Quality of Life Index in Norway

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Abstract

The thesis estimates the quality-of-life (QOL) index for Norwegian municipalities. By using the Rosen-Roback framework, extended by Albouy (2008), it finds that the QOL index is higher in urban areas, like the capital of Oslo. This means that Norwegian citizens find urban amenities highly attractive. It is also found that high QOL index municipalities have both higher population growth and housing prices, while rural municipalities often have the opposite. By running a multivariate regression on the quality-of-life (QOL) index with respect to different amenities, it is found that higher education, recreational outdoor area, accessibility and number of hospitality workers have a positive correlation with the QOL index. In contrast, population density is found to have a negative correlation with the QOL index. This can be interpreted as higher density giving higher levels of pollution and noise. Crime is found to be irrelevant for the QOL index, which most likely is due to the low crime levels in Norway. Overall, the results are in line with the existing literature

Keywords: *Quality-of-life, Wage, Rent, Rosen-Roback, Amenities, Urban economics, Spatial equilibrium.*

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I would also like to thank Statistics Norway and the Norwegian Institute of Transport Economics for being very helpful in the search of data. Searching for the correct data can be a difficult task, and both organisations took time out of their day to help.

Writing this thesis has introduced me to the world of urban economics and why households choose their specific location of residence. I always find learning about economics useful as it provides me with a better image of how the world works. For this reason, I would also like to thank Copenhagen Business School for letting me write this thesis and complete my Master's in Applied Economics and Finance.

Thank you all,
Ole-Kristian Kleivan Skjong.

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1. Introduction

In Norway, 80% of the population lives in urban areas (Statistics Norway, 2021). This is despite the fact that urban areas generally have denser space, worse air quality and higher housing costs. In Norway's capital of Oslo, residents live more than twice as dense as in the rest of the country (Statstics Norway, 2021k). The capital has also seen a phenomenon where more and more people buy apartments with their friends or family to sustain a life in the capital. This is because of the ever-growing gap between urban wages and housing costs (Pedersen & Nilsen, 2021). However, 20% of the population has still made it their home, raising the question of why people prefer to live in dense urban areas (Statistics Norway, 2021k). This thesis will answer this question by investigating what it is that makes urban areas particularly attractive.

Traditionally, cities have been considered centres of productivity and production, while bad for consumption. Whilst workers earn more in cities, they often have to pay higher housing costs, live more densely and face negative amenities such as pollution. However, like described in the previous paragraph, modern households still choose to reside in urban areas. In the paper Consumer city, Glaser and his co-writers even discusses the phenomenon of reverse-commuting, which is when people live in an urban area and commute out of the city for work. They found that reverse commuting had seen a significant increase from 1960 to 1990. Additionally, urban housing cost seems to have risen faster than urban wages, suggesting a high demand for urban areas (Glaeser et. al, 2001). Modern literature often explains this observation in terms of urban demographics by comparing the quality of life (QOL) index of an area.

As stated by Blomquist (2006) "life is good when the quality of life is good" (p. 483). Income is often considered a measure of well-being. The logic is that the higher the income, the more it relaxes the budget constraint of a household, which again let the household increase its welfare through higher consumption. However, while income measures well-being in some form, it is limited. This is because it does not take into account the social and natural environment. This can for instance be local amenities such as warm climate, good air quality, and low levels of crime. The quality of life (QOL) index, developed by Rosen (1982) and Roback (1979), estimates the attractiveness of a specific area by valuing such local amenities. This was done by comparing changes in housing costs and wages, where a sacrifice in welfare, in form of higher housing costs or lower wages, points to a higher willingness to pay for local amenities. They argue that a household will choose where to live, not only based on wages and housing prices, but on the amenity value it provides. In many respects, urban areas like Oslo can be considered to have superior amenities in terms of cultural events and restaurants compared the rural part of Norway. For this reason, based on the research by Rosen (1982) and Roback (1979), Oslo should have a higher score on the QOL index, and therefore be more attractive to live in. Glaser et al. (2001) found that this was indeed correct for the United States, where urban areas with higher amenity values experience higher population growth.

Policy wise, in Norway, there has been a large focus on decentralising the population away from urban areas, like Oslo and Bergen. This is because many of the rural areas have experienced a declining population, which has created problems related to the local workforce (Statstics Norway, 2021k). They have also seen a lack of essential personnel, such as teachers and doctors, which is critical. It has for therefore been one of the focusing points of the Norwegian government, where they have tried different monetary incentives, such as tax subsidies, student loan forgiveness and moving public jobs out of the capital. (Langørgen, 2007). Nevertheless, more and more people are moving to urban areas, leaving a negative impact on the rural part of Norway (Statstics Norway, 2021k). If we consider the research from Glaser et al. (2001), the monetary approach of the Norwegian government might be the wrong way to go, as people move to a certain area, not just based on housing costs and labour income, but local amenities. Bartik and Smith (1997) considered this hypothesis for the United State, where they found that that local amenity affects residential location patterns, population density and urban development. Consequently, if public policy also considered local amenities, it might have been more successful.

1.2 Research question

This thesis estimates the quality of life (QOL) index for Norway and its respective municipalities for 2018. To the knowledge of the author, the QOL index has not been constructed for Norway. One paper, to be discussed in the literature review, computed it for Oslo but not the nation as a whole. For this reason, it is believed that the QOL index could be both interesting and useful for assessing urban development in Norway. This gives a research question of:

What is the quality of life in Norwegian municipalities based on the Rosen-Roback framework?

1.3 Overview

This thesis finds that urban areas in Norway, such as the capital area of Oslo, generally have a higher QOL index based on the Rosen-Roback framework. Comparing these municipalities to their population growth and housing prices, a clear positive trend is found. Comparatively, rural municipalities are found to have a low QOL index and negative population growth. This points to the fact that Norwegian households find urban amenities attractive, which is in line with existing literature. By regressing the relevant amenities on the QOL index, it is found that the higher education, recreational outdoor areas, accessibility, and the number hospitality workers have a positive correlation with the QOL index. In contrast, population density is found to have a negative correlation with the QOL index. This can be interpreted as higher density giving higher levels of pollution and noise. Crime is found to be irrelevant for the QOL index, which most likely is due to the low crime levels in Norway. Overall, the results are in-line with the existing literature.

The structure of the paper takes the form of a literature review, methodology, data, empirical results, discussion of limitations and conclusion chapter. Chapter 2, the literature review, gives an overview of the existing literature. Chapter 3, the methodology, gives a description and discussion of the theoretical framework used. Chapter 4, the data chapter, gives a detailed description of collected data. Chapter 5, the results, gives a presentation and discussion of the results. Chapter 6, the discussion of limitations, gives a discussion of the limitations and the possible effects it could have on the results. Chapter 7 concludes the thesis and gives recommendations for further research.

2. Literature Review

Chapter 2 introduces the exiting literature of the QOL index. Research on urban amenities is long and vast. The chapter therefore tries to include the most important research to give the reader background knowledge of the research topic.

Research on the QOL index builds on theory by Tiebout (1956) of that households “vote with their feet” and move to an area that best suits their preference for local goods or amenities. By assuming that workers are fully mobile and have perfect information, it is possible to value local goods based on the workers choice of location. This is because workers move freely to maximise their utility by “voting with their feet”. This creates an equilibrium where workers cannot improve their utility by changing their location and where utility is uniformly distributed across locations.

Building on the framework from Tiebout (1956), Rosen (1978) valued the willingness to pay for local amenities by looking at how wages vary across areas. Roback (1982) later extended the model to include rents and non-traded goods. She argued that a homogenous household can pay for local amenities both in terms of lower wages and higher housing costs. For example, moving to attractive urban cities, like Oslo, tend to increase the housing costs more than the respective wage. This sacrifice in utility can be explained by an increase in the quality of local amenities. By using this way of thinking, the QOL index was constructed, where high levels local amenities point to a high QOL index. In the paper, Wages, Rents, and the Quality of Life, Roback (1982) also deployed the model to United States data, by regressing the QOL index on amenities such as crime, pollution and climate individually. She found that amenities largely explain regional differences in wages and rents.

Since then, the Rosen-Roback model has served as the core model for valuing spatial amenities. One of the more famous use of the model is Blomquist et al. (1988), that provided an updated QOL index ranking for the United States. The QOL index was estimated using a hedonic[1] wage and rents regression on United States microdata, that was matched with amenities such as climate, environmental and urban conditions. They found that differences between the top and bottom ranked in terms of amenity value was $10,923, adjusted for 2018 inflation. The highest ranked areas were found in smaller and bigger cities around the sunbelt and Colorado. Another example is Gyourko and Tracy (1991), which extended the model to look at the willingness to pay for different types of local fiscal conditions, such as local taxes and public services. They find that local fiscal condition is important for the QOL index. Additionally, there has also been a lot of papers investigating the willingness to pay for other amenities. For instance, Theebe (2004) looked at traffic noise, Chay and Greenstone (2005) looked at air quality, Pope (2008) looked at crime and Rouwendal et al. (2017) looked at the distance to the water.

These papers mainly estimate the QOL index by focusing on single amenities. One concern with this way of estimating the index is the potential omitted variable bias caused by the researcher picking the amenities (Albouy & Lue, 2015). To address this, Beeson and Eberts (1989), Gabriel and Rosenthal (2004), and Chen and Rosenthal (2008) estimated the QOL indexes based on wages and rents, only controlling for workers and housing characteristics. By estimating it this way, the index did not take a stand on which amenities to include, leading to both the observed and un-observed amenities visible in the result.

However, the hedonic method of estimating the QOL index showed to produce counter-intuitive results, where city rankings had a negative correlation with city size (Albouy, 2008). This does not make sense, as urban areas such as New York are both highly populous and attractive. Albouy (2008) pointed this out in his literature review, where he referred to several examples. For instance, Gabriel et al. (2003) ranked Wyoming, South Dakoda and Arkansas first, second and third respectively, while ranking the more desirable areas like California 42nd. Berger et al. (1987) found that Pueblo in Colorado, Macon in Georgia and Reno in Nevada had the highest QOL in the United States, while popular urban areas like New York ranked 165th. To tackle this, Albouy (2008) suggested

[1] A hedonic regression model is defined as valuing a good by assuming the value is equal to the implicit market value of the related characteristics of that good (Rosen, 1974).

three corrections to the model. Firstly, the cost of living outside of housing costs should be incorporated. Secondly, household income outside of labour income should also be considered. Lastly, wages should be corrected for local taxes. Using United States data from 2000, Albouy (2008) finds that real income in urban areas, defined as wage minus housing cost, is lower than previously thought, leading to an increased QOL index for urban areas. Importantly, urban areas like New York, Los Angeles, Chicago and Boston are found to rank far above national average. Moreover, to investigate different individual amenities, he used a two-step method where he estimates the QOL index before regressing individual amenities on them. This is opposite to the approach of Roback (1982), who used the valuation of different amenities to estimate the QOL. In terms of results, he finds a significantly higher willingness to pay in areas with rich arts and culture, restaurants and bars, and clean air.

Abouly and Lue (2015) further extended the model by including commuting costs and a place of work wage index instead of place of residence, like used in the Rosen-Roback model. This improvement showed to fit well with the original Rosen-Roback model of using local housing costs and household income, as household commute across municipalities in pursuit of work and leisure. It also revealed that the willingness to pay to live in suburban areas or areas with long commutes was higher than what the original model estimates. This makes sense, as higher commuting costs can also be seen as a sacrifice of utility. By including a place of work wage index instead of the place of residence, it revealed that wages in central cities and suburbs are about equal in terms of wage levels, suggesting that neither are at a disadvantage income-wise.

Considering more resent papers, Hybel and Mulalic (2020) computed the QOL index for 98 Danish municipalities using the Albouy and Lue (2015) extension of the Rosen-Roback model. They found that the QOL index indeed is higher in metropolitan areas such as Copenhagen and Aarhus, and that the quality of public transport is significantly important for the QOL. For France, Feuillade (2018) find that the general QOL index is higher in the south of France and closer to the Alps. However, the metropolitan, Paris, has the highest QOL index. For China using 2005 data, Shi et al. (2021) finds that the QOL index is highest in the provincial capital cities and in cities with amenities such as nice weather, convenient transport and better quality of public services. For Norway, the study on the QOL index across municipalities is unfortunately limited. Carlsen et al. (2020) estimate the QOL index, using the Rosen-Roback model, for the capital of Oslo and comparing it with the subjective well-being of its households. They found that the general QOL index is highest in Oslo for both methods.

3. Methodology

The methodology chapter is divided into 2 sub-chapters. Chapter 3.1 of provides a description of the theoretical framework. The goal is to introduce the reader to the economic model used and the assumptions it applies. Chapter 3.2 includes a discussion of the model-limitations.

3.1 Theoretical Framework

Building on the Rosen (1979) and Roback (1982) model, this thesis uses the extended model by Albouy (2008), which extend the Rosen-Roback model by including local taxes. The model initially assumes heterogeneous households. However, this assumption is removed due to complexity (see chapter 3.1.3 - model limitations). The addition of transportation from the Albouy and Lue (2015) paper is also dropped due to data limitations. A discussion on this can be found in chapter 6 (discussion of limitations).

Households are assumed to be homogenous, perfectly mobile and have full information. This implies that they have full information on house prices, wages and amenities. To further simplify, zero moving cost is assumed. This implies a spatial equilibrium that is uniformly distributed. Households consume local housing y in location j at the local price p^j, a traded good x and a vector $\boldsymbol{Z}$ for amenities. To simplify the model, amenities are collected into a single index $Q^j = \tilde{Q}(\boldsymbol{Z})$.

Household preferences are modelled by a quasi-concave utility function $U(y, x, Q^j)$, which increases in y , x and Q^j. A household supply one unit of labour and earn a wage w^j. In addition, households receive non-labour income I, which does not vary across locations. This gives a total household income of $m^j = w^j + I$. They also choose consumption levels x and pay local taxes τ. Households choose their residential location j, based on local prices p^j, local amenities Q^j, and income potential w^j that is adjusted for local taxes τ. This gives a household budged constraint of $x + yp^j \leq (w^j + I)(1 - \tau)$.

The after-tax minimum net expenditure required for a household to obtain utility $\overline{u}$ can be expressed as:

$$E\left(p^j, w^j, x, \tau, \overline{u}, Q^j\right) = \min_{y,x}\left\{x + p^j y - w^j + \tau\left(w^j + I\right) \mid U\left(y, x, Q^j\right) \geq \overline{u}\right\}, \quad (1)$$

where the function, assumed to be continuously differentiable, increases in the cost parameters of local prices p^j and local taxes τ, while decreasing in the welfare parameters of local wages w^j and local amenities Q^j, meaning $\frac{\partial E}{\partial p} \geq 0$, $\frac{\partial E}{\partial w} \leq 0$ and $\frac{\partial E}{\partial Q} \leq 0$.

3.1.2 Equilibrium

In equilibrium, households choose a location j that provides the same level of utility $\overline{u}$, so that all households are equally satisfied. For households with free mobility, homogenous preferences and perfect information, the net expenditure at equilibrium for utility $\overline{u}$ must be the same for all locations. In more formal terms this can be written as:

$$E\left(p^j, w^j, \tau, \overline{u}, Q^j\right) = 0 \quad (2)$$

Since we are interested in the willingness to pay for a change in the QOL, we differentiate p^j, w^j and Q^j from equation (2).

$$\frac{\partial E}{\partial p} dp^j + \frac{\partial E}{\partial w} dw^j + \frac{\partial E}{\partial Q} dQ^j = 0 \quad (3)$$

The Shepard's Lemma[2]- is applied to equation (2) in order to interpret the derivates, which is evaluated at national averages of $\overline{y}$ and $\overline{w}$. This means that, $\frac{\partial E}{\partial p} = \overline{y}$, is the average consumption with respect to housing and, $\frac{\partial E}{\partial w} = \overline{w}(1-\tau)$, is the average supply of labour corrected for local taxes τ. Furthermore, the model is re-arranged with $\frac{\partial E}{\partial Q} dQ^j$ on the right-hand side of the equation. This gives equation (4):

[2] The Shepard's Lemma states that the demand for a good at a given price and level of utility equals the derivative of the expenditure function with respect to the price of the given good (Fuchs-Seliger, 2002).

$$\bar{y}dp^j - (1-\tau)\bar{w}dw^j = -\frac{\partial E}{\partial Q}dQ^j, \quad (4)$$

where $p_Q = -\frac{\partial E}{\partial Q}Q^j$ is the willingness to pay for an increase in the QOL index. The model relates the urban benefits of $\frac{\partial E}{\partial Q}dQ^j + (1-\tau)\bar{w}dw^j$ (amenities and local wages) to the urban expenditures of $\bar{y}dp^j$. This means that households can accept higher urban costs for higher urban benefits. For instance, a household could increase its housing prices for an increase in local amenities or wages. It could also receive a higher wage based on higher housing prices or a lower level of amenities.

