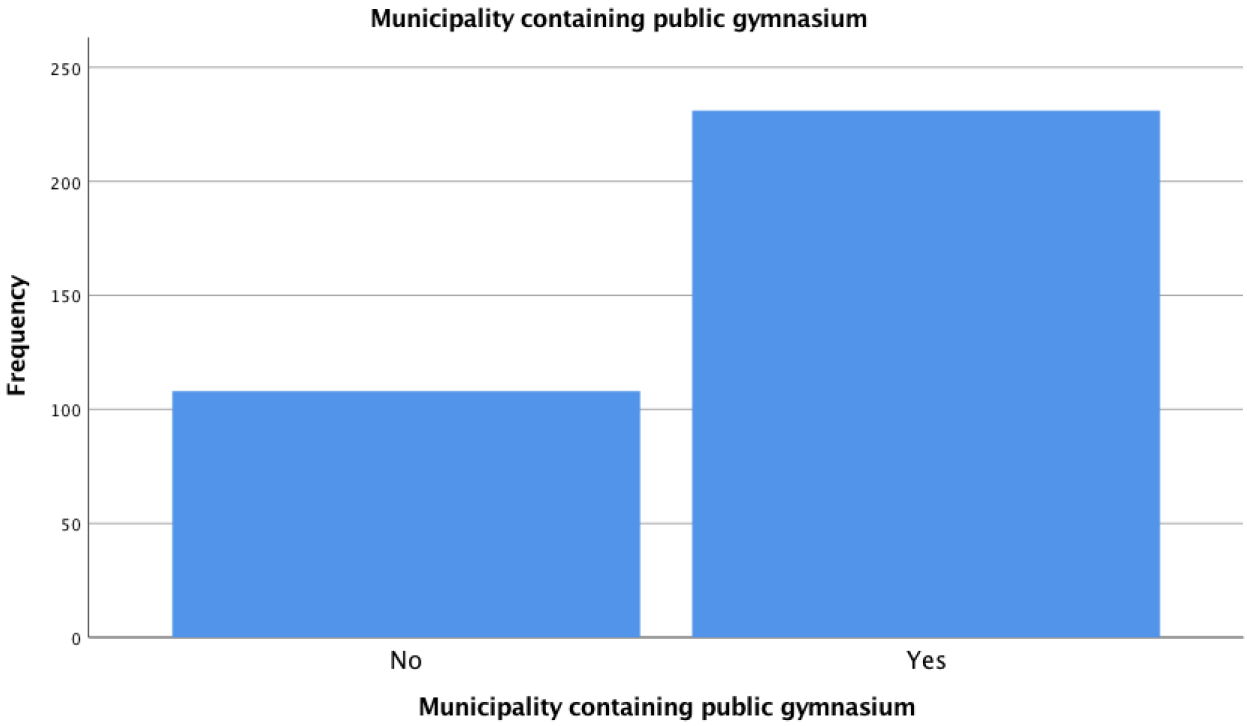

Figure 4.1.6. Frequency bar chart showing the frequency of urban areas within municipalities which contain a public gymnasium

The figure shows that more urban areas included in the analysis are located in municipalities containing public gymnasiums than in municipalities without public gymnasiums.

Table 4.1.6. Frequency table showing the frequency of urban areas within municipalities which contain a public gymnasium

Municipality containing public gymnasium

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	108	31,9	31,9	31,9
	Yes	231	68,1	68,1	100,0
	Total	339	100,0	100,0	

This table shows that 68.1% of urban areas which have access to a regional center through public transport are located in a municipality which runs a public gymnasium, while 31.9% of these urban areas are located in municipalities without public gymnasiums. This is not surprising, especially because urban areas in municipalities with regional centers (which, of course, have gymnasiums) may have better public transport access to regional centers than urban areas in other municipalities, and may therefore be included in this analysis to a larger extent.

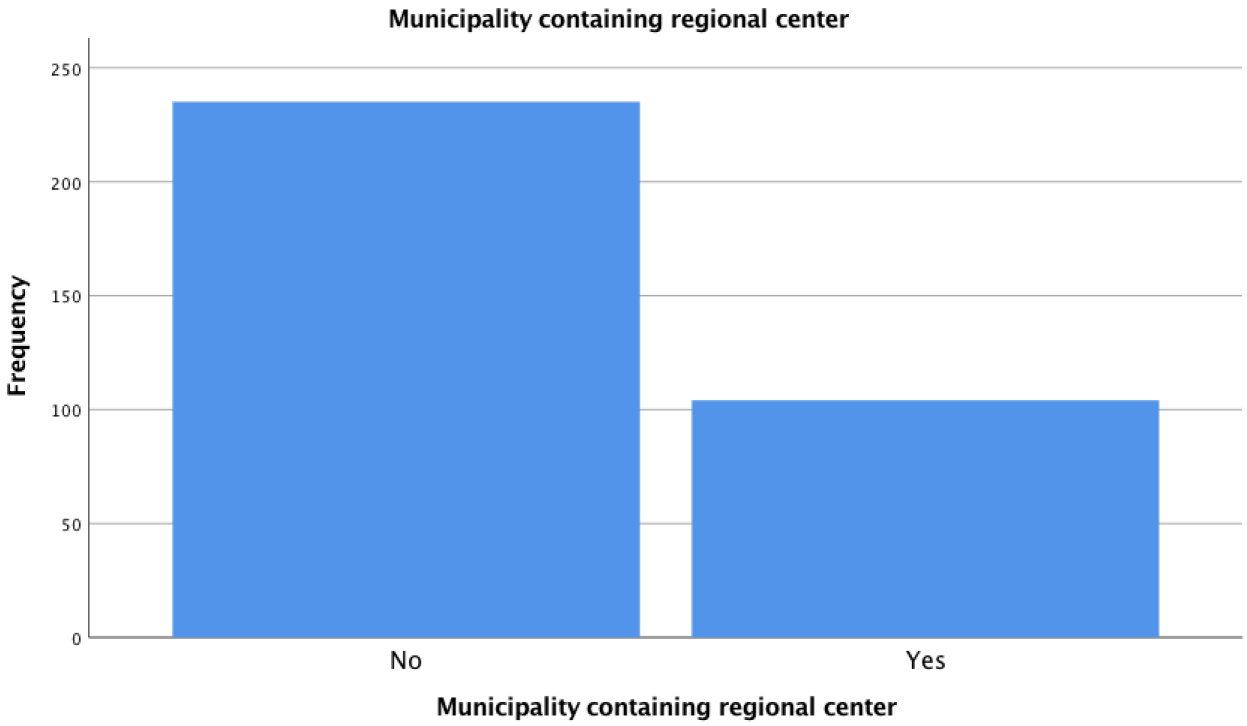

Figure 4.1.7. Frequency bar chart showing the frequency of urban areas within municipalities which contain a regional center

The figure shows that more urban areas included in the analysis are located in municipalities which do not contain a regional center than in municipalities with a regional center.

Table 4.1.7. Frequency table showing the frequency of urban areas within municipalities which contain a regional center

Municipality containing regional center

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	235	69,3	69,3	69,3
	Yes	104	30,7	30,7	100,0
	Total	339	100,0	100,0	

This table shows that 69.3% of urban areas with public transport access to regional centers are not located in municipalities where there is a regional center, meaning further that 30.7% of the urban areas included in this analysis are located in a municipality which also contains a regional center. This is not surprising, since only seven municipalities contain regional centers, leaving twenty-six municipalities without regional centers.