3.1.3 Model Operationalization

Equation 4 is then operationalised into the final model by applying log-differencing to the wage index and housing price index, $\hat{z} = \frac{z-\bar{z}}{\bar{z}}$, where $z = p, w$, and dividing it by national averages of income $\bar{m}$. Lastly, it is normalised into $\hat{Q}^j = -\left(\frac{\partial E}{\partial Q}Q^j\right)\frac{dQ^j}{\bar{m}}$, leading to an operationalized model of:

$$\hat{Q}^j = s_y\hat{p}^j - (1-\tau)s_w\hat{w}^j, \quad (5)$$

where $s_y = \frac{\bar{y}\bar{p}}{\bar{m}}$ is the household share of local expenditures related to housing and $s_w = \frac{(1-\tau)\bar{w}}{\bar{m}}$ is the household share of income received from labour. The shares do not take into account household heterogeneity, it therefore only applies to a typical household. Moreover, $s_y\hat{p}^j$ represents how high the cost of living in city j is relative to the national average, while $(1-\tau)s_w\hat{w}^j$ represents after-tax labour income. The QOL index ($\hat{Q}^j$) is then calculated by seeing how high the cost of living in location j is compared to the national average, or how low the after-tax income is. In short terms, the QLI index represents how much consumption a household is willing to sacrifice in order to live in a specific location.

3.3 Parameter Parametrization

The household shares (s_y, s_w) are retrieved at national averages from Statistics Norway. The household share of local expenditures related to housing s_y is set to 22% and is retrieved from the household income and expenditure data in 2018. The household share of labour income s_w is set to 100%. This is because average nominal income is used in this thesis, meaning that the data represents 100% of labour income. It is therefore assumed that 100% of household income comes from labour. The tax rate is retrieved from OECD at 35,8% and represents the average nominal tax rate. This gives a final model of:

$$\hat{Q}^j = 0.22\hat{p}^j - (1 - 0.358)\hat{w}^j \quad (6)$$

3.3 Model limitations

Assuming households to be homogenous, perfectly mobile and have full information is unrealistic in the real world. However, like most economic models, a simplification is needed to make meaningful results. Like seen in the literature review, the model has created a great deal of meaningful and policy relevant results.

First of all, the chosen parameters only represent a typical household. Different households might differ s_y. For instance, a household with children may pay more for housing because it needs more space, and vice versa. In reality, even though it is assumed to be 100%, the share of income from labour, s_w, is also likely to differ. This is because some households might have more capital income and family transfer, while some have a higher share of labour income. Furthermore, assuming households to be perfectly mobile is also unrealistic, as moving to new area requires money, time and even a new social network (Feuillade, 2018). Berger and Blomquist (1992) found this in the US, where households only relocated if their utility gain is greater than the relocation costs. Likewise, the assumption of full information is also doubtful. For instance, a household that is not familiar with an area might discover that the respective amenities are different than excepted.

The assumption of homogenous households is also a strong assumption. In the real world, household have vastly different preferences that could have a real impact on deciding where to live. The taste of amenities could be affected by personal biases, such as where they are born, interests and age group. Taken to the extreme, it is not unreasonable to assume that every household is different in some form. Literature on the topic often finds that household "sort" to locations based on heterogenous preferences. For example, Chen and Rosenthal (2008) finds that households have different preferences in terms of where they want to live at different points in their life cycle (young/old), Cutler and Glaeser (1995) finds evidence of racial sorting by looking at the African American community and Yannis (2004) finds evidence of income sorting by looking at different United States neighbourhoods. With heterogenous preferences, supply and demand for local amenities matter (Gyourko et al., 2013). For example, a specific ethnic composition of a neighbourhood might attract that specific ethnicity base on their heterogenous preference (Yinger, 2014). With respect to Norwegian research, there is not much on heterogenous preferences. Still, the assumption is considered a strong assumption. Nevertheless, for smaller spatial units it not such a bad approximation, as most of the exiting literature have provided meaningful result.

Economists have tried different strategies to limit the bias created by household heterogeneity. Structural sorting models have shown to offer a solution for household sorting according to income and taste. The structural approach uses properties of household behaviour and market equilibrium to infer structural parameters that categorize heterogeneity (Kuminoff, Smith, & Timmins, 2010). While these models have shown to provide robust results, they are complex and computational heavy. This makes it hard to assess the validity of the model (Albouy & Lue, 2015). Considering this together with the fact that hedonic models are subjected to omitted variable bias, the one-dimensional QOL index was used in this paper, which is the same used in Albouy and Lue (2015). Strictly speaking, this thesis provides an estimate of the QOL index for a homogenous, fully mobile (zero relocation cost) and fully informed household.

4. Data

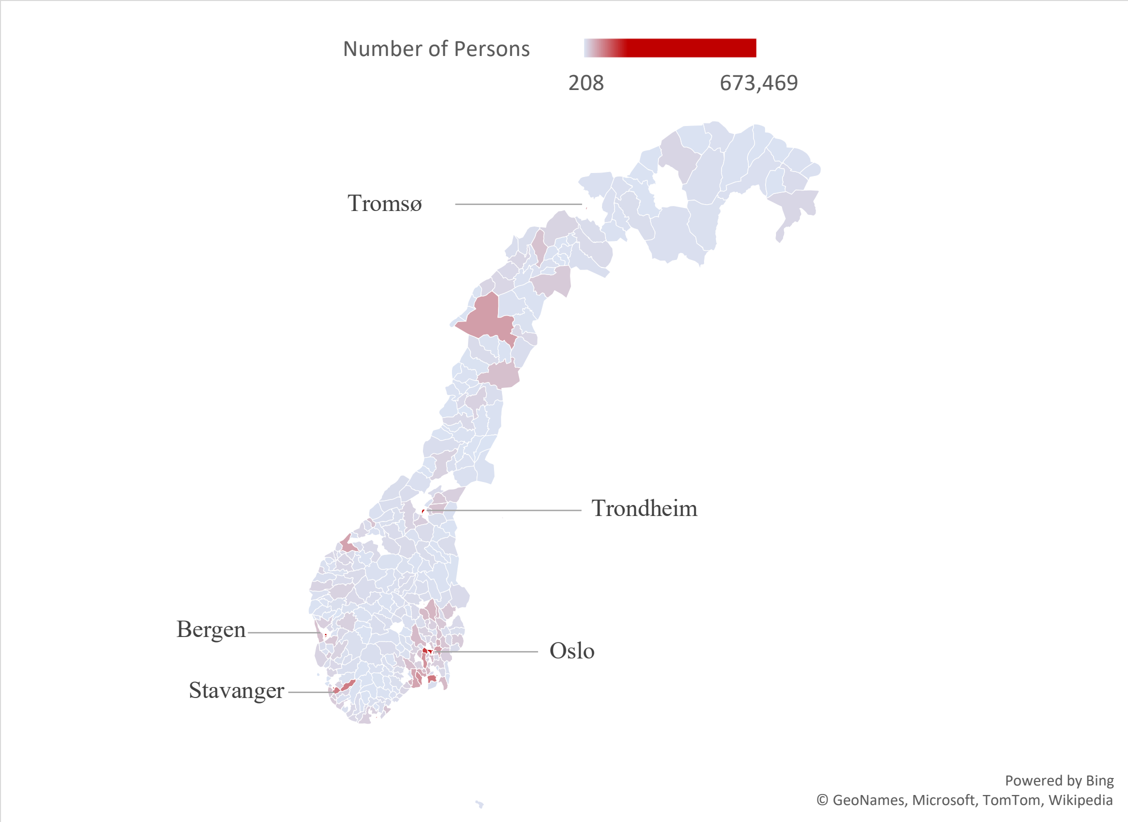
Chapter 4.1 gives a brief introduction to the demographics and geographics of Norway. This is to provide the reader with a better understanding of Norway, so that it is easier to understand the data/results. Chapter 4.2 introduces the main variables of the model (housing price and wage). This includes data descriptive and a small analysis of the geographical trends of the data to give the reader some context. Chapter 4.3 does the same as chapter 4.2 but for amenities. Chapter 4.5 summarises the chapter.

4.1 The Country of Norway

Norway is located north in Europe, bordering Sweden and Russia and stretches over 365 km^2 (Statistic Norway, 2020a). It has a varied geography of green fields, mountains, fjords and an extensive coastline. The coastline has provided Norway with many of its main industries, such as fishing and oil. The oil industry has been especially helpful for Norway, helping it become one of the richest countries in the world (Caleb, 2020). This has led to high average wages and prices of local goods, such as housing. Furthermore, the country has a low unemployment of 3,8% (2018 numbers), pointing to a solid labour-market (Statistics Norway, 2021). It also subscribes to the social-welfare system of the Nordics, which gives free goods such as healthcare and education at the cost of high taxes. (Norden, 2021)

In 2018, the population of Norway was 5 285 528 spreads across 426 municipalities. The average municipality had a population of 12 556 residents, where the least and the most populated municipality had 208 and 673 469 residents, respectively. Approximately 80% of the Norwegian population live in urban areas, which has left many of 426 municipalities with a relatively low population, see map 1 (Statstics Norway, 2021k). This has some implication for data collection, which will be discussed later in this chapter. The capital of Oslo has the most residents by a large margin, housing approximately 20% (673 469 residents) of the Norwegian population as of 2018. The other urban cities of Bergen, Trondheim, Stavanger Tromsø also have a large share of the total population with 279 792, 193 591, 133 140 and 71 000, respectively. Together, these four major urban areas summarize to 1 350 992 people or 33% of the population spread across a relatively low area of Norway. This explains the low levels of red on map 1, as there is a significant gap between residents in urban and rural areas (Statstics Norway, 2021k).

Map 1: Population of Norway in number of persons



Note: *Total Norwegian population equals* 5,285,528 *Tromsø is very hard to see on the map due to its small geographical area. A full list can be found in appendix A. Source: Statistics Norway (2021k).*

4.2 Quality of Life (QOL) Index Data

A housing price index and wage index is required to estimate the QOL index. These are often estimated using hedonic regression methods with microdata (see chapter 2). This is to control for differences in terms of characteristics across municipalities. Since we want to compare the QOL-index across municipalities, it is important that they are equal. If not, different characteristics can inflate or deflate the QOL index score. For instance, if we want to compare two houses with different quality, it is hard to get the difference in local value without controlling for the quality differences, as they likely have an impact on the value. It is therefore important to control for both in the wage and housing index.

However, due to the time limit and difficulty of gathering microdata, a hedonic estimation of the wage and housing index was not possible. For this reason, already created indexes had to be relied upon. Fortunately, Statistics Norway had created one for housing prices. However, this kind of index was not available for wages, leaving the result vulnerable for biases. See chapter 6 for a discussion on the potential effects on the result.

4.2.1 Housing Price Index

The housing cost index was retrieved from Statistics Norway. It contains the average square meter price for Norwegian freeholder dwellings[3]- for 288 of out 426 municipalities in 2018. Freeholder dwellings represents approximately 86% of all Norwegian houses, making it highly representable (Statistics Norway, 2021d)[4]. The data was originally divided into three sub-indices of apartments, detached homes and semi-detached homes (Statistics Norway, 2021d). In the final housing price index used in this thesis, the three sub-indices have been merged by weighting them according to the number of respective transactions in each municipality. This is an important step, as urban municipalities, like Oslo, often have an overweighed of apartments, which usually have a much higher square meter price compared to detached homes (Statistics Norway, 2021d). Moreover, the data is also normalised to provide a better understanding of the number's context. Normalised data is defined by having a mean of 0 and a standard deviation of 1 ($\frac{x-\overline{x}}{std\ dev}$) (Geller, 2019).

The data is produced by Statistics Norway using hedonic methods and sourced from Finn.no, Norway's largest marketplace for housing, where 70% of Norwegian housing transaction is registered (Walbækken & Benedictow, 2021). To ensure the absence of anomalies, the data is controlled for outliers. The data is then weighed based on region and corrected for potential biases regarding average size, geographical location, type and year of construction using hedonic methods. However, it does not control for a change in the quality of the housing stock. This could create biases in the form of different

[3] A freeholder dwelling is defined as being 100% owned by the owner (Statistics Norway, 2021d).
[4] In the Statistics Norway data, a dwelling can either be freeholder or a housing cooperative. Unfortunately, the data was not available for housing cooperatives at a municipality level (Statistics Norway, 2021d).

municipalities offering different mix of quality in their housing stock. While the index control for a lot the biases like average size, geographical location, type and year of construction, it can still be affected by sorting biases due to not taking into account the quality of the houses. A discussion on this can be found in chapter 6. Lastly, the data is seasonally adjusted, as the Norwegian housing market usually experience higher volumes of sales during the summer and lower during the winter (Statistics Norway, 2021d).

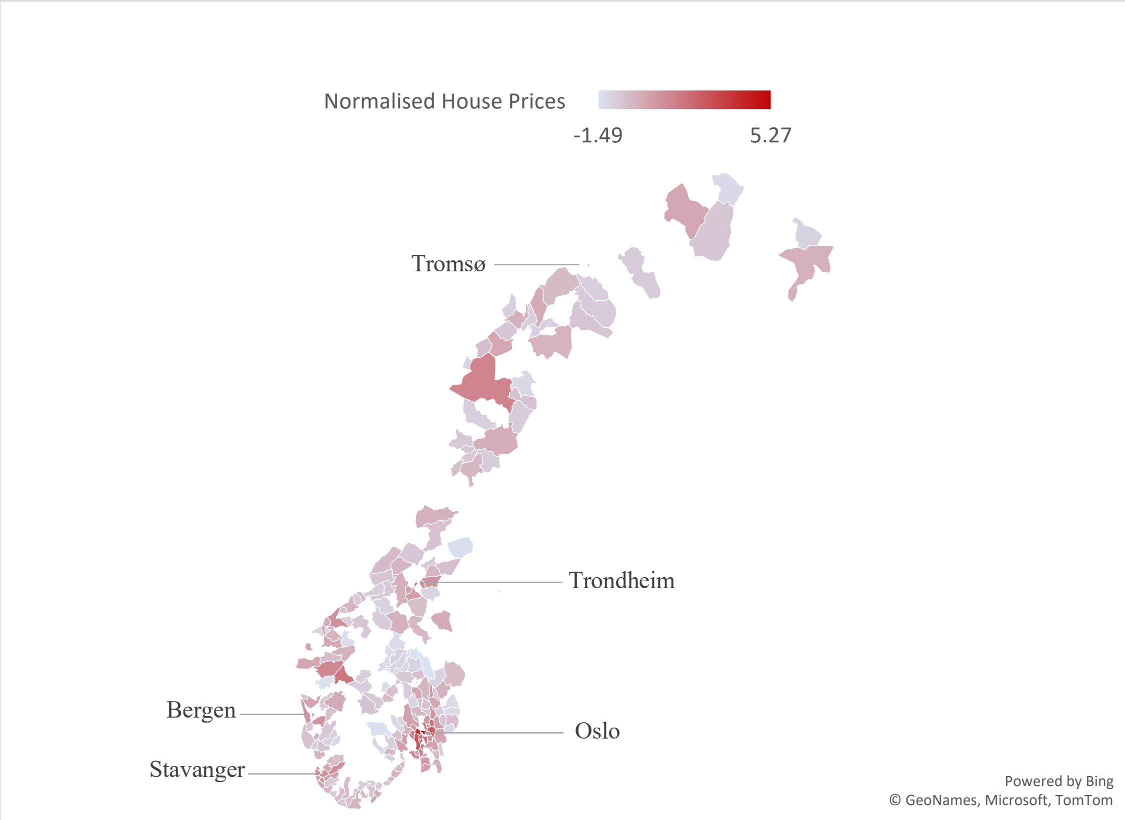
The statistic is produced for 288 out of 426 municipalities. This is because of Norway has a large number of municipalities with a low population, leading to an insignificant number of housing transactions in some municipalities. In the estimation of the QOL index, these missing observations are removed (Statistics Norway, 2021d). The implications of this are found in chapter 6.

Figure 1: House price Index (p^j)

	N	**Mean**	**Std.Dev**	**Min**	**Max**
House Price Index in NOK per km^2	422	22 121	9 666	7 676	73 024

Note: *1€ = 10,02 NOK (6th of may 2021). Source: Statistics Norway (2021d)*

Map 2: Housing Price Index (p^j)



Note: *Normalised data is defined as being rescaled to have a mean of 0 and a standard deviation of 1. Tromsø is very hard to see on the map due to its small geographical area. A full list can be found in Appendix A. Source: Statistics Norway (2021d).*

Inspecting the data, there is a clear gap in house prices in Norway, where the price generally is higher in and around urban areas like Oslo, Stavanger, Bergen, Trondheim and Tromsø. This is not surprising, as approximately 33% of the Norwegian population live around these areas (Statstics Norway, 2021k). The capital of Oslo has a much higher housing cost compared to the rest of the country, where the average square meter price is 67% higher than in the second biggest city of Bergen. Naturally, this also affect the housing prices of the surrounding municipalities of Oslo, especially the closest once of Bærum, Asker, Lørenskog and Frogn, which ranks 2nd, 3rd, 4th and 5th, respectively, in terms of average square meter price. Even in the top 10, 8 out of 10 municipalities are located within the capital areas of Oslo. The only exception is Trondheim and Tromsø which ranks 8th and 10th. They are both popular urban areas of Norway for many reasons. Tromsø is famous for its nature and university, while at the same time having geographical issues that makes it hard to build new dwellings. This has made the housing prices in Tromsø especially high. Trondheim is one of the four big cities in Norway. It is generally assumed to be an attractive place to live with high-ranking university and cultural amenities, which can explain the high prices.

Figure 2: Top and bottom five on the House price index (p^j)

Rank	**Municipality**	**Housing Price per km^2 (NOK)**	**Housing price Index (Normalised)**
1	Oslo	73 024	5.27
2	Bærum	60 962	4.02
3	Asker	49 808	2.86
4	Lørenskog	49 439	2.83
5	Frogn	49 107	2.79
252	Snåsa	9217	-1.34
253	Høyanger	8422	-1.42
254	Tinn	8243	-1.44
255	Verran	8156	-1.44
256	Stor-Elvdal	7676	-1.49

Note: *1€ = 10,02 NOK (6^{th} of may 2021). Normalised data is defined as being rescales to have a mean of 0 and a standard deviation of 1. Source: Statistics Norway (2021d)*

The low-cost areas are found in more remote places further away from cities, like in the inner-south and north part of Norway. The bottom five municipalities are all relatively unknown with a low population. Profession wise, they are mainly occupied by farmers who need large areas for agricultural production (Statistics Norway, 2021). In total, the housing price in Norway displays a large gap of 851% from the lowest to the highest, where the urban areas are much more expensive to live in.

4.2.1 Wage Index

The wage index is retrieved from Statistics Norway as the average monthly nominal income. The data is presented as nominal wages for full-time employees living in their respective municipalities, collected for 423 out of 426 municipalities in 2018. Part-time employees are excluded to ensure that workers work the same hours (8 hours). Having income data with different working hours negatively impacts the validity of the result, as hours can fluctuate. Moreover, the data is normalised to provide a better understanding of the number's context.

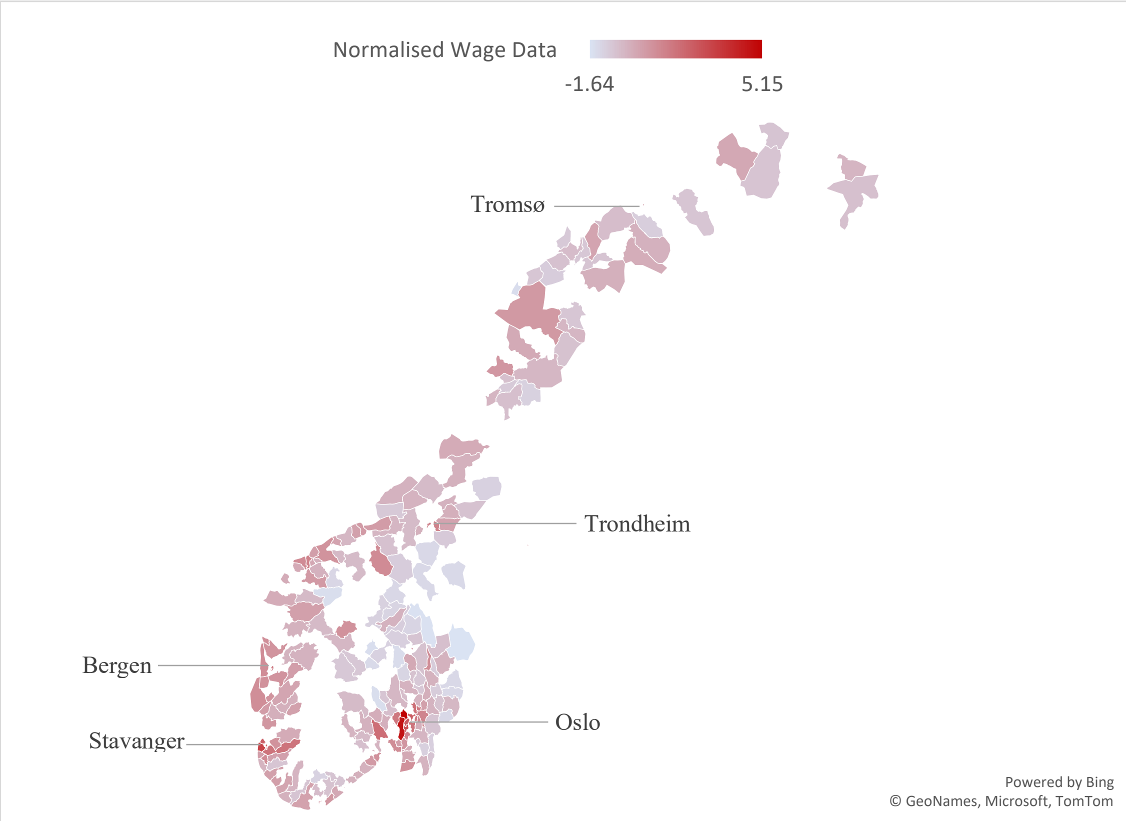
The data is originally sourced from the Norwegian Tax Authority and the Norwegian Labour and Welfare Administration. When processing the data, Statistics Norway control for errors and outlier. In cases where the income reporting is delayed for a specific year, the over-time average is taken. The data is not estimated using hedonic methods like the housing data. It is therefore not corrected for potential household sorting biases. This presents a limitation where the end-result can be affected by structural differences across municipalities. A discussion on this can be found in chapter 6 (discussion of limitations).

Figure 3: Wage Index (w^j)

	N	**Mean**	**Std.Dev**	**Min**	**Max**
Average Nominal Wage (NOK)	423	45068	3230	39760	61690

Note: *1€ = 10,02 NOK (6th of may 2021). Source: Statistics Norway (2021g)*

Map 3: Wage Index (w^j)



Note: *Normalised data is defined as being rescales to have a mean of 0 and a standard deviation of 1. A full list can be found in appendix A. Source: Statistics Norway (2021g). Tromsø is very hard to see on the map due to its small geographical area.*

Overall, Norway has a high average income of 45 068 NOK (approximately €4500). The income dispersion is also very low in Norway, with the highest average monthly salary only being 36% higher than the average. Like with the housing prices, the higher income municipalities are found in urban areas. Surprisingly, Oslo only ranks 8th in terms of average monthly income, where the highest can be found in the neighbouring municipalities of Bærum, Asker and Oppegård, all of which are categorized as wealthy municipalities (Statistics Norway, 2021). Based on this, it seems like high earning households prefer to live outside, rather than inside of Oslo. These are areas that offer lower housing prices and population density, while still being close to the capital. However, it could also be because of the wealth differences within Oslo, where the east part of Oslo houses more low-income households (Oslo kommune, 2016). Furthermore, not located within the Oslo area, Stavanger and Sola ranks 4th and 5th, respectively. Stavanger is Norway's 4th largest city and is famous for being the oil-centre of Norway, while Sola is the neighbouring municipality to Stavanger. They both have high average wages due to the presence of the oil industry (Statistics Norway, 2021).

Figure 4: Top and bottom five Wage Index

Rank	Municipality	Nominal Average Monthly Income	Wage Index (Normalised)
1	Bærum	61 690	5.15
2	Asker	59 900	4.59
3	Oppegård	56 930	3.67
4	Stavanger	55 570	3.25
5	Sola	55 090	3.10
252	Sigdal	40 260	-1.49
253	Vestre Slidre	40 220	-1.50
254	Åsnes og Våler	40 210	-1.50
255	Stor-Elvdal	39 970	-1.58
256	Trysil	39 760	-1.64

Note: *1€ = 10,02 NOK (6th of may 2021). Normalised data is defined as being rescales to have a mean of 0 and a standard deviation of 1. Source: Statistics Norway (2021g)*

If we consider the bottom five municipalities, the distance from the mean is much lower than for the highest earning municipalities, at only 12%. This points to the fact that most Norwegian households are relatively well off in terms of income. Moreover, the low wages can be found in more rural municipalities, like with the house prices, where the main occupation often is agriculture. (Statistics Norway, 2021). In total, urban areas show to have higher wages, while rural generally have the opposite.

4.4 Amenities

To complement the QOL index, it has been compared to different observable amenities. This has been done using a multivariate regression with the higher education percentage, violent crimes, accessibility, recreational outdoor area, population density and hospitality workers as explanatory variables. All variables have been retrieved from Statistics Norway in 2018. The amenities have been chosen based on existing literature and available data. Among them, Glaeser et al. (2001) finds that urban areas have a higher population growth due to higher levels of amenities, meaning that urban amenities is considered to be attractive. The same is also concluded in other papers (e.g Hybel and Mulalic 2020). For this reason, similar results should be expected for Norway. Therefore, amenities that can help explain urban attractiveness is chosen. In this sub-chapter, the data descirption combined with an explanation of the data is presented.

4.4.1 Higher Education Percentage

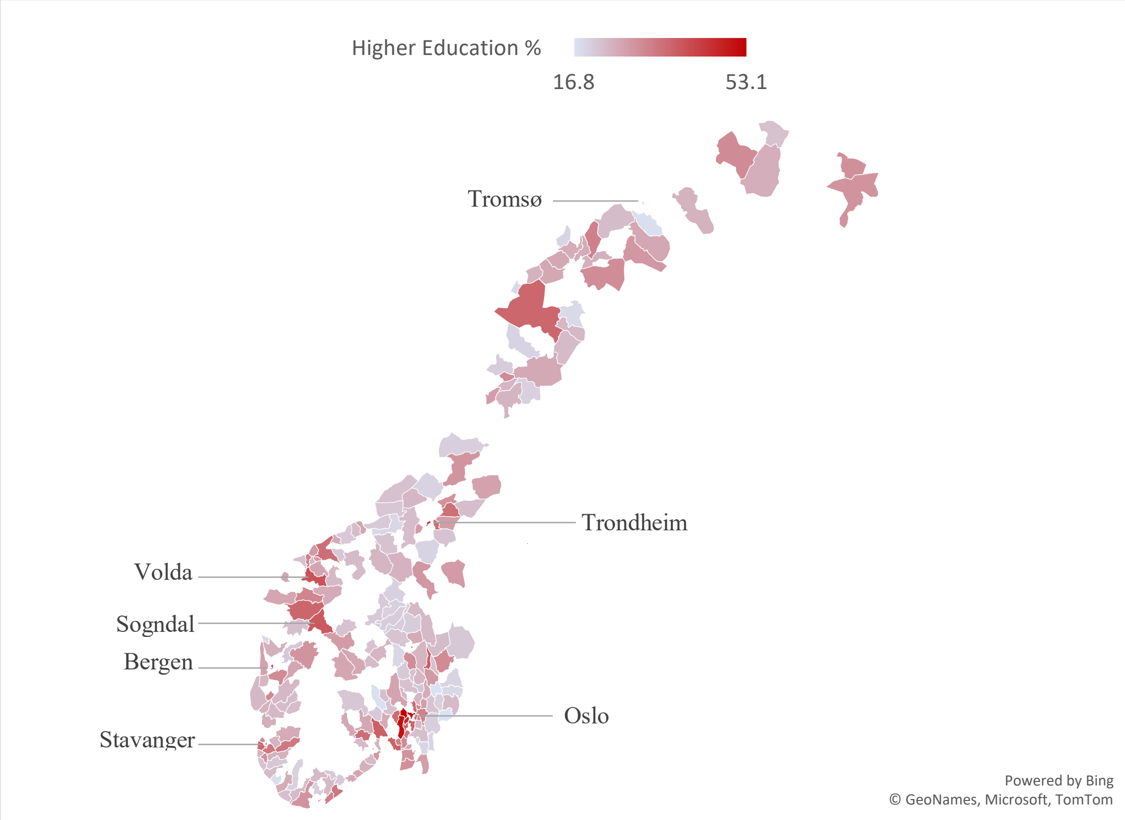
Higher education percentage is retrieved as the percentage of the population in a municipality who has three or more years of higher education, which is equal to a bachelor's degree or more (Statistic Norway, 2020b). Good schools are often linked to urban growth and attracts educated households (Glaeser et al., 2001). Attractive municipalities should therefore have a higher share of well-educated households. This is something Hybel & Mualic (2020) finds by including it as a explanitory variable in their regression on the QOL index for Denmark. Since Denmark have similar school systems of free education, similar results should be expected for Norway. Higher education is therefore belived to useful in explaning variation in the QOL index.

Figure 5: Percentage of local population with higher education

	N	**Mean**	**Std.Dev**	**Min**	**Max**
Share of Local Population with Higher Education	422	27%	7%	17%	53%

Note: *Source: Statistics Norway (2020b)*

Map 4: Share of local population with higher education



Note: *Higher education is defined as 3 or more years of education. Tromsø is very hard to see on the map due to its small geographical area. A full list can be found in appendix B. Source: Statistics Norway (2020b).*

Even with higher education being free in Norway, there is a clear gap in higher education, with a 36% difference from the minimum to the maximum observation. Higher education seems to be concentrated around urban areas, especially for the Oslo region where highest educated municipalities of Bærum, Oslo, Asker, Nesodden and Ås is found, ranking from one to five, respectively. In these municipalities, approximately half of the population have three or more years of higher education. High levels of higher education are also found in other urban areas such as Stavanger, Bergen, Trondheim and Tromsø. Additionally, areas with popular universities are also found to have a high level, where Sogndal and Volda is found at 39% and 40%, respectively. The least educated municipalities are found in more rural areas, further away from the coast and in non-urban districts of the North. Moreover, the percentage share of higher education is highly correlated with the housing price index, at a correlation coefficient of 80%. This points to that municipalities with a high share of educated households are in demand housing wise.

4.4.2 Violent Crimes

Violent crimes represent reported offences of violent crimes per thousand residents in a given municipality. In the existing literature, crime is often used as an example of a negative amenity (e.g., Gleaser et al. (2001) and Albouy and Lue (2015)). Among other things, the presence of crime is found to prevent people from relocating to a specific area. According to Bishop and Murphy (2011), the average American household is willing to pay $472, in 2011, for a 10% decrease in crime. Based on this, it is expected the coefficient to be negative and have high relevance for explaining variations in the QOL index.