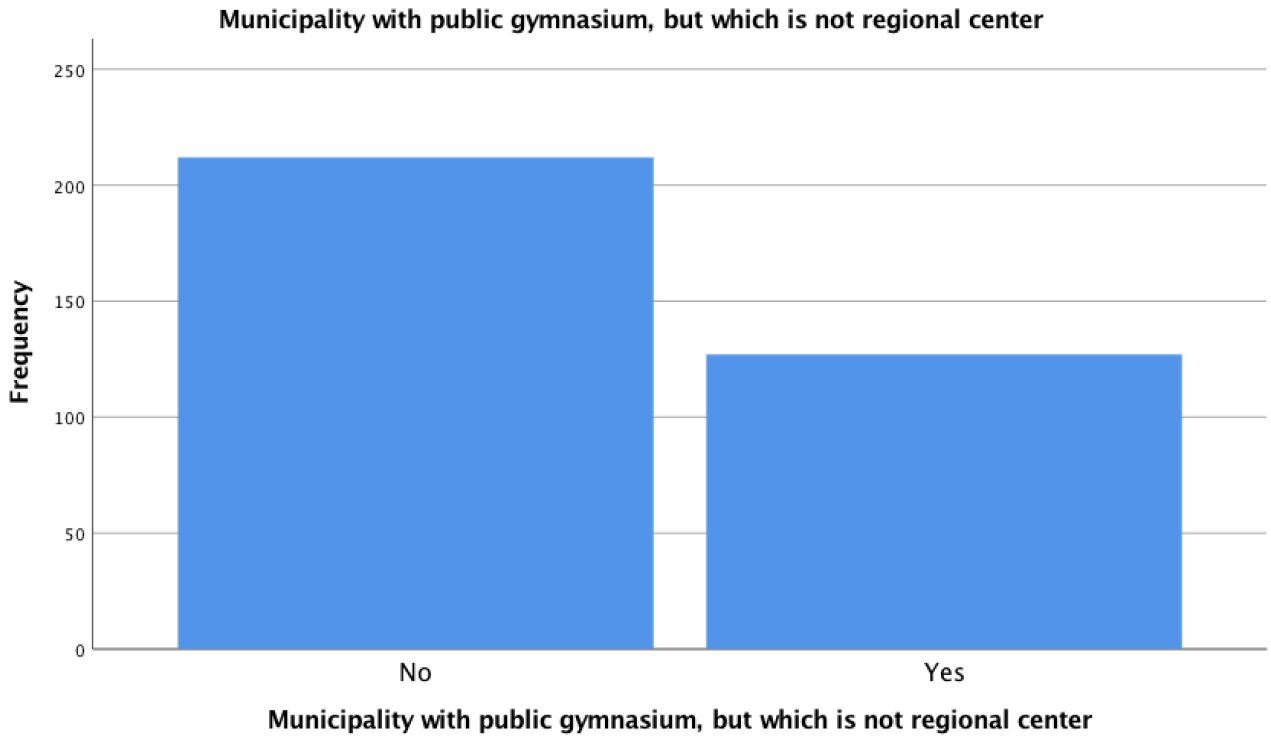

Figure 4.1.8. Frequency bar chart showing the frequency of urban areas within municipalities which contain a public gymnasium, but not a regional center

The figure shows that the larger number of urban areas included in the analysis are located in municipalities which do not fall into the category of having a public gymnasium but not a regional center. Meaning that a majority of urban areas included are located in municipalities which either do not have public gymnasiums, or, if they do, also contain a regional center.

Table 4.1.8. Frequency bar chart showing the frequency of urban areas within municipalities which contain a public gymnasium, but not a regional center

Municipality with public gymnasium, but which is not regional center

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	212	62,5	62,5	62,5
	Yes	127	37,5	37,5	100,0
	Total	339	100,0	100,0	

This table shows that 62.5% of all urban areas included in the data are not located in municipalities which fall into the category of having a public gymnasium, but not a regional center. This leaves 37.5% of the urban areas being located in municipalities which do fall into that category. This means that a majority of urban areas included are located in municipalities which either do not have public gymnasiums, or, if they do, also contain a regional center. This is not surprising, since seven municipalities contain regional centers and several municipalities completely lack gymnasiums.

Table 4.1.9. Descriptive statistics concerning average travel time per urban area

Statistics

Average travel time (minutes)

N	Valid	339
	Missing	0
Mean		39,26
Median		38,00
Mode		26
Std. Deviation		17,982
Range		92
Minimum		6
Maximum		98
Percentiles	25	26,00
	50	38,00
	75	51,00

This table shows descriptive statistics for the average travel time for each urban area. It shows the mean, median, mode, standard deviation, range, minimum, maximum as well as percentiles. As mean > median > mode the distribution of the values is positively skewed.

4.2. Statistical relationships

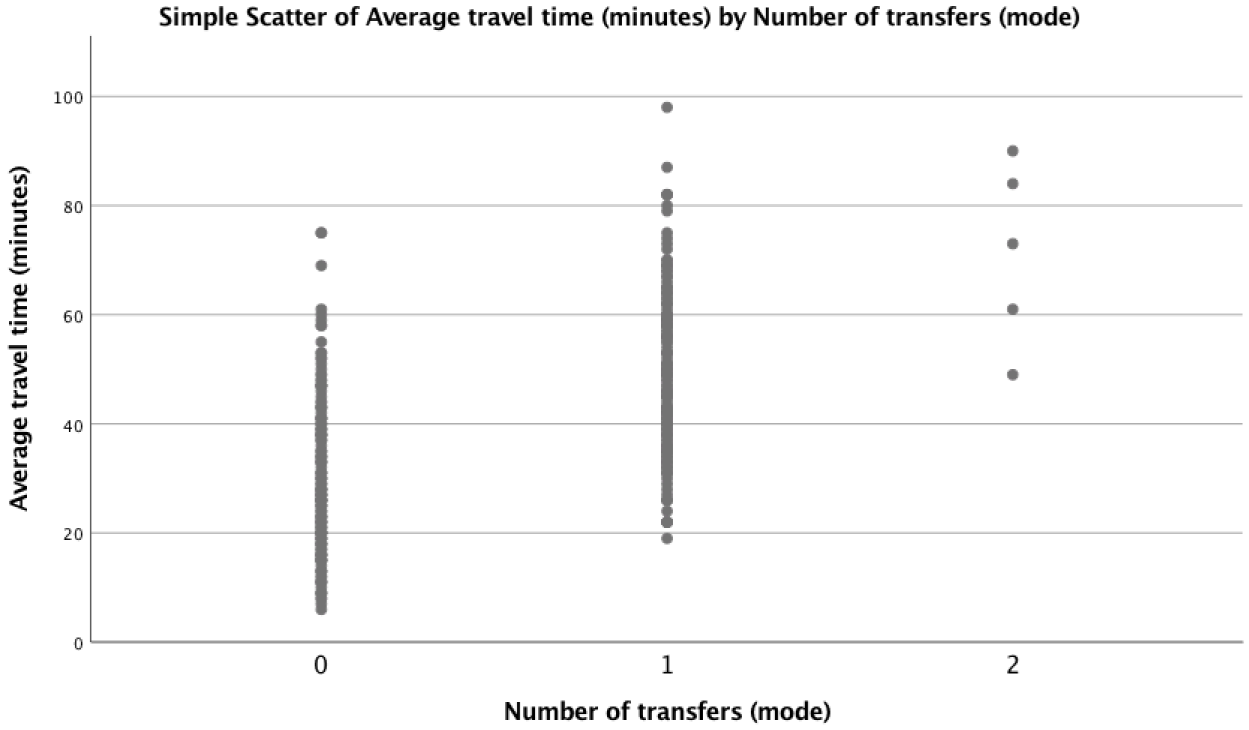

Figure 4.2.1. Scatter plot of the relationship between the modal number of transfers and the average travel time

The scatter plot seems to show a somewhat positive correlation between the modal number of transfers and the average travel time.

Table 4.2.1. Correlation analysis between average travel time and modal number of transfers

Correlations

		Average travel time (minutes)	Number of transfers (mode)
Average travel time (minutes)	Pearson Correlation	1	,593**
	Sig. (2-tailed)		,000
	N	339	339
Number of transfers (mode)	Pearson Correlation	,593**	1
	Sig. (2-tailed)	,000	
	N	339	339

**. Correlation is significant at the 0.01 level (2-tailed).

Based on the analysis we can state that average travel time and modal number of transfers are moderately positively correlated, and that this is statistically significant ($r = 0.593$, $p = 0.000$). This cannot be considered a surprise, as a less direct commute which includes transfers can be expected to take longer, and, of course, the transfers themselves and the wait also take time.