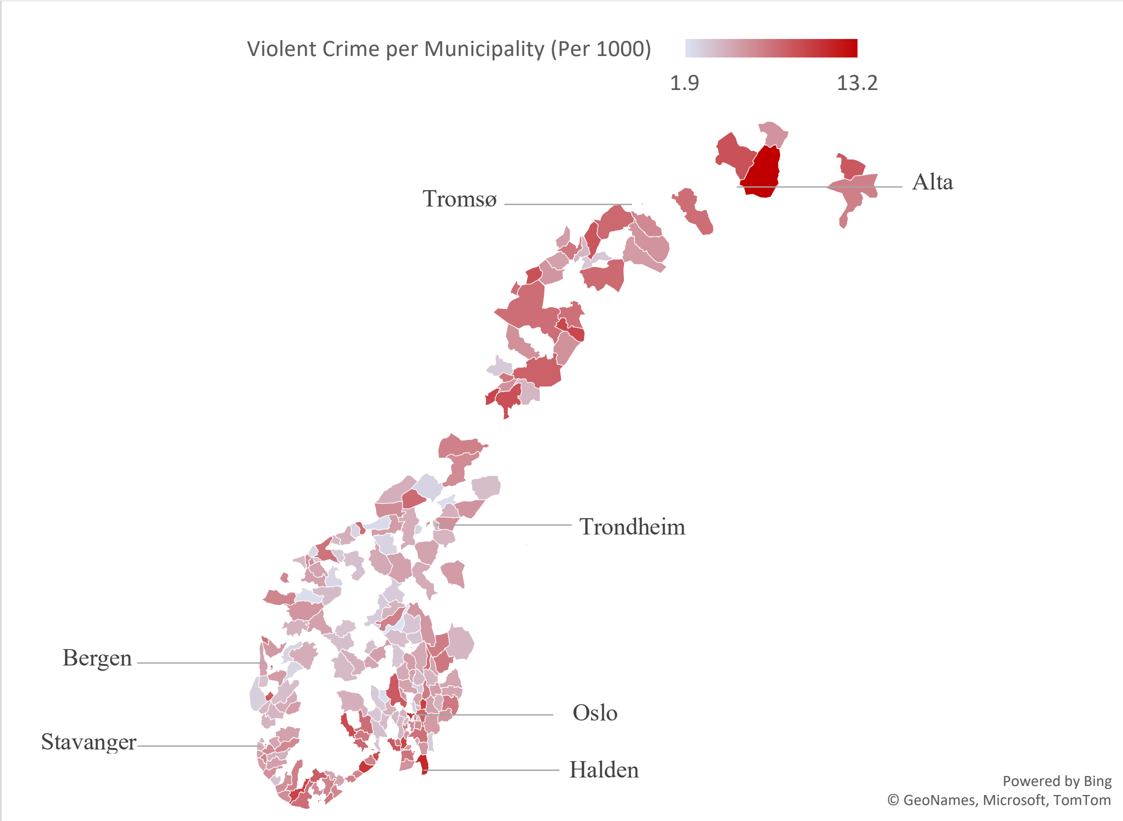
Note that violent crime per thousand residents is used instead of total crime in the model. This is due to two reasons. Firstly, if total crimes were used, non-relevant crimes for household's safety would be included. For example, if we consider the data on total crime, the top-ranking municipality have a high rate if crime due to a control station for speeding that automatically reports cars that drives faster than the speed limit. It also happens that this municipality have a highly trafficked road within its boarder (Humlen, 2014). Hence, considering total crime would most likely give misleading results. Secondly, higher crime rates tend to be correlated with urban density. Albouy and Lue (2015) argues that using murder rate as a proxy for crime fixed the above mention problem due to murders varying more withing urban areas than across. Violent crime is therefore used instead of total crime.

Figure 6: Violent crime per 1000 resident

	N	Mean	Std.Dev	Min	Max
Violent Crimes per Municipality (per 1000)	422	5.6	2.1	1.9	13.2

Note: *Source: Statistics Norway (2020c)*

Map 5: Violent crimes per 1000 resident



Note: *The data represents number of violent crimes reported in the specific municipality. Tromsø is very hard to see on the map due to its small geographical area. A full list is available in appendix B. Source: Statistics Norway (2020c).*

Crime rates are generally low in Norway, with a mean of 5.6 per thousand residents. At least for violent crimes as we consider here. Inspecting the data, the northern part of Norway has a generally higher crime level compared to the rest of the country. Smaller urban areas outside of cities, like Alta and Halden, also seem to have high levels of crime, with 11.3 and 11.2 reported violent crimes per thousand residents, respectively. However, there is no clear trend that dense urban areas have more crime. Although, the capital of Oslo is found to have a higher level of crime, where it ranks 3rd with 11.3 reported violent crimes per thousand residents. Even though Oslo is seen as a highly attractive urban area by many, it still has a higher level of crime. This can be due to a relatively poorer east side of the city (Oslo Kommune, 2016). Overall, there is no clear trend of urban or rural areas having higher levels of crime.

4.4.3 Accessibility Index

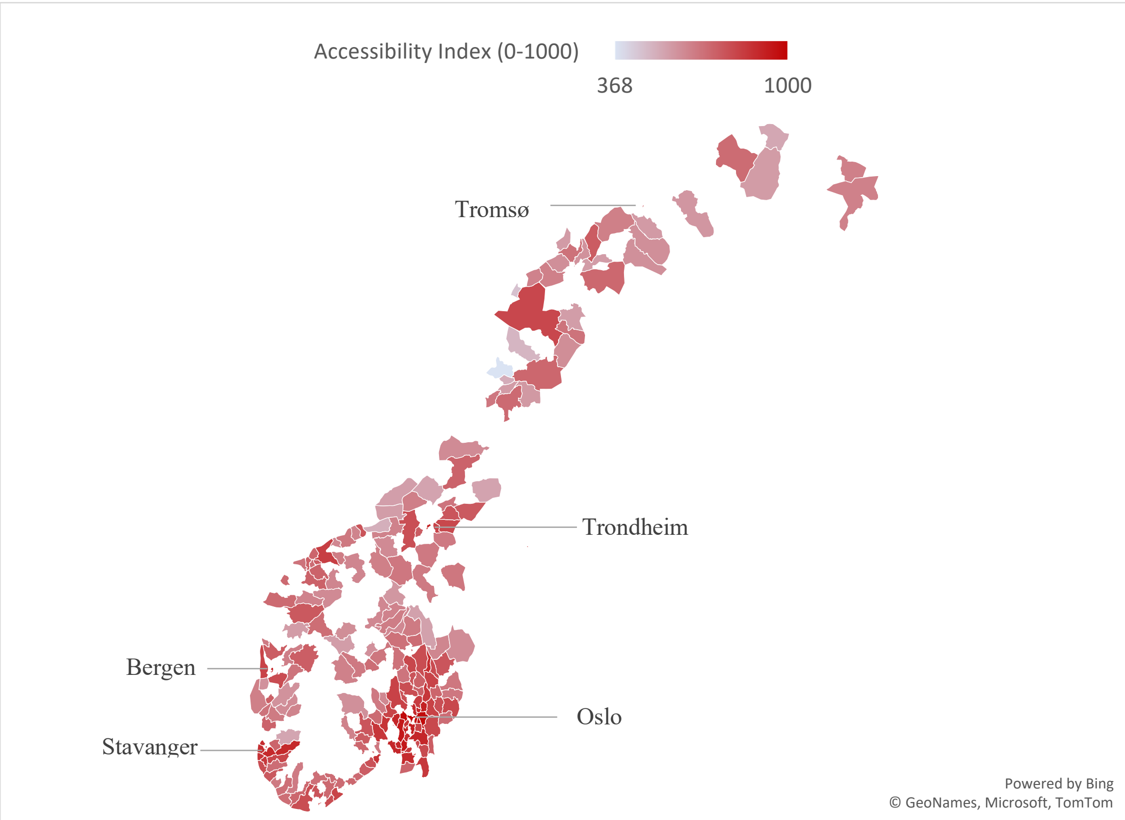
The accessibility index tells us how central a specific municipality is on a scale of 1-1000. It is produced by gathering data on the average distance to a place of work and service, where a place of service can be a restaurant or concert venue. In the index, highly popular urban areas are ranked highly due to it having rich amounts of jobs and service-opportunities (Høydahl, 2020). Since the existing literature often finds that urban areas have a higher QOL index, comparing it with the accessibility index could help to explain a lot of the variation in the QOL index (Glaeser et al., 2001).

Figure 7: Accessibility Index

	N	Mean	Std.Dev	Min	Max
Accessibility Index	422	720	112	368	1000

Note: *Source: Høydahl, E (2020)*

Map 6: Accessibility Index



Note: *The accessibility index goes from 0-1000 and is based on the distance to work and service opportunities. Tromsø is very hard to see on the map due to its small geographical area. A full list is available in appendix B. Source: Høydahl, E. (2020)*

With a mean of 720, most of Norway's municipalities are considered to be somewhat centrally located in terms of jobs and service opportunties. Unsurprisingly, Oslo is found to be the most central municipality with a score of 1000 on the accessibility index. This is followed by nearby municipalities of Lørenskog, Skedsmo, Bærum and Rælingen, that have easy access to the capital. They have an accessibility score of 976, 973, 971 and 941, respectively. Other metropolitan areas in Norway, like Trondheim, Bergen, Stavanger and Tromsø, are also found to be centrally located. Interestingly, the nearby municipalities of Oslo are found to be more accessible than many of the other metropolitan areas. This suggests that capital area have a richer level of jobs and service opportunities. Moreover, the accessibility index is highly correlated with the housing price index, at a correlation coefficient of 80%, which shows that there is a high demand for accessible housing. Overall, urban areas are found to be highly accessible.

4.4.4 Recreational Outdoor Areas

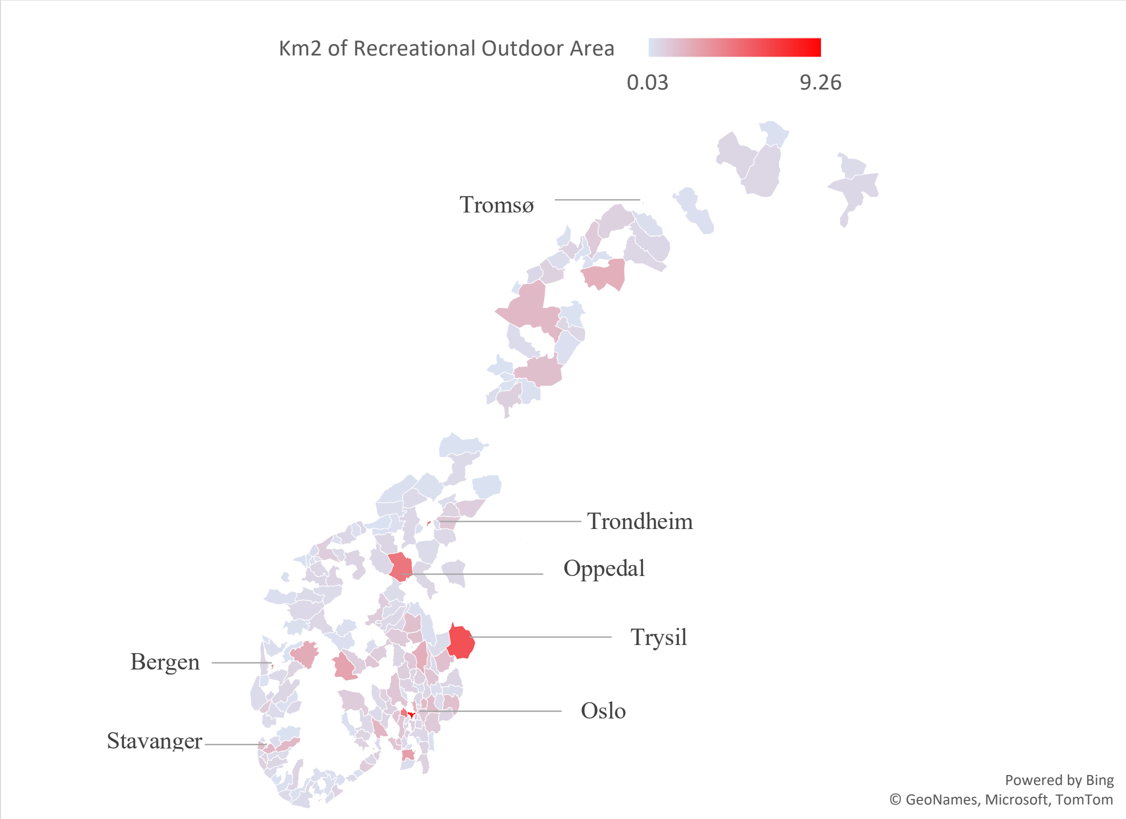
Recreational outdoor areas are retrieved as the number of km^2 of useable nature and sporting areas. This can for instance be publicly available parks and football fields (Statistic Norway, 2020a). Having close by areas like this allows for an active lifestyle, which a lot of researchers points to having a positive effect on the life quality (Chen & Zhang, 2019). Parks and outdoor areas are also commonly used as an example of desired amenities by the existing literature (e.g., Glaeser (2008)). Based on this, it is expected to have a positive coefficient and be significant in explaining variation in the QOL index.

Figure 8: Recreational Outdoor Area

	N	**Mean**	**Std.Dev**	**Min**	**Max**
Recreational Outdoor Area	422	0.76	0.96	0.03	9.26

Note: *Source: Statistics Norway (2020a).*

Map 7: km^2 of Recreational Outdoor Area per municipality



***Note:** Tromsø is very hard to see on the map due to its small geographical area. A full list is available in appendix B. Source: Statistics Norway (2020a).*

The average recreational outdoor area is 0.03 km^2, which is quite low compared the highest-ranking municipality. The highest km^2 municipalities are found in urban areas, such as Oslo, Trondheim and Bergen, with 9.26, 4.4 and 3.59 km^2, respectively. Likewise, municipalities that are famous for having a high density of vacation homes, like Trysil and Oppdal, are found to have a high level of recreational outdoor area with 5.98 and 4.46 km^2, respectively. These are located in the middle of Norway, further away from the coast, where the climate allows for skiing in the winter and hiking in the summer. Overall, high levels of recreational outdoor area are found in dense urban areas and municipalities famous for leisure activities.

4.4.5 Population Density

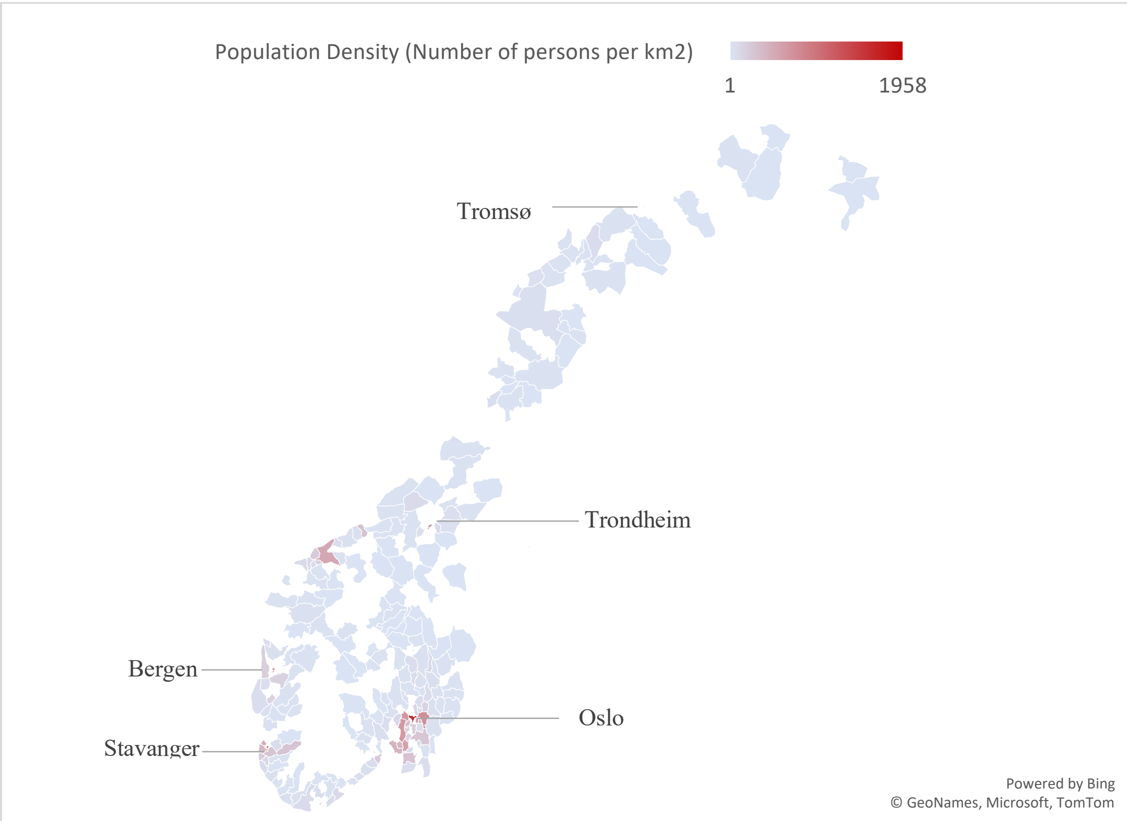
Population density is retrieved as the number om residents per km^2 (Statstics Norway, 2021k). The amenity tells us something about how narrow the residents of a specific municipality live. It could help to explain both negative and positive effects or urban areas. The positive effects could be due to agglomeration effects of people living close to each other. Agglomeration refers to the additional economic productivity given by being located in a city or industry clusters (Glaeser, 2010). In contrast, population density can also have a negative effect, though, for instance, pollution and noise (Hybel & Mulalic, 2015). Either way, it's a highly relevant amenity that could give us good insight into high QOL index municipalities.

Figure 9: Population Density per km^2

	N	Mean	Std.Dev	Min	Max
Population Density (per km^2)	422	91	208	1	1958

Note: *Source: Statistics Norway (2021k)*

Map 8: Population density per km^2



Note: *Tromsø is very hard to see on the map due to its small geographical area. A full list is available in appendix B. Source: Statistics Norway (2021k).*

Norway has an average population density of 91 people per km^2, where average geographical size of municipalities decreases with the population density. The highest density is found around the Oslo area. Ranking 2nd, Oslo has a population density of 1581 residents per km^2, which is far above the average of 91 km^2. Next up we find the neighbouring municipalities of Oppegård, Skedsmo and Bærum with a population density of 799, 722 and 664 residents per km^2, respectively. Surprisingly, Stavanger, Norway's 4th largest city, has the highest population density of 1958 residents per km^2, which is even significantly higher than Oslo. This might be because of Stavanger's relatively small size of 71.35 km^2 compared to Oslo's size of 480.75 km^2 (Statistics Norway, 2021). Other urban areas such as Ålesund and Trondheim also have a high population density. However, as seen on map 8, most of the municipalities have a relatively low population density, where several of them even have a population density of 1. This is most likely due to the large number of low-populated municipalities, as seen in chapter 4.1. Overall, the urban areas have a significantly higher population density compared to the rural areas. This can also explain a high correlation coefficient of 65% with the housing price index, as more people often want to live in urban areas (see chapter 2).

4.4.6 Hospitality Industry Workers

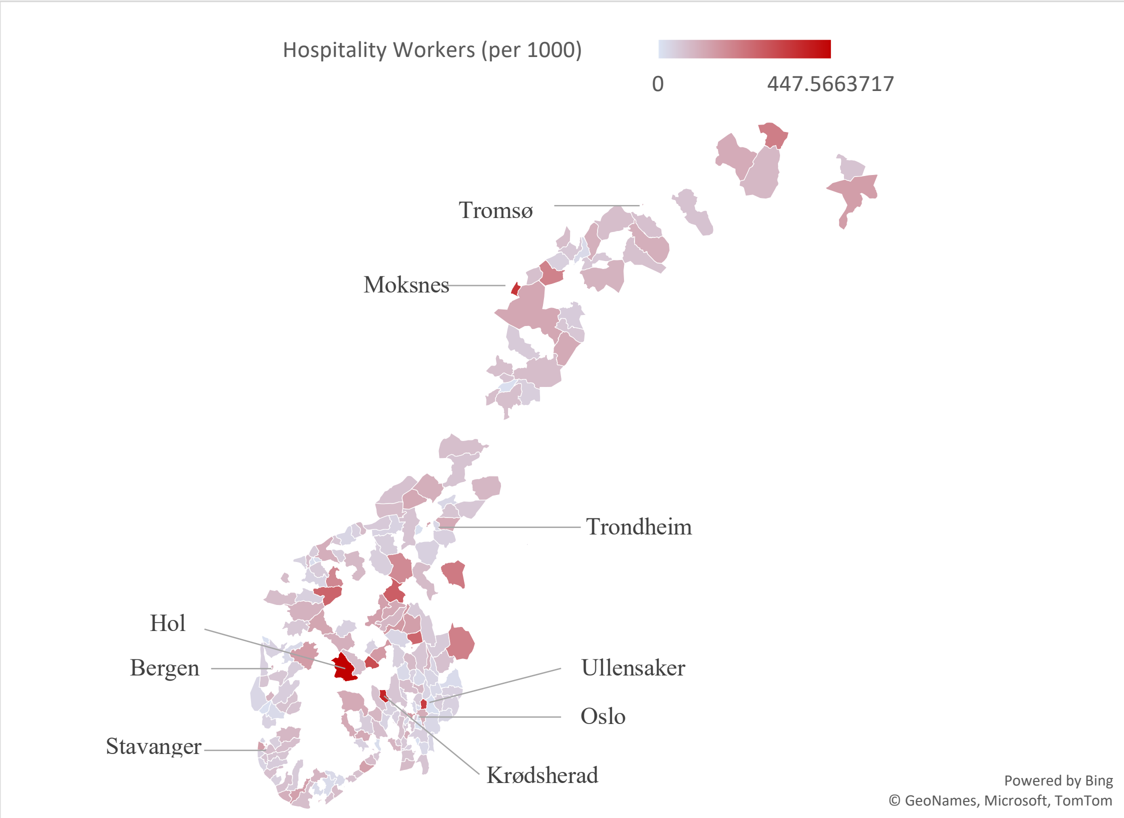
Hospitality industry workers are gathered as number of employees in the hospitality sector. This includes both hotel and restaurant workers. To remove population bias, the data is transformed into workers per thousand residents. This is done by dividing the number of hospitality workers on total population in the respective municipality before multiplying it by 1000. Moreover, hospitality workers can serve as a proxy for both tourism and number of restaurants and hotels. A high level of tourism often points to a municipality being attractive, since a lot of people want to visit it. Consequently, it creates a high demand for restaurants and hotels to supply the tourists with food and accommodations (Radu et al., 2010). Additionally, restaurants and hotels are often considered classic examples of attractive amenities in most of the existing literature (e.g. Glaeser et al. (2001)).

Figure 10: Hospitality Workers per Municipality (per 1000)

	N	Mean	Std.Dev	Min	Max
Hospitality Industry Workers per Municipality (per 1000)	422	69	61	3	477

Note: *Source: Statistics Norway (2021a)*

Map 9: Hospitality Industry Workers per Municipality (per 1000)



Note: *Tromsø is very hard to see on the map due to its small geographical area. A full list is available in appendix B. Source: Statistics Norway (2021a)*

The average municipality is found to have 69 hospitality industry workers per 1000 residents, which is substantially lower than the municipalities the highest amount of hospitality workers. The municipalities with the highest number of hospitality workers are mostly found in touristy municipalities, where the five municipalities with the highest level of hospitality workers are found in Hol, Krødsherad, Moskenes and Ullensaker. Both Hol and Krødsherad are famous for having high level tourism due to a high level of winter activities such as skiing. Moskenes is located in Lofoten, which is famous for international tourism all year around. Ullensaker has Norway's busiest airport located within its borders. Whilst the highest concentrated tourism areas are on the top of the list, urban municipalities are also found to have a high level of hospitality workers. Hereby, Oslo, Tromsø, Trondheim and Bergen have 152, 139, 126, 104 hospitality workers per 1000 resident, respectively, which if far above the average of 69. Overall, urban and touristy areas are found to have a higher level of hospitality workers.

4.5 Summary of data

Both the wage and the housing price index are found to be higher in urban areas. They are also found to be highly correlated at a correlation coefficient of 70%. This points to that Norwegian households, at least partly, compensate higher housing prices with higher wages. This is expected as attractive urban areas tend to have both high wages and housing prices. However, the remaining 30% points to other things being important for the willingness to pay for local housing, such as local amenities. Like mentioned, the amenities are chosen based on available data and existing literature. Figure 11 summarises the geographical trend and expected correlation with the QOL index based on existing literature.

Figure 11: Summary of amenity data.

	Geographical Trend	**Expected Correlation with the QOL Index (Based on existing literature)**
Higher Education Percentage	Higher in urban areas and municipalities with popular universities	Positive
Violent Crime (Per 1000)	No clear trend	Negative
Accessibility Index	Higher in urban areas	Positive
Recreational Outdoor Area (km^2)	Higher in urban and leisure filled areas	Positive
Population Density (per km^2)	Higher in urban areas	Positive or negative
Hospitality Workers	Higher in urban and touristy areas	Positive

Note: *Source: Own creation*

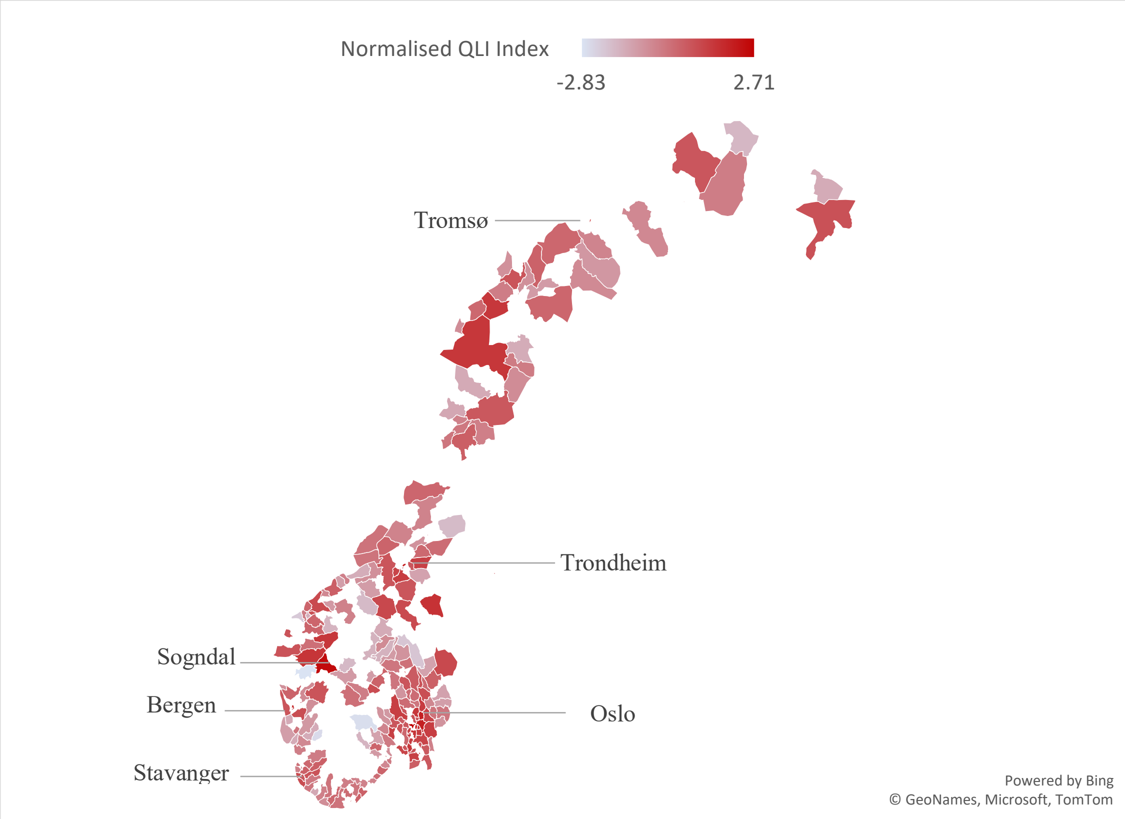
5. Results

This chapter presents the results combined with a discussion on the findings. Chapter 5.1 presents the results from the Rosen-Roback model (QOL index). This includes a discussion on the top and bottom five municipalities to give the reader context of why they have received the rankings they have. Chapter 5.2 compares the QOL index to the respective population growth and housing price. A high QOL index municipality should have both high population growth they are highly attractive. Chapter 5.3 compared the QOL index to different observable amenities as a compliment to the QOL index results. It also tells us something about what amenities are in-demand for Norwegian households. Lastly, chapter 5.4 summarises the findings.

5.1 Quality of life (QOL) Index

By combining the housing price index (p^k), wage index (w^j) and the respective household shares, the QOL index (Q^j) is calculated. The calculation is done in the same way as Albouy and Lue (2015) and Hybel and Mulalic (2020), where the respective data is applied directly to the model (equation 6). The end results show an estimation of the marginal willingness to pay for local amenities of Q^j across municipalities in Norway.

Map 10: The QOL Index (Q^j)



Note: *Represents the willingness to pay for local amenities Q^j. Tromsø is very hard to see on the map due to its small geographical area. A full list can be found in appendix A. Source: own creation (data from Statistics Norway (2021d); Statistics Norway (2021g)).*

The result is plotted on map 10 and shows that the willingness to pay for local amenities is higher in urban areas. The willingness to pay is especially high in the capital of Oslo and its surrounding municipalities. Other urban areas such as Bergen, Trondheim and Tromsø is also found to have a high QOL index. Comparatively, rural municipalities are found to have a low QOL index. This confirms the expected results of that urban areas have a higher QOL index, like most of the existing literature (e.g., Albouy and Lue (2015) and Hybel and Mulalic (2020)). Figure 11 reports the five highest and lowest ranked municipalities in terms the QOL index, which is followed by a discussion on the given municipalities. A full list can be found in appendix A.

Figure 12: Top and bottom five municipalities on the QOL index (Q^j)

Rank	Municipality (j)	House price Index (p^j)	Wage Index (w^j)	QLI Index (Q^j)	Net Migration (2018-2019)
1	Oslo	5.27	2.33	2.71	1.13%
2	Sogndal	1.75	-0.43	2.44	1.64%
3	Tromsø	2.33	0.60	2.17	1.34%
4	Lørenskog	2.83	1.45	1.96	3.71%
5	Skedsmo	2.54	1.18	1.94	2.72%
252	Herøy	-0.95	0.98	-2.19	-0.42%
253	Verran	-1.44	-0.96	-2.36	-0.97%
254	Sauda	-1.26	0.32	-2.62	-1.42%
255	Tinn	-1.44	-0.45	-2.70	-1.30%
256	Høyanger	-1.42	-0.17	-2.83	-1.52%

Note: *Source: own creation (based on data from Statistics Norway data from Statistics Norway (2021d); Statistics Norway (2021g); Statistics Norway (2021k).*

The capital of Oslo ranks the highest in terms of the QOL index. This is not surprising, as approximately 20% of Norway's population have chosen to make Oslo their home, despite the large gap between income and house price in the city. This points to high levels of amenities, where Oslo has several universities, restaurants and cultural institutions. Oslo also has very high rates of tourism, where it creates 311% more value from tourism compared to the second most popular tourist destination of Bergen (Menon Economics, 2018). This point to Oslo being a highly attractive city, where the residents enjoy a high QOL through high levels of amenities.

Second on the QOL index, Sogndal is more of a surprising addition to the top five list. Sogndal is situated in the famous fjords of Norway, a few miles north of Bergen. This means that the residents of Sogndal enjoys beautiful nearby nature that offers the possibility of great nature related activities. Due to the beautiful nature, the municipality also experience a lot of tourism, especially in terms of cruise ships (Menon Economics, 2018). The Western University of Applied Science, with a total of 17,000 students, also have one of their campuses in Sogndal, bringing a lot of students to the area (HVL, 2021). In addition to this, Sogndal also have a relative high net migration rate, with an increase of 1.64% from 2018 to 2019 compared to the average the national average of 0.15% (Statstics Norway, 2021k).

Third on the list we find Tromsø, the northernmost city on the top five list. Like introduced in chapter 4, Tromsø is the largest city in the North of Norway with a population of 71,000 people (Statistics Norway, 2021k). Besides being the urban centre of the north, Tromsø is famous for its nature and the northern light. This has made the city the 6th largest contributor in terms of tourism in Norway (Menon Economics, 2018). The municipality also have a large university named The Arctic University of Norway present. The university hosts 12,000 students, of which 10% are international (The Arctic University of Norway, 2021). Tromsø also have the 10th most expensive housing prices compared with relatively low local wages, meaning that the residents of Tromsø puts a high value on the local amenities.