Table 4.2.2. Regression analysis between average travel time (dependent) and modal number of transfers (independent)

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	,593[a]	,352	,350	14,494

a. Predictors: (Constant), Number of transfers (mode)

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	38493,630	1	38493,630	183,236	,000[b]
	Residual	70796,004	337	210,077		
	Total	109289,634	338			

a. Dependent Variable: Average travel time (minutes)

b. Predictors: (Constant), Number of transfers (mode)

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	29,391	1,073		27,389	,000
	Number of transfers (mode)	20,160	1,489	,593	13,536	,000

a. Dependent Variable: Average travel time (minutes)

The analysis shows that 35.2% of variation in average travel time can be connected to modal number of transfers (as $r^2 = 0.352$). This model is statistically significant, as $p = 0.000$. If the modal number of transfers increases by 1, the average travel time increases by 20.160 minutes. This coefficient is statically significant as $p = 0.000$. Once again, as noted for the correlation analysis, this is not surprising.

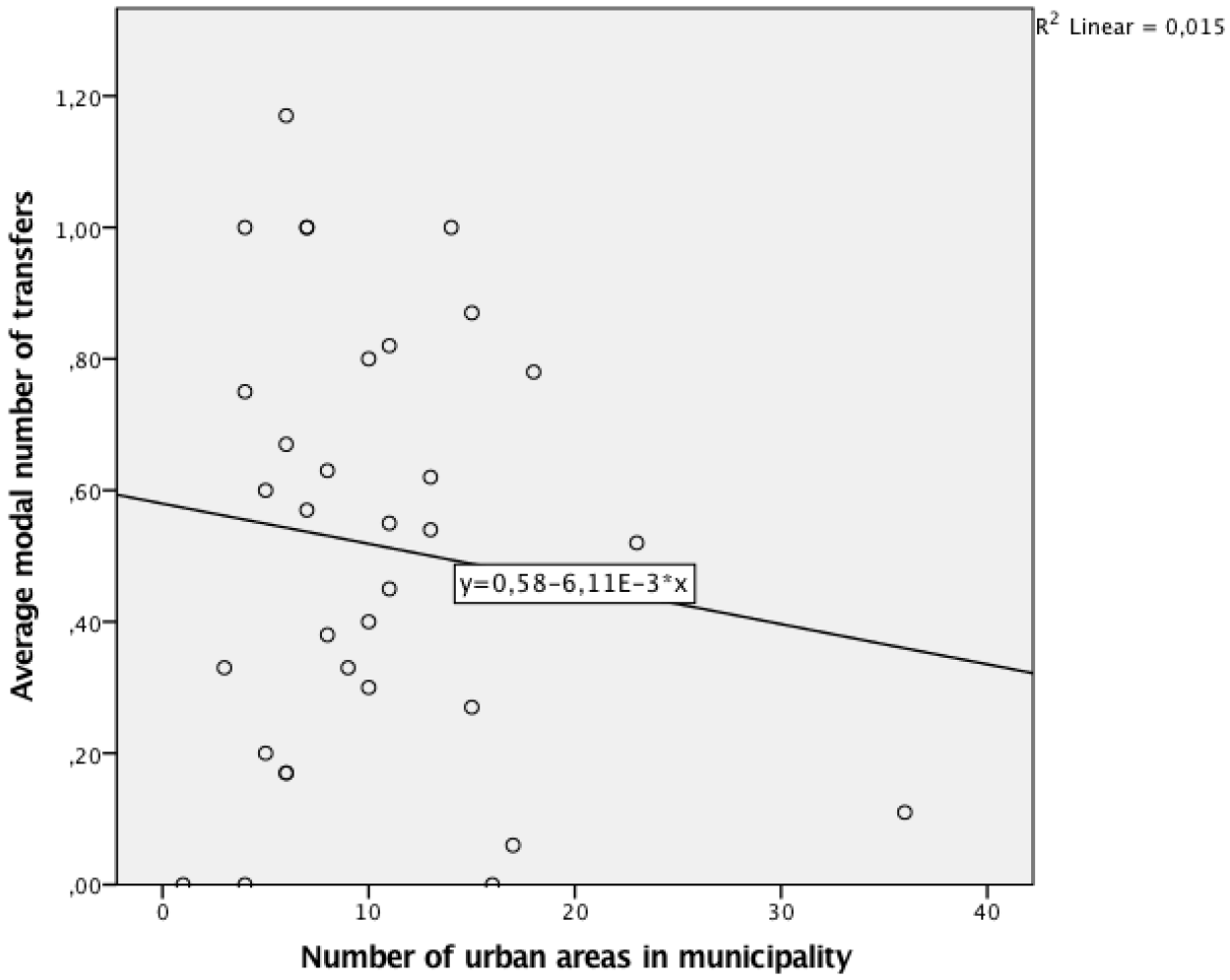

Figure 4.2.2. Scatter plot of the relationship between the number of urban areas with public transport access to a regional center in a municipality and the average modal number of transfers for urban areas in the municipality in reaching a regional center

The scatterplot seems to show a possible slight negative correlation between the two variables.

Table 4.2.3. Correlation analysis between the number of urban areas with public transport access to a regional center in a municipality and the average modal number of transfers for urban areas in the municipality in reaching a regional center

Correlations

		Number of urban areas in municipality	Average modal number of transfers
Number of urban areas in municipality	Pearson Correlation	1	-,124
	Sig. (2-tailed)		,492
	N	33	33
Average modal number of transfers	Pearson Correlation	-,124	1
	Sig. (2-tailed)	,492	
	N	33	33

Based on the analysis we can state that there is no statistically significant correlation between the two variables (since p = 0.492). This is slightly surprising, as one might assume that a municipality where a higher number of urban areas have access would also have a lower modal number of transfers, as its public transport access would be better ”all around”. However, that is not the case.