Lørenskog and Skedsmo, the last two municipalities on the top five list, are located in the suburbs of Oslo. They both have two of the highest net migration rates in Norway of 3.71% and 2.72%, respectively, which is among the five highest in the country. According to Statistics Norway's accessibility index, both are also considered to be highly accessible, ranking second and third in terms of the accessibility index. While these municipalities are not famous for any particular amenity, they seem to be highly attractive based on the above mention data. This could be due to the relatively close distance to the capital, which enables households have easy access to a metropolitan area, while still enjoying around half the population density. Since these municipalities rank above other metropolitan areas, like Bergen and Trondheim, this could also point to Oslo being far more attractive in terms of amenities.

The bottom five municipalities on the QOL index of Herøy, Verran, Sauda, Tinn and Høyanger are found in more rural parts of Norway. These are all found to have a low housing price and negative population growth, which suggests that there is not much demand to live in the area. Likewise, they also generally have low wages, except for Herøy and Sauda, which are found to have above average wages. The reason for this is the presence of the fishing industry, which actually provide very high wages (Statistic

Norway, 2021a). However, outside of high wages, the municipalities seem to have a low level of amenities, leaving them unattractive.

However, we do find some anomalies in the results. The city of Stavanger is found to have a much lower QOL index score compared to the rest of the urban areas, which is surprising as it is the 4th largest city in Norway. This could be due to the city having one of the highest average wages in Norway, while at the same time having one of the lowest housing prices among the urban areas. If we follow the Rosen-Roback model, this means that a household does not have to sacrifice much to live in Stavanger, as they can get both higher wages and lower housing costs compared to other urban areas. Subsequently, this points to a low amenities value in Stavanger, which can be supported by the relatively low 2018-2019 migration rate of 0,67% compared to municipalities with a high QOL index score. Surprisingly, the neighbouring municipalities have a lot higher score on the QOL index. In chapter 5.3, we find that population density has a negative effect on the QOL index, and Stavanger has the highest population density in Norway. This could help to explain the result, as the neighbouring municipalities have a much lower population density. It could be due to household sorting in the wage index (see chapter 6.1 for a discussion on this).

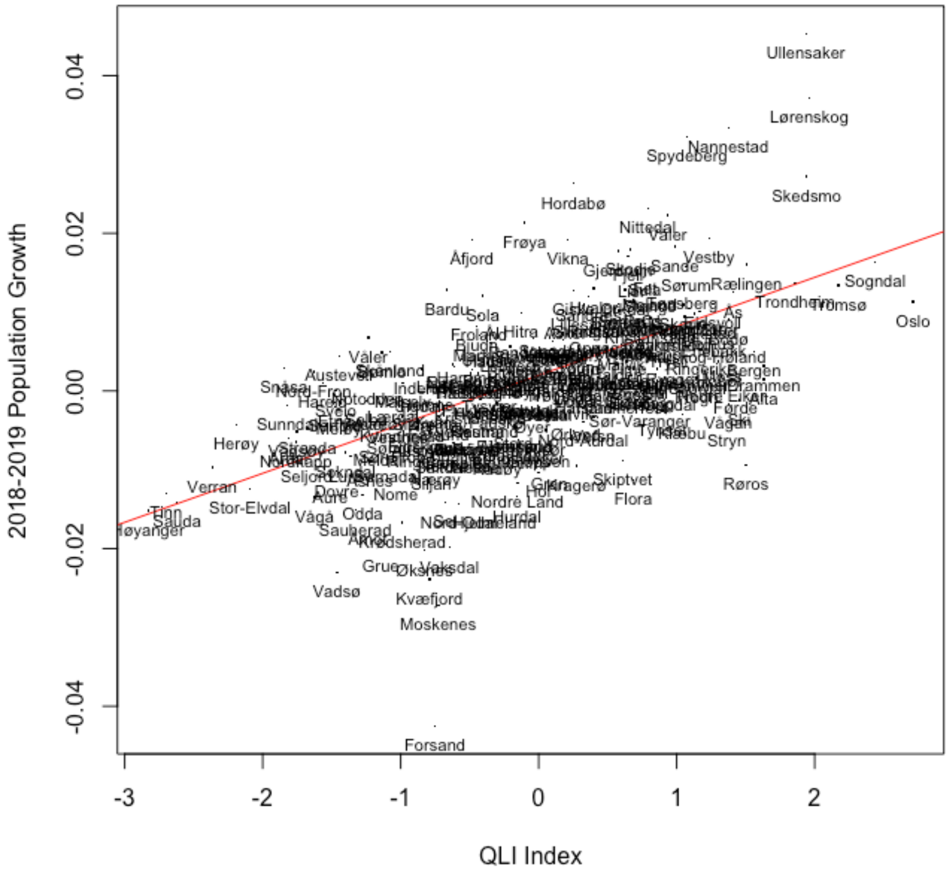
5.2 Quality of Life (QOL) Index, Population Growth and Housing Prices

Like suggested by Glaser et al. (2001), areas with high levels of amenities should experience higher population growth, as they are considered to be more attractive. By comparing the 256 municipalities in this analysis with their population growth in 2018-2019, it is found that the overall amenity levels reflect the population growth (see figure 14)[5]. Accordingly, the trend line regression, as seen in figure 15, show that if the QOL index increases by 1, the population growth would increase by 0.6%. While a 1-point increase on the QOL index can be considered to be sizeable, a 0.6% population growth is also greater than the average population growth of 0.52%. This suggests that Norwegian households are attracted by high quality amenities. The finding also confirms that the

[5] Although still with positive net migration, Oslo found under the trend line. However, with 20% of the Norwegian population residing in Oslo, it requires a lot more people to move there to acquire a percentage change in the population. In level terms, new movers in Oslo are significantly higher compared to the rest of the country (Statstics Norway, 2021k)

results from the QOL index have some merit to them, as people actually are moving to municipalities with a higher QOL index score. Likewise, Glaser et al. (2001) find this for the United States, where they empirically show that cities with high levels of amenities have grown faster than those with a low level.

Figure 13: QOL index (Q^j) compared to local population growth



Note: *Source: Own creation (data from Statistics Norway (2021k) & QLI index from chapter 5.1)*

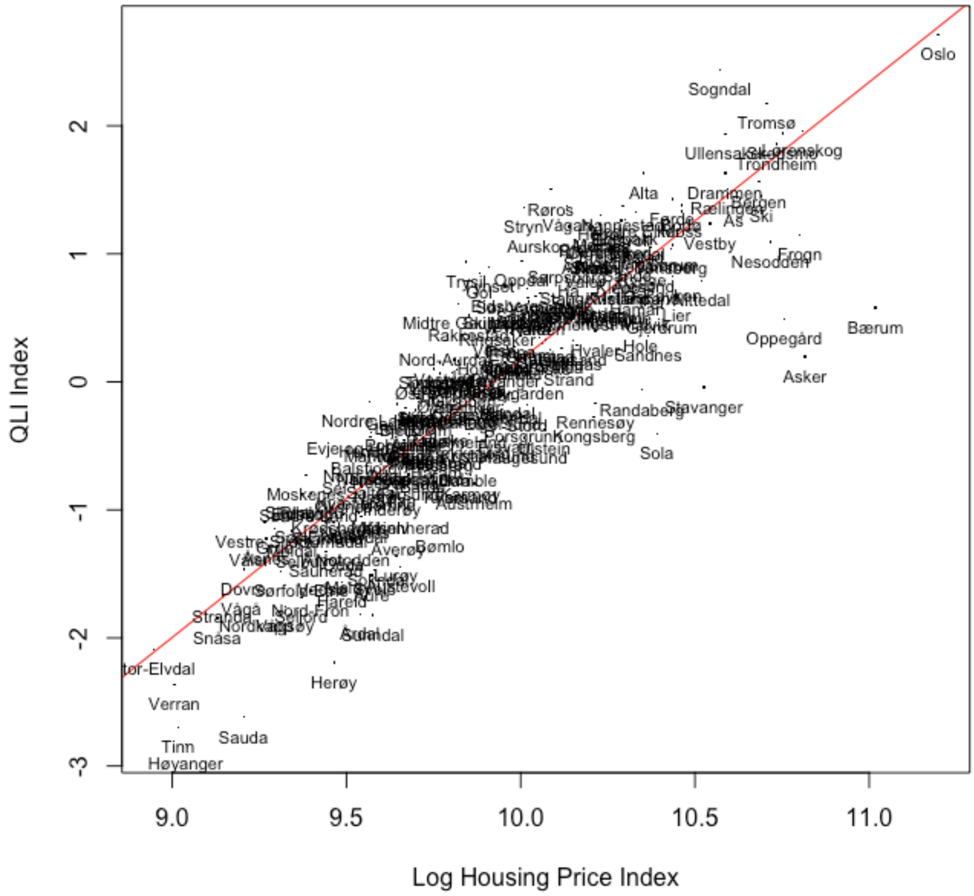
Figure 14: QOL index and population growth regression

	Dependent variable:
	2018-2019 Population Growth
QLI Index	0.006^{***}
	(0.001)
Constant	0.002^{***}
	(0.001)
R^2	0.348
Adjusted R^2	0.345

Note: *$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$. Data retrieved from Statistics Norway (2021k) & QLI index (chater 5.1).*

Furthermore, Glaser et al. (2001) also find in their empirical research that urban house prices had risen faster than urban wages. With respect to the Rosen-Roback model, this suggests that the demand for an urban life is higher than the opposite, as households sacrifice utility in form of higher housing costs without an equal increase in wages. The same observation is true for Norway, where the ever-increasing gap between wages and housing prices has been discussed for a long time. Especially in Oslo, where, among other things, experts warn of infertility due to the large gap (Wig, 2021). Based on this, we also expect the housing prices to be high in these municipalities, as there should be a high demand to live there. This is what we find in figure 16. Likewise, as these municipalities are very expensive to live in, it also explains why households are moving to lesser municipalities in terms of the QOL index.

Figure 15: QOL index and the house price index (p^j)



Note: *Regression results can be found in appendix C. Source: own creation (data from Statitics Norway (2021d) & QLI index (chapter 5.1).*

5.3 Amenities

By definition, the QOL index captures the value of all amenities in a specific municipality. Some of these have a positive correlation with the QOL index, while some have the opposite. For example, parks, clean air and a rich culture life most likely have a positive correlation with the QOL index, while high levels of crime and a lack of service areas might have a negative correlation. There are also amenities that are not visible for researchers, such as the smell, how polite the neighbours are and beautiful nature. To both support the results from the QOL index and investigate the QOL index's correlation with different amenities, a multivariate regression of selected amenities is performed. A summary of the selected amenities can be found in figure 11. Moreover, it is important to note that the amenities used in the regression might be endogenous at different levels of the population, due to household sorting. Omitted variable bias is not unlikely either, as there are unknown and undefined amenities. The results in the following multivariate regression should therefore be taken as an illustrative measure rather than causal relationships.

Figure 16: QOL index (Q^j) regressed on amenities

	Dependent variable:		
	QLI Index		
	(1)	(2)	(3)
Share of Population with Higher Education	0.068***	0.026***	0.023**
	(0.010)	(0.010)	(0.009)
Recreational Outdoor Area (km^2)	0.222***	0.181***	0.134**
	(0.069)	(0.061)	(0.059)
Population Density (per km^2)	-0.0002	-0.001***	-0.001***
	(0.0003)	(0.0002)	(0.0003)
Violent Crimes (per 1000)		0.034	0.028
		(0.021)	(0.021)
Accessibility Index (0-1000)		0.006***	0.006***
		(0.001)	(0.001)
Hospitality Industry Workers (per 1000)			0.002**
			(0.001)
Constant	-1.952***	-5.107***	-5.373***
	(0.258)	(0.355)	(0.360)
R^2	0.295	0.543	0.553
Adjusted R^2	0.287	0.534	0.543

Note: **p<0.1; **p<0.05; ***p<0.01. See chapter 4.4 for an explanation of the data. White robust standard errors are used in regression (1), (2), (3).*

The multivariate regression gives the expected result based on existing literature and normal economic intuition. Regression (1) gives as adjusted R^2 of 0.295, which means that the regression explains 29.5% of the variation in the QOL index. However, population density, which often is considered an important factor for the QOL index, is insignificant (Glaeser, 2001). This is most likely due to omitted variable bias, as it is significant at 1% after adding violent crime (per 1000) and the accessibility index to regression (2). Adding these two variables also improved the R^2 to explain 54.3% of the variation in the QOL index, which is a substantial improvement. In regression (3), Hospitality industry workers (per 1000) is added, which further improves the model, leading to regression (3) as the preferred model. Regression (3) explains approximately 55% of the variation in the QOL index. Naturally, it is hard to explain 100% of the QOL index, as there are both unknown and unobserved amenities.

Inspecting the regression, population density and the accessibility index have the highest statistical significance at 1%. For the population density, a 1 person increase per km^2 gives a -0.001 decrease in the QOL index. This means that Norwegian household prefer to live less densely. Like pointed out in chapter 4.4.2 (data chapter), one possible explanation of this could be that that a higher population density gives higher levels of noise and pollution. Furthermore, the accessibility index shows that a 1-point increase to the index gives a 0.006 increase to the QOL index. This is what we expect according to the existing literature, since urban areas tend to be more accessible and the QOL index is found to be higher in urban areas (see figure 11). Adding the accessibility index also increased the R^2 by a great deal, pointing to that it helps to explain a lot of the variation in the QOL index. Interestingly, this points to that Norwegian households prefer to live both spacious and accessible, which often is a trade-off they have to make. This could explain why neighbouring municipalities to popular cities rank so highly.

The share of population with higher education, km^2 of recreational outdoor area and number of hospitality workers per 1000 residents is found to be statistically significant at 5%. All of the coefficients display the expected result according to the existing literature (see figure 11). Firstly, considering the share of population with higher education, a 1% increase to the coefficient, gives a 0.023 increase on the QOL index. This means that a having a high share of higher education is an attractive amenity for Norwegian households, which make sense as higher education often is correlated with urban growth

(Glaeser et al., 2001). For the km^2 of recreational outdoor area, a 1 km^2 increase in the recreational outdoor area increases the QOL index by 0.134. Like with the higher education percentage, this points to that recreational outdoor area is an attractive amenity for Norwegian households. This is not unexpected, as recreational outdoor areas, like for instance parks, are often used as example of desired amenities in the existing literature. Lastly, increasing the hospitality workers per 1000 resident by 1, increases the QOL index by 0.002. Hospitality workers serve as a proxy both for tourism, restaurant and hotels, where all are classic examples of desired amenities in most of the existing literature (e.g., Gleaser et al. (2001)). Most of the top five municipalities in chapter 5.1 also have a large tourism presence, pointing Overall, the results are as expected and point to that Norwegian households find urban amenities attractive.

The only insignificant variable is violent crime per thousand residents. Based on existing literature, we expected a negative coefficient here, as crime usually have a negative impact on urban attractiveness (e.g., Albouy and Lue (2015)). The insignificant result is likely due to the low crime rate in Norway (Statistic Norway, 2020c). When inspecting the geographical trends of the data in chapter 4.4.2, there were no clear trend either, which further supports the insignificant result. Thus, it does not seem like crime is a consideration for Norwegian households when deciding where to live or to the general QOL index.

5.4 Summary of results

Using the Rosen-Roback model extended with local taxes by Albouy (2008), we find that urban municipalities, such as the capital of Oslo, have a higher QOL index, while rural municipalities have the opposite. This can be clearly seen on map 10, where the QOL index is declining the further away you move from an urban area. Based on the existing literature, this is what we expect, as modern households tend to have a higher willingness to pay for urban amenities. Accordingly, the municipalities with a high QOL index should experience higher population growth and housing prices, since they are highly attractive. This is something we find by comparing the local QOL index with the respective population growth and housing price. The QOL index results should therefore be considered meaningful. Moreover, using a multivariate regression on relevant amenities, we find significant results. Typical urban amenities of higher education percentage, recreational outdoor area (parks, skiing resort etc) and hospitality industry workers (proxy for tourism, restaurants and hotels) are found to be positively correlated with the QOL index. This can also help explain the non-metropolitan municipalities with a high QOL index score, like for instance Sogndal, as the typically have higher levels of leisure activities, tourism and universities. The accessibility index is also found to be highly significant, pointing to that Norwegian households prefer to live accessible. In contrast, population density is found to be negatively correlated with the QOL index, which can be interpreted as a higher population density giving negative amenities such as pollution and noise. Combined with the positive coefficient on the accessibility index, this points to that Norwegian households prefer to live both spacious and accessible. This could explain why neighbouring municipality of popular urban areas, like Lørenskog and Skedsmo, also have a high QOL index score. Lastly, violent crime is found to be insignificant, pointing to that crime is not a factor for Norwegian households when deciding where to live. This could be due to the low crime levels in Norway (Statistic Norway, 2020c).

The findings suggest that amenities are important to consider for urban policy. While it can be hard for rural municipalities to accumulate the algometric effects a large cluster of people create, it should still focus on improving local amenities to stay attractive. Like mentioned in the introduction of the thesis, Norway have struggled with a population that's shifting away from the rural part of Norway to more urban areas. This has led to a lack of, among other things, workers, which is essential for every municipality to survive. To address this, monetary incentives such as student loan forgiveness and tax subsidies have been attempted by the Norwegian government. This has not been successful, as the number of urban residents has increase throughout the period (Statstics Norway, 2021k). Based on the findings of this thesis, a public policy shift towards the quality of the local amenities might prove to be helpful.

6. Discussion of Limitations

In this chapter a discussion of the limitation of paper and the related effects takes place. When writing a thesis, you are both time and resource constraint. This leads to natural limitations, which will be discussed in this chapter together with the potential implications on the results.

Using the Rosen-Roback model extended with local tax rates by Albouy (2008), the general results are in line with the related literature of urban areas having higher levels of amenities and thus a higher QOL index. However, by assuming that households are homogenous, fully mobile and have full information, it only enables us to get a limited estimate of the real world. Nevertheless, municipalities with a high QOL index generally have a higher level of net migration and housing prices compared to lower scoring municipalities, which often experience the opposite. The regressed amenities also show both statistically and economical significance. This points to the results being significant and having some merit to them despite the limitation discussed in this chapter.

6.1 Household Sorting Bias & Data Collection

Like introduces in chapter 4.2, related literature often estimates the wage index and housing costs index using hedonic regression method to combat household sorting (e.g Hybel and Mulalic (2020) and Blomquist, Berger and Hoehn (1988)). However, since the hedonic method values a durable good by looking at the related characteristics, a lot of data has to be collected. If we for example consider a house, there could be hundreds of characteristics impacting the value of a house. It is therefore hard to collect all the necessary data, making the methodology vulnerable for omitted variable bias (Kuminoff et al., 2010). However, in practice, the hedonic method has proven to be surprisingly robust (Case, 2006). This is also supported by the frequent use in the related literature. It would therefore be optimal to use hedonic price indexes in this thesis as well. Like mention in chapter 4.2, hedonic indexes were unfortunately not available for wages and the housing price index did not control for differences in quality across municipalities. This opens a flaw in the result due to the possibility of household sorting.

Household sorting is important to control for in the data, as failing to do this can result in significant biases. Since we want to compare the QOL index across municipalities, the data needs to be representable of an average household. With the presence of sorting a skewed representation is possible, as households sort based on heterogeneity (Albouy, 2008). Since the housing price index does not take into account differences in quality and the wage index does not control for sorting at all, it is important to consider the effects it could have on the result. If we consider the housing index, it is clear that not controlling for the differences in quality matters. However, it is hard to know which effect it has. This is because we do not have data on the local quality of Norwegian houses. Though, if we assume that urban areas have higher quality houses and that they are more expensive, it means that we overestimate the housing cost for urban areas in our model. This is because a skewed representation of higher quality houses pulls the price upwards. With respect to the QOL index, this means that it would be lower than the original estimate for urban areas, as lower housing costs, all else equal, gives a lower willingness to pay for local amenities.

For the wage index, one likely bias is the over-estimation of wages in cities. This is because cities tend to have an overrepresentation of highly skilled and -paid labour (Feuillade, 2018). This is something that is true for Oslo as well, where the average wage is approximately 37% higher than the average municipality (Statistics Norway, 2021f). The reason for this is that cities tend to have more advanced industries, like for instance the finance industry. Intuitively, since un-adjusted wage data is used in this thesis, wages could be overestimated for cities in our model. All else equal, the QOL index is then underestimated for cities, since lower wages points to a higher willingness to pay for local amenities. This could explain the low QOL index in Stavanger, as Stavanger have excessive wages due the oil industry. While this would have no change to Oslo's spot on the QOL-ranking, we might have seen Trondheim, Bergen and Tromsø higher up on the list as well. The same goes for Sauda and Herøy, two of the lowest rated municipalise in terms of the QOL index, which has a relative high salary due to the presence of the fishing industry. Although these are not urban municipalities, a large presence of a high paying industry cold have the same effects.

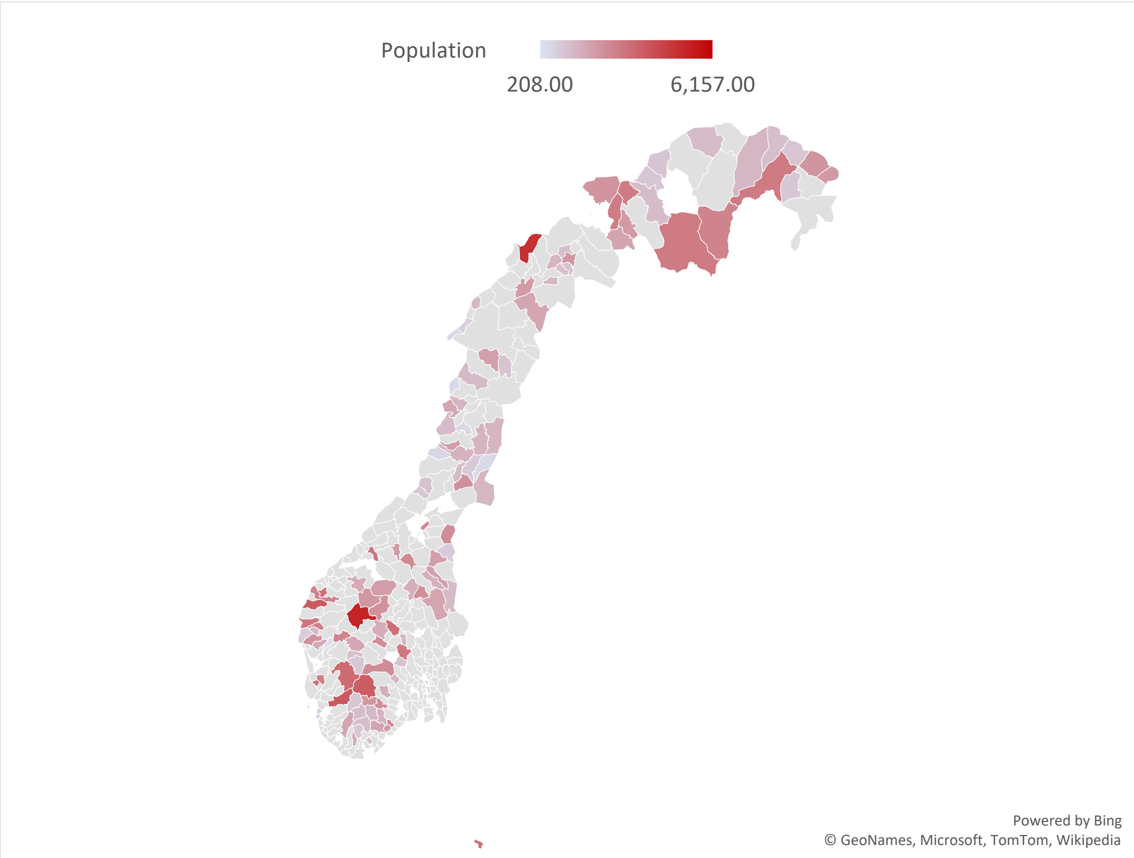
On the other side, the higher wages could be due to agglomeration effects, in which the higher wages are due to amenities related to agglomeration rather than household heterogeneity and should not be accounted for. While the literature on agglomeration is vast, it is generally assumed that urban workers tend to have a skill premium due to knowledge sharing and closer distances within a cluster (Glaeser, 2010). De la Roca and Puga (2017) find this using Spanish data, that workers do not attain high wages due to their ability, rather from the actual city size. However, using French data, Combes, Duranton and Gobillon (2008) find that not controlling for individual skill leads to very biased estimates. Estimating the QOL for Denmark, Hybel and Mulalic (2020) find that controlling for sorting, using hedonic methods, greatly reduce the wage gap from cities to rural areas. However, it is hard to know the real effect of this in the result, as there is not much research on this using Norwegian data. Nevertheless, it is reasonable to assume that not controlling for household sorting has impact on the final result.

The use of household income was also considered as a replacement for the wage index. This would be more in-line with the model, as it considers households and not individual workers. However, the household income data from Statistics Norway contained some significant biases that was hard to ignore. Systematically, the household income from cities were lower than expected with rural areas having the opposite. This was because urban households tend to have more singles, while rural household often are dual-owner households (Andersen, 2020). This created a bias where the QOL index favour rural areas, as cities had artificial high wages. All else equal, higher wages give a lower willingness to pay for local amenities. Based on this, average nominal monthly earnings are used, as it is not affected by the number of persons in a household. While weighting the household income based different household groups could have been an option, this was decided against to avoid complexity.

6.2 Omitted Housing Price Index Data

As mentioned in chapter 4.2, the housing price index is missing observations on several municipalities, where it reduced the number the municipalities from 446 to 288. Naturally, removing 47% of the observation likely has impact on the result. All valid data points provide us with some information, and a general rule in statistics is that the more observation the better. The reason missing observation is likely due to the low local population and insignificant number of housing transactions in the omitted municipalities, where average housing transaction was 5 in 2018 (Statistics Norway, 2021d). The omitted municipalities have been plotted with their respective population on map 11. A full list together with the population density and number of residents can be found in appendix D.

Map 11: Omitted municipalities due to the housing price data



***Note:** A full list can be found in appendix D. Source: Own creation, data retrieved from Statistics Norway (2021d); Statistics Norway (2021k).*

Overall, the omitted municipalities have a very low population, with an average of 1827 people compared to 12,556 on a national level. If we only consider the 288 municipalities that was included in the house price index, the average population per municipalities is 22,405, which is much higher (Statstics Norway, 2021k). Summarized, the omitted municipalises have a population of 263,051, which only equals 5% of the total population. This is spread over 33% (144 municipalities) of the total municipalities (Statistics Norway, 2021). It therefore makes sense that some municipalities have an insignificant number of housing transactions. According to population data from Statistics Norway (2021k), the average net migration was -1,62% for the omitted municipalities, suggesting that they are unattractive municipalities. This points to that the omitted municipalities most likely have a low QOL index score. Consequentially, Verran, Sande, Sauda, Tinn and Høyanger might not be the least attractive municipalities in Norway, only the least attractive according to the available data. Although, it could still have an impact on the overall empirical results, as we do not collect data on a significant part of Norway.

The Norwegian governments effort to reduce the number of municipalities also proved to be a small complication regarding data collection. From 2016 to 2020 the number of municipalises was reduced from 426 to 358. This was done by merging different municipalises. While this did not create any issue for the data situated in 2018, like house prices and income, it did for data spanning across several years. Ideally, a comparison of the QOL index with a 10-year population change would provide a good picture of the significance of the result, as high QOL areas should experience a positive net migration (Glaeser, Kolko, & Saiz, 2001). However, as the some municipalise have become larger and some smaller, it created a structural change in both the geographical and demographical aspect of the data. This means that it can be hard to trust a 10-year population change (Hagen, 2020). For this reason, the 2018-2019 population growth has been used, as it provides the same population numbers. While a 10-year growth would be preferable, 2018-2019 still provides results on par with the QOL index results.

6.3 Commuting Cost

In the Albouy (2008) model, a household is considered to live and work in the same municipality. However, in reality households commute across municipalities for work and leisure. Commuting costs might therefore be important for households when deciding where to live. Like mentioned in literature review, Albouy and Lue (2015) extended the Rosen-Roback model by including commuting cost and found that commuting cost is important for estimating the QOL index. Hybel and Mulalic (2020) found the same for

Denmark. It is therefore clear that including commuting cost would improve results in this thesis as well. According to the model with commuting costs, an increase in the commuting costs would, all else equal, increases the QOL index. This is because household sacrifice utility in terms of higher commuting costs. Intuitively, this means that suburbs can be underestimated in the QOL index, which is something that Albouy and Lue (2015) finds in their paper. However, this is given that housing costs and wages do not offset it, as sub-urban areas tend to have cheaper housing. Unfortunately, sufficient commuting data was not available for Norway[6]. For this reason, commuting costs were not included in the model.

[6] This was confirmed after speaking to the Norwegian Centre for Transport Research, which is a public research-centre that specialises in urban economics and transportation in Norway.

7. Conclusion

This chapter concludes the thesis and gives recommendations for further research.

In this thesis, the quality of life (QOL) index has been estimated for 256 Norwegian municipalities using the Rosen-Roback framework, extended to include local taxes by Albouy (2008). The model value local amenities by measuring how much utility a household is willing to sacrifice in order to live in a specific municipality. For example, if a household accept higher local housing cost without an equal increase to the local wage, it means that there is a higher willingness to pay for local amenities.

The thesis find that urban areas generally have a higher QOL index compared to rural areas. Accordingly, these areas have a higher population growth and housing price, suggesting that the urbanisation process is related to demand for urban amenities. Not surprisingly, the capital of Oslo is found to have the highest QOL in Norway, where the city house approximately 20% of the population and have a rich culture life. Surrounding municipalities of Oslo are also found to have a score high on the quality-of-life index. In fact, two of the top five municipalities in terms of QOL are closely located to Oslo.

The thesis also finds, through a multivariate regression, that the share of higher education, km^2 of recreational outdoor area, accessibility and the number of hospitality workers are positively related to the QOL index. Population density is found to have a negative correlation, which can be interpreted as higher population density giving negative amenities such as noise and population. Crime is found to be insignificant, which is most likely due to the low crime rate in Norway.

In total, urban areas with high quality amenities seems to be attractive for Norwegian households. Policy wise, this can be important to remember. In recent years, the Norwegian government have made efforts combat urbanisation due to the downwards population trend in the rural part of Norway. To do this they have used monetary incentives such as student loan forgiveness and tax breaks without clear results. Based on the research of this thesis, shifting the focus to increasing the quality of local amenities may shift the trend.

To further extend the results of this thesis, there is a lot that could be dine. First of all, correcting the data limitations would have provided more significant results. The addition of commuting cost would also most likely improve the results, as people commute outside of their municipality for work a leisure. One could also do a time-series analysis rather than a cross-sectional to investigate how the QOL index varied across time. Interestingly, the events of covid-19 also open up opportunities to get deeper knowledge of the demand for urban amenities, as many of the desired amenities, like bars and restaurants, have disappeared during the pandemic. Doing a similar analysis to the one done in this thesis on 2021 data and comparing it with results before the pandemic could be one approach. Either way, since the research on urban amenities are so limited in Norway, most new research on the topic would give great value.