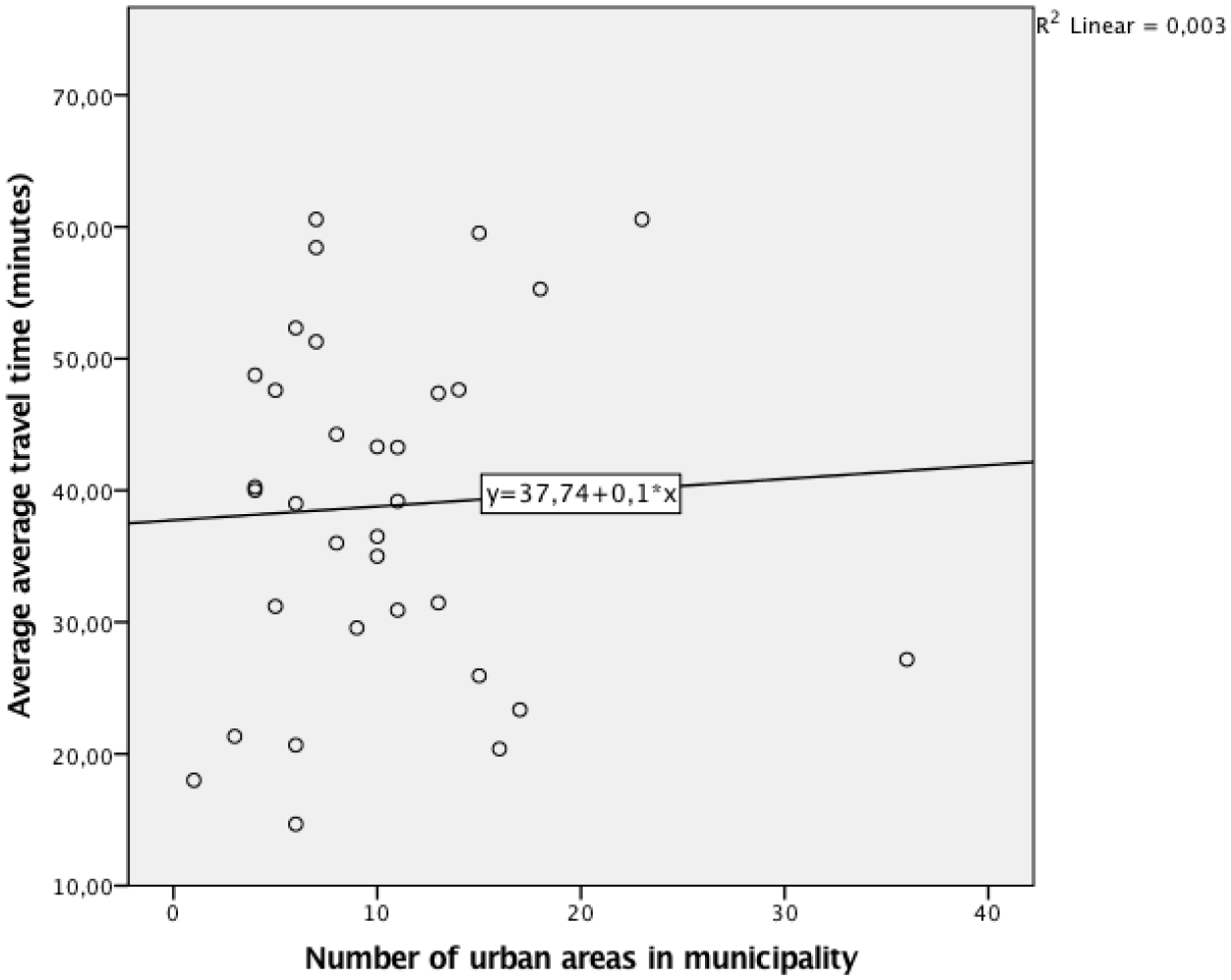

Figure 4.2.3. Scatter plot of the relationship between the number of urban areas with public transport access to a regional center in a municipality and the average average travel time for urban areas in the municipality in reaching a regional center

The scatter plot seems to show a very slight positive correlation, though likely no significant correlation at all.

Table 4.2.4. Correlation analysis between the number of urban areas with public transport access to a regional center in a municipality and the average average travel time for urban areas in the municipality in reaching a regional center

Correlations

		Average average travel time (minutes)	Number of urban areas in municipality
Average average travel time (minutes)	Pearson Correlation	1	,054
	Sig. (2-tailed)		,767
	N	33	33
Number of urban areas in municipality	Pearson Correlation	,054	1
	Sig. (2-tailed)	,767	
	N	33	33

Based on the analysis we can state that there is no statistically significant correlation between the two variables (since p = 0.767). This is once again slightly surprising, as, as mentioned concerning transfers, one may assume that a municipality where more urban areas have access would have better access all around.

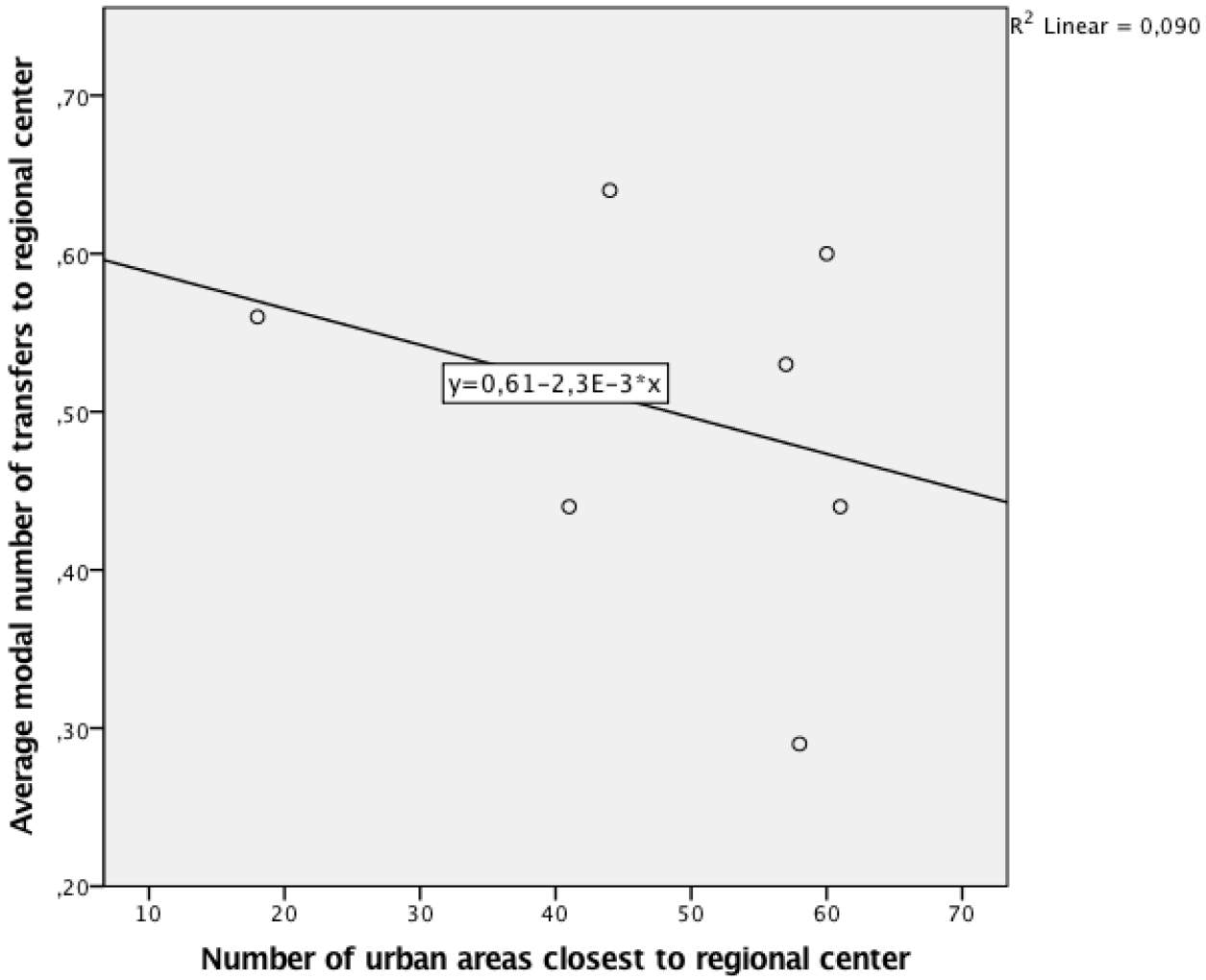

Figure 4.2.4. Scatter plot of the relationship between the number of urban areas closest to a regional center and the average modal number of transfers for urban areas when reaching that regional center

The scatter plot seems to show a negative correlation between the variables.

Table 4.2.5. Correlation analysis between the number of urban areas closest to a regional center and the average modal number of transfers for urban areas when reaching that regional center

Correlations

		Number of urban areas closest to regional center	Average modal number of transfers to regional center
Number of urban areas closest to regional center	Pearson Correlation	1	-,300
	Sig. (2-tailed)		,513
	N	7	7
Average modal number of transfers to regional center	Pearson Correlation	-,300	1
	Sig. (2-tailed)	,513	
	N	7	7

Based on the analysis we can state that there is no statistically significant correlation between the two variables (since p = 0.513). This is slightly surprising, as one may assume that a regional center which a lot of urban areas have public transport access to would also be easily accessibly, with less transfers needed. However, this is not the case.

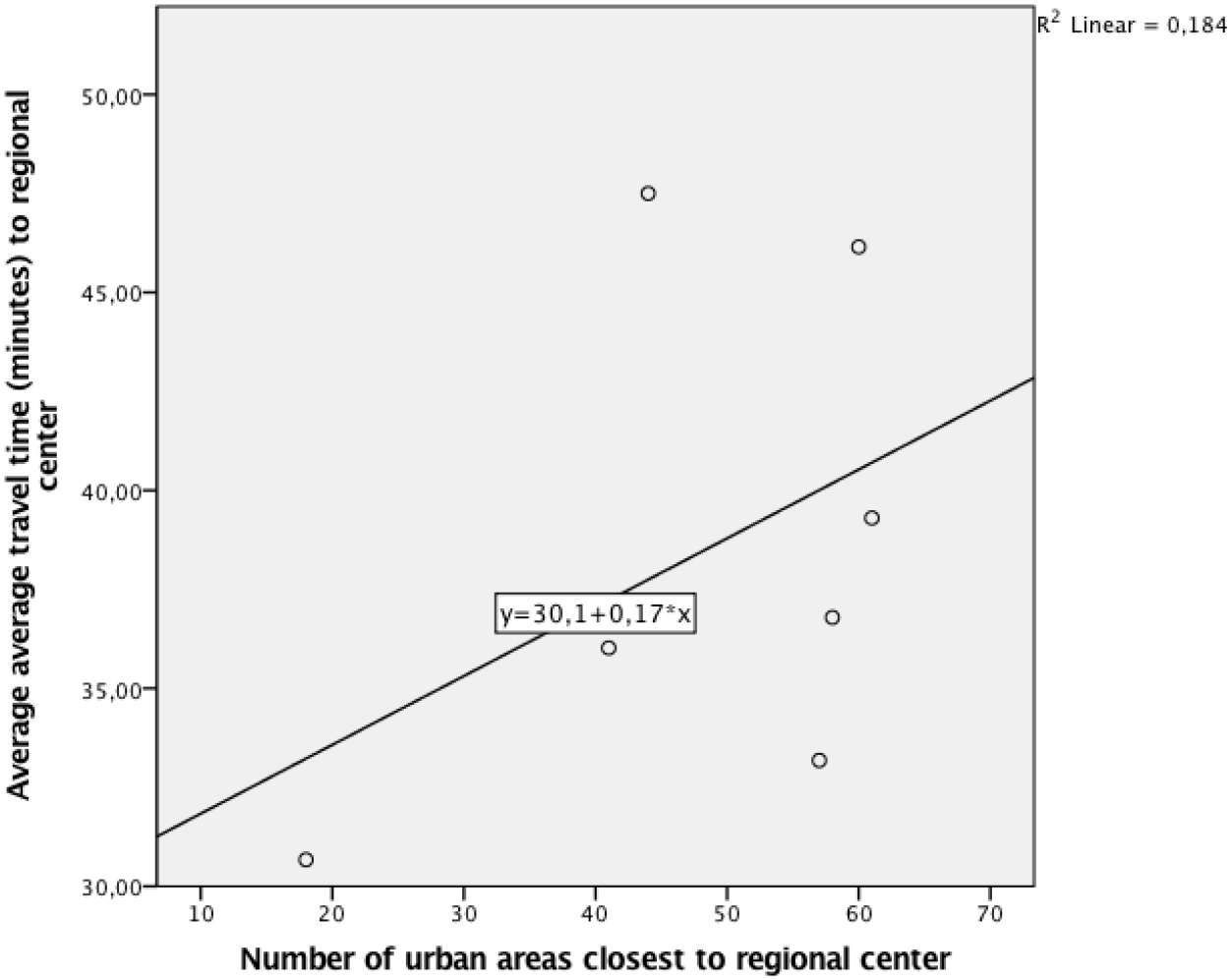

Figure 4.2.5. Scatter plot of the relationship between the number of urban areas closest to a regional center and the average average travel time for urban areas when reaching that regional center

The scatter plot seems to show a positive correlation between the variables.

Table 4.2.6. Correlation analysis between the number of urban areas closest to a regional center and the average average travel time for urban areas when reaching that regional center

Correlations

		Number of urban areas closest to regional center	Average average travel time (minutes) to regional center
Number of urban areas closest to regional center	Pearson Correlation	1	,430
	Sig. (2-tailed)		,336
	N	7	7
Average average travel time (minutes) to regional center	Pearson Correlation	,430	1
	Sig. (2-tailed)	,336	
	N	7	7

Based on the analysis we can state that there is no statistically significant correlation between the two variables (since p = 0.336). As mentioned concerning transfers, this is slightly surprising, as one might assume that a regional center which many urban areas have public transport access to would also be quickly accessible.

4.3. Comparing means

Table 4.3.1. Two sample t-test between urban area size and modal number of transfers

Group Statistics

	Locality size	N	Mean	Std. Deviation	Std. Error Mean
Number of transfers (mode)	Locality	247	,43	,528	,034
	Smaller locality	92	,64	,505	,053

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Number of transfers (mode)	Equal variances assumed	2,690	,102	-3,264	337	,001	-,208	,064	-,334	-,083
	Equal variances not assumed			-3,334	170,006	,001	-,208	,062	-,331	-,085

This test shows that there is a statistically significant difference in the modal number of transfers between urban areas of different sizes, as p = 0.001. Smaller localities have a higher mean modal number of transfers and the localities do, with smaller localities' mean modal number of transfers being 0.64 and the localities' being 0.43. Smaller localities having a higher transfer number is not completely unexpected, yet it is noteworthy that both means are less than 1.

Table 4.3.2. Two sample t-test between urban area size and average travel time

Group Statistics

	Locality size	N	Mean	Std. Deviation	Std. Error Mean
Average travel time (minutes)	Smaller locality	92	43,55	18,158	1,893
	Locality	247	37,66	17,687	1,125

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Average travel time (minutes)	Equal variances assumed	,221	,639	2,707	337	,007	5,890	2,176	1,610	10,171
	Equal variances not assumed			2,675	159,323	,008	5,890	2,202	1,541	10,240

This test shows that there is a statistically significant difference in average travel time between urban areas of different sizes, as p = 0.007. The smaller localities have a longer mean travel time

than the localities do, with smaller localities' mean travel time being 43.55 minutes and localities' being 37.66 minutes. Seeing a difference here is not unexpected.

Table 4.3.3. One-way ANOVA between municipalities and modal number of transfers

Descriptives

Number of transfers (mode)

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Hässleholm	16	,00	,000	,000	,00	,00	0	0
Kristianstad	36	,11	,319	,053	,00	,22	0	1
Osby	6	1,17	,753	,307	,38	1,96	0	2
Sjöbo	14	1,00	,000	,000	1,00	1,00	1	1
Östra Göinge	8	,38	,518	,183	-,06	,81	0	1
Lund	10	,40	,516	,163	,03	,77	0	1
Ängelholm	15	,87	,352	,091	,67	1,06	0	1
Hörby	5	,60	,548	,245	-,08	1,28	0	1
Eslöv	13	,54	,519	,144	,22	,85	0	1
Tomelilla	11	,45	,522	,157	,10	,81	0	1
Simrishamn	23	,52	,511	,106	,30	,74	0	1
Svalöv	10	,80	,632	,200	,35	1,25	0	2
Klippan	7	1,00	,000	,000	1,00	1,00	1	1
Ystad	17	,06	,243	,059	-,07	,18	0	1
Helsingborg	15	,27	,458	,118	,01	,52	0	1
Trelleborg	18	,78	,428	,101	,57	,99	0	1
Örkelljunga	7	,57	,535	,202	,08	1,07	0	1
Höör	11	,82	,405	,122	,55	1,09	0	1
Svedala	8	,63	,518	,183	,19	1,06	0	1
Båstad	7	1,00	,000	,000	1,00	1,00	1	1
Skurup	5	,20	,447	,200	-,36	,76	0	1
Bromölla	6	,67	,516	,211	,12	1,21	0	1
Perstorp	1	,00	.	.	.	.	0	0
Malmö	4	,75	,500	,250	-,05	1,55	0	1
Kävlinge	9	,33	,500	,167	-,05	,72	0	1
Höganäs	13	,62	,506	,140	,31	,92	0	1
Vellinge	10	,30	,483	,153	-,05	,65	0	1
Landskrona	6	,17	,408	,167	-,26	,60	0	1
Bjuv	4	1,00	1,155	,577	-,84	2,84	0	2
Staffanstorp	11	,55	,522	,157	,19	,90	0	1
Åstorp	4	,00	,000	,000	,00	,00	0	0
Lomma	6	,17	,408	,167	-,26	,60	0	1
Burlöv	3	,33	,577	,333	-1,10	1,77	0	1
Total	339	,49	,529	,029	,43	,55	0	2

ANOVA

Number of transfers (mode)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	34,487	32	1,078	5,476	,000
Within Groups	60,227	306	,197		
Total	94,714	338			

This test shows that which municipality one travels from has a statistically significant effect on the modal number of transfers, as $p = 0.000$. Osby is the municipality with the highest mean modal number of transfers with 1.17, as it is one of only two municipalities with the modal number 2 transfers represented (The other being Bjuv, which has a mean modal number of 1.). Three municipalities have the mean model number 0: Hässleholm, Perstorp and Åstorp. Hässleholm is a regional center municipality, which likely simplifies the commute for residents there. Perstorp is located right next to Hässleholm and only has one urban area included in the analysis, and that urban area has train access, which likely simplifies the commute process. The lack of transfers needed for urban areas in Åstorp is less easy to explain, however the municipality is located quite close to the regional center Helsingborg.

Table 4.3.4. One-way ANOVA between municipalities and average travel time

Descriptives

Average travel time (minutes)

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Hässleholm	16	20,38	8,778	2,194	15,70	25,05	8	39
Kristianstad	36	27,17	11,666	1,944	23,22	31,11	7	60
Osby	6	52,33	28,374	11,584	22,56	82,11	26	90
Sjöbo	14	47,64	10,172	2,719	41,77	53,52	31	64
Östra Göinge	8	36,00	8,384	2,964	28,99	43,01	20	47
Lund	10	35,00	10,435	3,300	27,54	42,46	15	47
Ängelholm	15	59,53	14,392	3,716	51,56	67,50	40	98
Hörby	5	47,60	12,992	5,810	31,47	63,73	33	67
Eslöv	13	31,46	13,950	3,869	23,03	39,89	9	53
Tomelilla	11	43,27	22,141	6,676	28,40	58,15	19	87
Simrishamn	23	60,57	10,259	2,139	56,13	65,00	39	82
Svalöv	10	43,30	16,405	5,188	31,56	55,04	21	73
Klippan	7	51,29	6,849	2,589	44,95	57,62	43	62
Ystad	17	23,35	16,624	4,032	14,81	31,90	6	82
Helsingborg	15	25,93	12,032	3,107	19,27	32,60	9	56
Trelleborg	18	55,28	12,979	3,059	48,82	61,73	37	82
Örkelljunga	7	60,57	11,208	4,236	50,21	70,94	47	70
Höör	11	39,18	8,987	2,710	33,14	45,22	20	52
Svedala	8	44,25	19,404	6,860	28,03	60,47	24	72
Båstad	7	58,43	6,579	2,487	52,34	64,51	49	69
Skurup	5	31,20	7,190	3,216	22,27	40,13	21	40
Bromölla	6	39,00	6,782	2,769	31,88	46,12	32	49
Perstorp	1	18,00	.	.	.	.	18	18
Malmö	4	40,25	22,633	11,316	4,24	76,26	26	74
Kävlinge	9	29,56	9,396	3,132	22,33	36,78	11	42
Höganäs	13	47,38	10,324	2,863	41,15	53,62	28	58
Vellinge	10	36,50	7,649	2,419	31,03	41,97	23	52
Landskrona	6	14,67	6,593	2,692	7,75	21,59	9	26
Bjuv	4	48,75	10,658	5,329	31,79	65,71	35	61
Staffanstorp	11	30,91	10,464	3,155	23,88	37,94	12	46
Åstorp	4	40,00	10,296	5,148	23,62	56,38	28	53
Lomma	6	20,67	6,802	2,777	13,53	27,80	11	30
Burlöv	3	21,33	1,155	,667	18,46	24,20	20	22
Total	339	39,26	17,982	,977	37,34	41,18	6	98

ANOVA

Average travel time (minutes)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	60237,477	32	1882,421	11,743	,000
Within Groups	49052,158	306	160,301		
Total	109289,634	338			

This test shows that which municipality one travels from has a statistically significant effect on the average travel time, as p = 0.000. The shortest mean travel time is 14.67 minutes, for urban areas in Landskrona. Landskrona is a regional center municipality, and it is therefore not surprising that those urban areas would experience a shorter travel time. Eleven municipalities have mean travel times longer than the 45 minutes generally considered an acceptable travel time (Skolverket 2011). Those are Osby, Sjöbo, Ängelholm, Hörby, Simrishamn, Klippan, Trelleborg, Örkelljunga, Båstad, Höganäs and Bjuv. Four of these, Ängelholm, Simrishamn, Örkelljunga and Båstad have mean travel times at about an hour. Why this is is not immediately clear, as three of these municipalities (all but Båstad) border a regional center municipality.

Table 4.3.5. Two sample t-test between access to trains and modal number of transfers

Group Statistics

	Access to train	N	Mean	Std. Deviation	Std. Error Mean
Number of transfers (mode)	No	281	,52	,535	,032
	Yes	58	,33	,473	,062

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Number of transfers (mode)	Equal variances assumed	15,124	,000	2,583	337	,010	,196	,076	,047	,344
	Equal variances not assumed			2,799	89,720	,006	,196	,070	,057	,334

This test shows that there is a statistically significant difference in modal number of transfers between urban areas with and urban areas without access to train travel, as p = 0.006. The mean modal number of transfers for urban areas with access to the train network is 0.33 and for urban areas without train access the mean modal number of transfers is 0.52. This can be considered quite expected, since trains can generally be assumed to lead to more direct commutes than buses, especially when the destination is chosen by proximity.

Table 4.3.6. Two sample t-test between access to trains and average travel time

Group Statistics

	Access to train	N	Mean	Std. Deviation	Std. Error Mean
Average travel time (minutes)	No	281	41,67	17,836	1,064
	Yes	58	27,59	13,687	1,797

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Average travel time (minutes)	Equal variances assumed	5,474	,020	5,677	337	,000	14,086	2,481	9,206	18,967
	Equal variances not assumed			6,745	101,423	,000	14,086	2,089	9,944	18,229

This test shows that there is a statically significant difference in average travel time between urban areas with and urban areas without access to train travel, as p = 0.000. The average travel time for urban areas with access to the train network is 27.59 minutes, and for urban areas without train access the average travel time is 41.67 minutes. Once again, as discussed concerning transfers, this is not unexpected.

Table 4.3.7. One-way ANOVA between urban areas' closest regional center and modal number of transfers

Descriptives

Number of transfers (mode)

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Hässleholm	41	,44	,502	,078	,28	,60	0	1
Kristianstad	58	,29	,530	,070	,15	,43	0	2
Lund	57	,53	,504	,067	,39	,66	0	1
Ystad	61	,44	,501	,064	,31	,57	0	1
Helsingborg	60	,60	,527	,068	,46	,74	0	2
Malmö	44	,64	,487	,073	,49	,78	0	1
Landskrona	18	,56	,705	,166	,21	,91	0	2
Total	339	,49	,529	,029	,43	,55	0	2

ANOVA

Number of transfers (mode)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4,313	6	,719	2,640	,016
Within Groups	90,401	332	,272		
Total	94,714	338			

This test shows that which regional center one travels to has a statistically significant effect on the modal number of transfers, as p = 0.016. The mean modal number of transfers varies from 0.29 for commutes to Kristianstad to 0.64 for commuters to Malmö. All the mean modal numbers are below 1, which could be seen to indicate quite straight-forward commuting regardless of the regional center.

Table 4.3.8. One-way ANOVA between urban areas' closest regional center and average travel time

Descriptives

Average travel time (minutes)

	N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
					Lower Bound	Upper Bound		
Hässleholm	41	36,02	18,220	2,846	30,27	41,78	8	70
Kristianstad	58	36,79	19,104	2,509	31,77	41,82	7	90
Lund	57	33,18	12,437	1,647	29,88	36,48	9	67
Ystad	61	39,30	17,276	2,212	34,87	43,72	6	82
Helsingborg	60	46,15	16,660	2,151	41,85	50,45	9	98
Malmö	44	47,50	19,276	2,906	41,64	53,36	18	87
Landskrona	18	30,67	19,140	4,511	21,15	40,18	9	73
Total	339	39,26	17,982	,977	37,34	41,18	6	98

ANOVA

Average travel time (minutes)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	10057,557	6	1676,260	5,608	,000
Within Groups	99232,077	332	298,892		
Total	109289,634	338			

This test shows that which regional center one travels to has a statistically significant effect on the average travel time, as p = 0.000. The average travel times vary from 30.67 minutes for commuters to Landskrona to 47.50 minutes for commuters to Malmö. Only two of the average travel times, the average for Malmö and the average for Helsingborg (which is 46.15 minutes) are just above the generally accepted commute length of 45 minutes (Skolverket 2011).

Table 4.3.9. Two sample t-test between urban areas being located in municipalities with or without public gymnasiums and modal number of transfers

Group Statistics

	Municipality containing public gymnasium	N	Mean	Std. Deviation	Std. Error Mean
Number of transfers (mode)	No	108	,53	,538	,052
	Yes	231	,47	,526	,035

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Number of transfers (mode)	Equal variances assumed	,253	,615	,906	337	,366	,056	,062	-,065	,177
	Equal variances not assumed			,899	205,026	,370	,056	,062	-,067	,179

This test shows that there is no statistically significant difference in modal number of transfers between urban areas located in municipalities with or without public gymnasiums, as p = 0.366. The mean modal number of transfers for municipalities with a public gymnasium is 0.47 and the mean modal number of transfers for municipalities without a public gymnasium is 0.53. That the difference is insignificant is not necessarily surprising, since the number of transfers is calculated to the nearest regional center, not the nearest gymnasium, meaning that for many of the urban areas included in this analysis, their status as being located in a municipality with a gymnasium is irrelevant.

Table 4.3.10. Two sample t-test between urban areas being located in municipalities with or without public gymnasiums and average travel time

Group Statistics

	Municipality containing public gymnasium	N	Mean	Std. Deviation	Std. Error Mean
Average travel time (minutes)	No	108	37,24	13,291	1,279
	Yes	231	40,21	19,753	1,300

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Average travel time (minutes)	Equal variances assumed	35,090	,000	-1,418	337	,157	-2,967	2,093	-7,084	1,150
	Equal variances not assumed			-1,627	295,495	,105	-2,967	1,823	-6,556	,621

This test shows that there is no statistically significant difference in average travel time between urban areas located in municipalities with or without public gymnasiums, as p = 0.105. The average travel time for urban areas in municipalities with a public gymnasium is 40.21 minutes, while for urban areas in municipalities without a public gymnasium the average travel time is 37.24 minutes. That the difference is insignificant is not necessarily surprising, as explained above concerning transfers.

Table 4.3.11. Two sample t-test between urban areas being located in municipalities with or without regional centers and modal number of transfers

Group Statistics

	Municipality containing regional center	N	Mean	Std. Deviation	Std. Error Mean
Number of transfers (mode)	No	235	,63	,525	,034
	Yes	104	,16	,372	,036

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Number of transfers (mode)	Equal variances assumed	80,387	,000	8,266	337	,000	,471	,057	,359	,583
	Equal variances not assumed			9,410	272,010	,000	,471	,050	,372	,569

This test shows that there is a statistically significant difference in modal number of transfers between urban areas located in municipalities with or without regional centers, as p = 0.000. The

mean modal number of transfers for urban areas located in regional center municipalities is 0.16, while for the remaining municipalities the mean modal number of transfers is 0.63. This is a big and significant difference, but not a surprising one. It is natural to assume that urban areas located close to a regional center will have a simple commute, demanding fewer transfers.

Table 4.3.12. Two sample t-test between urban areas being located in municipalities with or without regional centers and average travel time

Group Statistics

	Municipality containing regional center	N	Mean	Std. Deviation	Std. Error Mean
Average travel time (minutes)	No	235	45,20	16,558	1,080
	Yes	104	25,86	13,281	1,302

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Average travel time (minutes)	Equal variances assumed	9,715	,002	10,507	337	,000	19,340	1,841	15,719	22,961
	Equal variances not assumed			11,431	242,869	,000	19,340	1,692	16,007	22,673

This test shows that there is a statistically significant difference in average travel time between urban areas located in municipalities with or without regional centers, as p = 0.000. The average travel time for urban areas located in regional center municipalities is 25.86 minutes, while for the remaining municipalities the average travel time is 45.20 minutes. This is not surprising, as described above concerning transfers.

Table 4.3.13. Two sample t-test between urban areas being located in municipalities with public gymnasiums but without regional centers and modal number of transfers

Group Statistics

	Municipality with public gymnasium, but which is not regional center	N	Mean	Std. Deviation	Std. Error Mean
Number of transfers (mode)	No	212	,35	,497	,034
	Yes	127	,72	,499	,044

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Number of transfers (mode)	Equal variances assumed	1,388	,240	-6,719	337	,000	-,375	,056	-,485	-,265
	Equal variances not assumed			-6,714	264,646	,000	-,375	,056	-,485	-,265

This test shows that there is a statistically significant difference in modal number of transfers between urban areas located in municipalities which fall into the category of having a public gymnasium but not a regional center and those who do not, as p = 0.000. The mean modal number of transfers for urban areas located in municipalities which have a public gymnasium but no regional center is 0.72, while for urban areas located in municipalities which either have a regional center or lack a public gymnasium the mean modal number of transfers is 0.35. I would theorize that this discrepancy is mostly due to the urban areas located in municipalities with regional centers generally having fewer transfers, and impacting the mean in this analysis.

Table 4.3.14. Two sample t-test between urban areas being located in municipalities with public gymnasiums but without regional centers and average travel time

Group Statistics

	Municipality with public gymnasium, but which is not regional center	N	Mean	Std. Deviation	Std. Error Mean
Average travel time (minutes)	No	212	31,66	14,430	,991
	Yes	127	51,96	16,087	1,428

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Average travel time (minutes)	Equal variances assumed	1,572	,211	-12,007	337	,000	-20,305	1,691	-23,631	-16,979
	Equal variances not assumed			-11,684	243,020	,000	-20,305	1,738	-23,728	-16,882

This test shows that there is a statistically significant difference in average travel time between urban areas located in municipalities which fall into the category of having a public gymnasium but not a regional center and those who do not, as $p = 0.000$. The average travel time for urban areas located in municipalities which have a public gymnasium but no regional center is 51.96 minutes, while for urban areas located in municipalities which either have a regional center or lack a public gymnasium the average travel time is 31.66 minutes. Once again, I would theorize that this difference is more so due to the shorter travel times for those urban areas located in municipalities with regional centers, not really due to the municipalities with public gymnasiums being very isolated from the regional centers, especially since many of them border the regional center municipalities.

4.4. Result summary

Here, the results from the previously presented analyses will be summarized, to facilitate discussion, which follows in the next sections.

Firstly, one can note that a statistically significant connection can be established between average travel time and the modal number of transfers, with these variables being moderately positively correlated. Further, there is a statistically significant difference in average travel time and modal number of transfers between urban areas with and urban areas without access to the train network. An urban area having access to the train network generally seems to mean a shorter travel time and fewer transfers to reach a regional center.

Which municipality one travels from and which regional center one travels to could be established as having a statistically significant impact on one's travel time and number of transfers. Generally, where one lives seems to have an impact on the travel experience, as urban areas in municipalities with a regional center generally experience shorter travel times and fewer transfers to reach a regional center (in most cases the one in the same municipality). Urban areas in municipalities which have public gymnasiums but no regional center could be established as having significantly different travel times and number of transfers than urban areas in municipalities which either have a regional center or no gymnasium, with municipalities in this group having longer travel times and higher number of transfers. Also, locality size could be connected to both travel time and number of

transfers, with urban areas in the smaller locality category having longer travel times and higher numbers of transfers.

However, no significance could be established for a connection between urban areas being located in a municipality with a public gymnasium and travel time or number of transfers, which is reasonable, since travel time and transfers have been calculated to the nearest (time-wise) regional center, not the nearest public gymnasium. Finally, no significant relationship could be found between travel time/number of transfers and how many urban areas are located in each municipality or how many urban areas are closest to a certain regional center, meaning that even if only one urban area in a municipality has public transport access to a regional center that does not necessarily mean a longer average travel time or more transfers for that municipality when compared to other municipalities.

5. Discussion

People's ability to move through space-time is impacted by three types of constraints: capability, coupling and authority (Hägerstrand 1970), all of which are relevant to a student's commute to a regional center. Being reliant on public transport instead of an individual mode of transportation is a capability constraint, which can be assumed to be experienced by all students living in the urban areas included in this analysis, if they are trying to reach a regional center. This is because biking and walking can be considered irrelevant for these students due to the distances involved, and Swedish gymnasium students generally cannot drive until later on during their gymnasium years, and even then most will likely not have access to their own car. Further, students experience the coupling constraint of having to be in school at a certain time. Based on this, only urban areas whose residents can reach a regional center during the morning commute span, earlier defined as 7.30-8.30, were included in the analysis. This means that residents in urban areas which do not fulfill this condition have been excluded from the analysis because this coupling constraint shuts them off from regional centers, in the morning. Also, students are impacted by the authority constraint of public transport schedules, which they have no control over. This impacts the travel time, since different possible routes between two urban areas will take different amounts of time, and the number of transfers. This constraint also decides which urban areas have access at all, since some urban areas have no public transport available to them at all. These constraints all impact the space-time prism which one can move within, as it gets smaller when one is reliant on public

transport, even more so with longer travel times and more transfers (ibid.). This of course may also complicate the process of working towards the project of achieving a gymnasium-level education, putting teenagers in different parts of Skåne in differing positions when working towards this, often crucial, goal.

The results from the analyses show that not every resident in Skåne experiences commuting to a regional center equally, with differences in travel and transfers between places. For example, the average travel time varies widely between different municipalities, with some municipalities' urban areas having average travel times of 15-20 minutes to a regional center, and other municipalities' having an hour or slightly more, which is significantly longer than the 45 minutes generally considered as an acceptable commute time (Skolverket 2011). The urban areas experiencing the shortest travel times are those located in the same municipality as a regional center, or in a municipality directly adjacent to a municipality with a regional center, as may be expected, since there are no clear borders between municipalities set up in the public transport network. This means that people in different places have limitations placed on their space-time to differing extents, as someone who live in a place with shorter travel time needed to reach a regional center will not have to spend as much time commuting as someone living is a more distant place.

It could be noted in the results that those urban areas classified as smaller localities experience both longer travel times and a higher number of transfers than larger localities, and, as mentioned in an earlier section, it has been previously noted that less central locations generally have access to fewer options and have to weigh the inconvenience of travel against choosing the best option (Næss et al 2018). It would be easy to therefore connect these two and say that smaller localities are also less central locations, but this is not always necessarily the case. Some smaller localities are located very close to larger urban areas, and therefore cannot be considered less central in general, even though they may have less accessibility to a regional center. However, of course, this depends on ones definition of centrality, and could be further explored. Also, one can note that a much fewer amount of smaller localities are included in the analysis than localities, as urban areas without public transport access to any regional center (during the morning commute span of 7.30-8.30) were excluded. This is even though there are approximately the same number of smaller localities as localities in Skåne, which means that there are more smaller localities than localities which are completely shut out from commuting by public transport to regional centers for gymnasium studies, because of the authority constraint placed on them by public transport routes and time tables.

In general it has been noted that more transfers are not preferred by travelers (Chowdhury, Ceder & Schwalger 2015) and, when it comes to students, it has been established that a longer travel time leads to less commute satisfaction (Westman et al 2017). Based on this one can assume that students residing in those urban areas and municipalities which have been noted to have longer travel times and needing more transfers to reach a regional center may experience a lesser degree of satisfaction with their gymnasium commute. Engaging in socializing during ones commute has been noted to making one more satisfied (ibid.) so students who can share their commute with a local friend may not experience a strong dissatisfaction, even if they have a longer commute. However, inactive travel, which is inevitable for students residing further away, and assumably all students residing in the urban areas including in this study, if they commute to a regional center, has been connected to poorer school results (ibid.) as has a longer commute time been (Tigre, Sampaio & Menezes 2017). This means that students who commute to regional centers may experience poorer school results as they need to commute inactively, and this may be exasperated for students who live further from the regional centers. It was noted in the results however that very few urban areas had a modal number of transfers higher than 1, and none was higher than 2. This may mean that transfers does not have a large impact on students travel satisfaction, however travel time is still relevant.

All students in Skåne are allowed to apply to any gymnasium in the province (Skånegy 2018), and with this follows the assumption that all gymnasiums are accessible to Skåne's students. In general, school choice is often seen as an important as a way to break down social barriers (Ferrari & Green 2013), but whether that would be possible in Skåne is unclear. Not all urban areas in Skåne can reach all other urban areas within the morning commuting span (this is clear since some urban areas were excluded from this thesis' analysis because they could not reach any regional center during the morning span). Further all non-urban areas were excluded from this analysis, so the extent to which rural students can make use of their free gymnasium school choice within Skåne could be further explored. Basically, this means that some people are likely limited in their school choice by which schools they can feasibly reach, based on the constraints placed on them by their circumstances.

Gymnasium-age students have been noted as regularly sleeping too little, and this has been found to have a possible negative effect on students' school results (National Sleep Foundation 2006). One can assume that a longer commute may lead to less sleep, as students need to get up earlier in the morning, and, unless they do their homework during the commute, they may have to stay up later in

the evening to finish their schoolwork, especially if they also take part in any extracurricular activities. This means that the constraints placed on those students which lead them to having a longer commute, primarily the authority constraints of the public transport time tables and the coupling constraint of having to leave their homes to get an education, may lead to them having less time to sleep, and therefore they may experience negative consequences, such as poorer results in school.

5.1. Conclusion and answers to research questions

The aim of this thesis was to examine the opportunity for students in different parts of Skåne to commute by public transport to a regional center, and the research questions were as follows:

- How is the accessibility of gymnasiums in regional centers for students living in different areas of Skåne distributed?
  - Are there differences in travel time and transfers between municipalities?
  - Is there a relation between locality size and travel time and transfers?
  - Does access to train lead to a shorter and simpler commute?

To this we can now say that the results show that the commute opportunity (as measured in travel time and number of transfers needed) differs in different parts of the province. There are differences in both travel time and transfers between the different municipalities, with urban areas located in the same municipality as a regional center having shorter commutes with less transfers. Also, urban areas classified as smaller localities can be seen to have longer commute times and needing more transfers than larger localities. Finally, it was found that an urban area having a train station, and therefore having access to the train network, can be connected to the urban area having a shorter travel time and needing less transfers. This in total means that the ability to access regional centers' gymnasiums is not the same for all students in Skåne, and, as discussed above, this can have several consequences for the students with poorer access.

5.2. Further studies

For further inquiry into this field I would like to recommend examination of the commute circumstances for those people excluded from my analysis, i.e. those that do not have direct access to public transport whether they live in urban or rural areas, and rural residents in general, since

they were completely excluded from this analysis. These are of course also important residents of the province, and their ability to commute to a gymnasium is also valid to examine.

Further, this study could not find an impact on travel time or number of transfers for people living in a municipality which provides a public gymnasium, highly likely because travel time and transfers were calculated to the nearest regional center, which is not necessarily the nearest gymnasium. This is because a main purpose of this study was to examine the effectiveness of regional centers to provide gymnasium-level education, however it may be as, if not more, relevant to instead examine the commuting possibilities to the nearest gymnasium. This would also likely include more urban areas in the analysis than this analysis has, since public transport to the nearest gymnasium may likely be more available than to the nearest regional center. This thesis has not taken into account where people actually want to commute, only where is closest, which means a place like Malmö is probably a lot more relevant when it comes to commuters than it has been in this thesis. Further research may do well to take into account commuter preferences when it comes to destination, since there are more factors than just proximity which impact school choice (He & Giuliano 2018).

In conclusion, this is a highly interesting as well as highly relevant topic, and one in which I have only just scratched the surface. Much more research could and should be done, to better understand the circumstances and consequences facing Skåne's gymnasium students as they commute to their chosen schools.

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