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9. Appendix

Appendix A

Figure A1: Full list of QOL-index, wage index and housing price index

Rank	Municipalities	QLI	Normalised QLI Index (Q^j)	Nomalised Wage Index (w^j)	Normalised House Prices (p^j)
1	Oslo	-4.52	2.71	2.33	5.27
2	Sogndal	-4.53	2.44	-0.43	1.75
3	Tromsø	-4.55	2.17	0.60	2.33
4	Lørenskog	-4.57	1.96	1.45	2.83
5	Skedsmo	-4.57	1.94	1.18	2.54
6	Ullensaker	-4.57	1.94	0.37	1.81
7	Trondheim	-4.57	1.86	1.23	2.46
8	Drammen	-4.59	1.63	0.82	1.81
9	Alta	-4.59	1.63	-0.31	0.96
10	Bergen	-4.59	1.56	1.43	2.23
11	Rælingen	-4.60	1.51	1.04	1.83
12	Røros	-4.60	1.50	-1.33	0.20
13	Ski	-4.60	1.45	1.64	2.26
14	Førde	-4.60	1.43	0.37	1.23
15	Ås	-4.60	1.41	1.29	1.91
16	Bodø	-4.60	1.38	0.57	1.33
17	Vågan	-4.60	1.38	-0.96	0.32
18	Nannestad	-4.60	1.38	-0.23	0.77
19	Stryn	-4.61	1.36	-1.48	0.01
20	Moss	-4.61	1.33	0.65	1.33
21	Nedre Eiker	-4.61	1.33	0.02	0.88
22	Hobøl	-4.61	1.31	-0.43	0.58
23	Enebakk	-4.61	1.27	-0.05	0.79
24	Eidsvoll	-4.61	1.26	-0.09	0.75
25	Vestby	-4.61	1.24	1.21	1.63
26	Melhus	-4.61	1.23	-0.33	0.57
27	Aurskog-Høland	-4.62	1.21	-0.72	0.33
28	Ringerike	-4.62	1.18	-0.33	0.53
29	Øvre Eiker	-4.62	1.17	-0.13	0.64
30	Stjørdal	-4.62	1.15	0.27	0.88
31	Frogn	-4.62	1.14	2.77	2.79
32	Fredrikstad	-4.62	1.13	0.10	0.76

33	Nesodden	-4.62	1.09	2.38	2.38
34	Spydeberg	-4.62	1.08	-0.05	0.61
35	Sørum	-4.62	1.07	0.92	1.24
36	Nes	-4.63	1.06	-0.21	0.50
37	Lillehammer	-4.63	1.05	0.62	1.02
38	Skaun	-4.63	1.05	-0.14	0.53
39	Askim	-4.63	1.04	-0.27	0.45
40	Tønsberg	-4.63	1.04	0.94	1.22
41	Klæbu	-4.63	1.04	-0.08	0.56
42	Sande	-4.63	0.99	0.39	0.81
43	Sarpsborg	-4.63	0.97	-0.41	0.31
44	Rygge	-4.63	0.95	0.65	0.94
45	Oppdal	-4.63	0.95	-0.97	0.00
46	Trysil	-4.63	0.94	-1.64	-0.34
47	Våler	-4.63	0.94	-0.13	0.45
48	Ålesund	-4.64	0.90	0.76	0.96
49	Tynset	-4.64	0.90	-1.31	-0.21
50	Klepp	-4.64	0.88	0.42	0.73
51	Hå	-4.64	0.86	-0.23	0.33
52	Gol	-4.64	0.85	-1.36	-0.26
53	Røyken	-4.64	0.82	1.29	1.23
54	Os	-4.64	0.82	0.74	0.87
55	Kristiansand	-4.64	0.81	0.74	0.86
56	Stange	-4.64	0.81	-0.18	0.31
57	Meland	-4.64	0.81	0.58	0.76
58	Nittedal	-4.64	0.79	1.79	1.54
59	Fet	-4.64	0.77	1.07	1.03
60	Sula	-4.64	0.77	-0.11	0.32
61	Eidsberg	-4.65	0.75	-0.91	-0.11
62	Sør-Varanger	-4.65	0.73	-0.60	0.03
63	Svelvik	-4.65	0.73	-0.10	0.30
64	Råde	-4.65	0.73	0.03	0.37
65	Hamar	-4.65	0.72	0.91	0.88
66	Re	-4.65	0.69	-0.37	0.12
67	Gjesdal	-4.65	0.69	0.34	0.51
68	Flora	-4.65	0.69	0.00	0.32
69	Lier	-4.65	0.68	1.59	1.28
70	Voss	-4.65	0.67	-0.19	0.20
71	Skodje	-4.65	0.67	-0.40	0.09
72	Horten	-4.65	0.67	0.41	0.53
73	Askøy	-4.65	0.66	0.65	0.67

74	Sortland	-4.65	0.66	-0.49	0.04
75	Time	-4.65	0.65	0.98	0.86
76	Fjell	-4.65	0.65	0.93	0.83
77	Gjøvik	-4.65	0.64	0.09	0.33
78	Molde	-4.65	0.64	0.58	0.61
79	Orkdal	-4.65	0.63	-0.44	0.04
80	Modum	-4.66	0.61	-0.55	-0.02
81	Skiptvet	-4.66	0.61	-0.87	-0.18
82	Midtre Gauldal	-4.66	0.61	-1.32	-0.38
83	Hurum	-4.66	0.61	0.62	0.60
84	Hammerfest	-4.66	0.60	0.12	0.32
85	Malvik	-4.66	0.60	1.24	0.97
86	Jevnaker	-4.66	0.58	-0.50	-0.02
87	Bærum	-4.66	0.58	5.13	4.02
88	Gjerdrum	-4.66	0.57	1.53	1.13
89	Halden	-4.66	0.57	-0.23	0.11
90	Rana	-4.66	0.56	-0.32	0.05
91	Rakkestad	-4.66	0.52	-1.07	-0.33
92	Oppegård	-4.66	0.49	3.66	2.57
93	Ringsaker	-4.66	0.48	-0.65	-0.16
94	Hole	-4.67	0.43	1.44	0.93
95	Hvaler	-4.67	0.40	0.82	0.53
96	Vefsn	-4.67	0.40	-0.58	-0.18
97	Fræna	-4.67	0.38	-0.34	-0.08
98	Sandnes	-4.67	0.36	1.66	1.00
99	Elverum	-4.67	0.36	-0.17	-0.01
100	Grimstad	-4.67	0.34	0.11	0.12
101	Harstad	-4.67	0.33	0.22	0.16
102	Lillesand	-4.67	0.33	0.61	0.36
103	Nord-Aurdal	-4.67	0.32	-1.11	-0.45
104	Søgne	-4.68	0.30	0.22	0.14
105	Lindås	-4.68	0.29	0.72	0.39
106	Kragerø	-4.68	0.28	-0.14	-0.05
107	Ørland	-4.68	0.27	-0.23	-0.10
108	Volda	-4.68	0.27	0.54	0.28
109	Bø	-4.68	0.25	-0.43	-0.20
110	Giske	-4.68	0.25	0.38	0.19
111	Ørsta	-4.68	0.24	-0.16	-0.08
112	Narvik	-4.68	0.22	-0.12	-0.08
113	Vikna	-4.68	0.21	0.04	-0.01
114	Lenvik	-4.68	0.20	-0.52	-0.27

115	Asker	-4.68	0.20	4.58	2.86
116	Strand	-4.68	0.18	0.78	0.33
117	Vestvågøy	-4.68	0.17	-0.79	-0.41
118	Lyngdal	-4.69	0.16	-0.73	-0.39
119	Levanger	-4.69	0.15	-0.09	-0.11
120	Trøgstad	-4.69	0.15	-0.94	-0.48
121	Songdalen	-4.69	0.15	-0.94	-0.48
122	Løten	-4.69	0.10	-0.96	-0.51
123	Vestre Toten	-4.69	0.10	-0.65	-0.39
124	Vennesla	-4.69	0.08	-0.49	-0.33
125	Gran	-4.69	0.08	-0.21	-0.22
126	Verdal	-4.69	0.07	-0.67	-0.42
127	Østre Toten	-4.69	0.07	-0.82	-0.48
128	Øygarden	-4.69	0.06	0.34	0.03
129	Risør	-4.69	0.05	-0.12	-0.19
130	Gloppen	-4.70	0.00	-0.43	-0.35
131	Hol	-4.70	0.00	-0.84	-0.52
132	Stavanger	-4.70	-0.04	3.24	1.57
133	Steinkjer	-4.70	-0.05	-0.31	-0.33
134	Øyer	-4.70	-0.05	-0.73	-0.50
135	Randaberg	-4.70	-0.06	2.27	0.94
136	Mandal	-4.70	-0.09	0.30	-0.10
137	Frøya	-4.70	-0.10	-0.19	-0.31
138	Skien	-4.70	-0.10	0.24	-0.13
139	Kvinesdal	-4.70	-0.10	-0.25	-0.34
140	Sør-Odal	-4.70	-0.12	-0.68	-0.52
141	Hitra	-4.70	-0.13	-0.85	-0.59
142	Arendal	-4.70	-0.13	0.43	-0.06
143	Birkenes	-4.70	-0.14	-0.65	-0.52
144	Kongsvinger	-4.71	-0.15	-0.35	-0.41
145	Nordre Land	-4.71	-0.15	-1.43	-0.81
146	Hurdal	-4.71	-0.16	-0.80	-0.59
147	Alstahaug	-4.71	-0.16	-0.27	-0.38
148	Rennesøy	-4.71	-0.17	1.71	0.54
149	Gausdal	-4.71	-0.17	-1.05	-0.69
150	Eigersund	-4.71	-0.18	0.36	-0.12
151	Stord	-4.71	-0.18	0.72	0.03
152	Leirfjord	-4.71	-0.21	-0.90	-0.65
153	Bjerkreim	-4.71	-0.22	-0.75	-0.60
154	Kongsberg	-4.71	-0.27	1.85	0.52
155	Porsgrunn	-4.71	-0.27	0.79	0.01

156	Radøy	-4.72	-0.30	-0.43	-0.52
157	Fauske	-4.72	-0.31	-0.31	-0.48
158	Hjelmeland	-4.72	-0.32	0.03	-0.35
159	Ål	-4.72	-0.34	-0.81	-0.68
160	Porsanger	-4.72	-0.34	-0.73	-0.66
161	Hadsel	-4.72	-0.35	-0.63	-0.62
162	Tysvær	-4.72	-0.36	0.64	-0.12
163	Evje og Hornnes	-4.72	-0.37	-1.14	-0.81
164	Ulstein	-4.72	-0.37	1.26	0.15
165	Hemnes	-4.72	-0.39	-1.10	-0.81
166	Sola	-4.72	-0.40	3.09	1.08
167	Flekkefjord	-4.72	-0.41	0.22	-0.33
168	Kristiansund	-4.72	-0.42	0.52	-0.21
169	Marker	-4.72	-0.43	-1.05	-0.81
170	Froland	-4.72	-0.43	-0.72	-0.70
171	Haugesund	-4.72	-0.44	1.05	0.01
172	Rauma	-4.72	-0.44	-0.44	-0.60
173	Bjugn	-4.73	-0.45	-0.34	-0.57
174	Nesna	-4.73	-0.45	-0.59	-0.66
175	Namsos	-4.73	-0.48	-0.14	-0.51
176	Tvedestrand	-4.73	-0.48	-0.14	-0.51
177	Åfjord	-4.73	-0.48	-0.45	-0.62
178	Flesberg	-4.73	-0.50	-0.05	-0.48
179	Balsfjord	-4.73	-0.52	-1.01	-0.83
180	Haram	-4.73	-0.55	-0.01	-0.50
181	Nord-Odal	-4.73	-0.58	-0.96	-0.84
182	Vindafjord	-4.74	-0.61	-0.08	-0.55
183	Nordreisa	-4.74	-0.61	-0.76	-0.79
184	Lindesnes	-4.74	-0.61	-0.57	-0.73
185	Aukra	-4.74	-0.62	0.26	-0.43
186	Bamble	-4.74	-0.62	0.53	-0.33
187	Nesset	-4.74	-0.62	-0.68	-0.77
188	Vaksdal	-4.74	-0.65	-0.20	-0.62
189	Bardu	-4.74	-0.66	-0.04	-0.57
190	Sel	-4.74	-0.67	-1.18	-0.95
191	Saltdal	-4.74	-0.71	-0.65	-0.80
192	Farsund	-4.74	-0.72	-0.14	-0.64
193	Moskenes	-4.74	-0.73	-1.47	-1.06
194	Karmøy	-4.74	-0.73	0.73	-0.32
195	Kvam	-4.75	-0.75	0.40	-0.45
196	Nærøy	-4.75	-0.75	-0.50	-0.77

197	Forsand	-4.75	-0.75	0.70	-0.34
198	Siljan	-4.75	-0.78	-0.25	-0.70
199	Kvæfjord	-4.75	-0.79	-0.82	-0.89
200	Austrheim	-4.75	-0.79	0.88	-0.29
201	Hemne	-4.75	-0.81	-0.30	-0.73
202	Øksnes	-4.75	-0.83	-0.86	-0.92
203	Inderøy	-4.75	-0.85	-0.19	-0.71
204	Sigdal	-4.75	-0.87	-1.49	-1.12
205	Ringebu	-4.75	-0.87	-1.20	-1.04
206	Eidskog	-4.75	-0.88	-1.32	-1.07
207	Søndre Land	-4.76	-0.90	-1.21	-1.05
208	Målselv	-4.76	-0.98	-0.16	-0.76
209	Krødsherad	-4.76	-0.99	-0.74	-0.95
210	Kvinnherad	-4.76	-0.99	0.20	-0.65
211	Vestnes	-4.76	-1.02	-0.40	-0.86
212	Nome	-4.76	-1.03	-0.58	-0.92
213	Lærdal	-4.77	-1.05	-0.32	-0.85
214	Sør-Fron	-4.77	-1.06	-0.99	-1.05
215	Skånland	-4.77	-1.07	-0.73	-0.98
216	Vestre Slidre	-4.77	-1.09	-1.50	-1.20
217	Surnadal	-4.77	-1.10	-0.63	-0.96
218	Bømlo	-4.77	-1.13	0.90	-0.48
219	Grue	-4.77	-1.14	-1.31	-1.16
220	Averøy	-4.77	-1.15	0.33	-0.68
221	Meldal	-4.77	-1.17	-1.06	-1.11
222	Åsnes	-4.78	-1.22	-1.31	-1.19
223	Våler	-4.78	-1.23	-1.50	-1.24
224	Notodden	-4.78	-1.24	-0.16	-0.88
225	Åmot	-4.78	-1.24	-0.57	-1.00
226	Selbu	-4.78	-1.25	-0.88	-1.09
227	Odda	-4.78	-1.28	-0.24	-0.92
228	Sauherad	-4.78	-1.33	-0.40	-0.99
229	Lurøy	-4.79	-1.36	0.61	-0.69
230	Sokndal	-4.79	-1.40	0.41	-0.78
231	Austevoll	-4.79	-1.45	0.81	-0.67
232	Meløy	-4.79	-1.45	0.07	-0.90
233	Vadsø	-4.79	-1.46	-0.27	-1.00
234	Dovre	-4.79	-1.46	-1.28	-1.26
235	Sveio	-4.79	-1.47	0.48	-0.79
236	Etne	-4.79	-1.47	-0.12	-0.96
237	Sørfold	-4.79	-1.48	-0.78	-1.14

238	Aure	-4.80	-1.51	0.49	-0.80
239	Hareid	-4.80	-1.57	0.15	-0.92
240	Vågå	-4.80	-1.62	-1.10	-1.27
241	Nord-Fron	-4.80	-1.63	-0.18	-1.04
242	Stranda	-4.81	-1.68	-1.27	-1.32
243	Seljord	-4.81	-1.68	-0.24	-1.07
244	Vågsøy	-4.81	-1.75	-0.35	-1.13
245	Nordkapp	-4.81	-1.76	-0.73	-1.22
246	Årdal	-4.82	-1.81	0.78	-0.85
247	Sunndal	-4.82	-1.82	0.98	-0.80
248	Snåsa	-4.82	-1.85	-1.11	-1.34
249	Stor-Elvdal	-4.83	-2.09	-1.58	-1.49
250	Herøy	-4.84	-2.19	0.98	-0.95
251	Verran	-4.85	-2.36	-0.96	-1.44
252	Sauda	-4.87	-2.62	0.32	-1.26
253	Tinn	-4.87	-2.70	-0.45	-1.44
254	Høyanger	-4.88	-2.83	-0.17	-1.42

Appendix B

Figure B1: List of amentieis values and population growth according to the QOL index rankings

QOL index Rank	Municipalities	Higher Education Percentage	Population Density (per km^2)	Violent Crime (per 1000)	Accessibility Index	2018-2019 population growth	Hospitality Index Workers
1	Oslo	51.60	1581.00	11.30	1000.00	0.01	152.34
2	Sogndal	38.80	11.00	5.20	695.00	0.02	120.98
3	Tromsø	41.90	31.00	8.10	808.00	0.01	142.47
4	Lørenskog	34.90	577.00	6.30	976.00	0.04	56.04
5	Skedsmo	32.70	722.00	8.30	973.00	0.03	108.01
6	Ullensaker	27.90	146.00	10.00	909.00	0.05	329.83
7	Trondheim	44.30	601.00	6.30	898.00	0.01	126.36
8	Drammen	33.90	509.00	8.30	933.00	0.00	85.47
9	Alta	31.60	6.00	11.30	721.00	0.00	83.31
10	Bergen	42.10	629.00	8.00	902.00	0.00	104.47
11	Rælingen	32.40	319.00	3.70	942.00	0.02	12.42
12	Røros	28.30	3.00	5.50	669.00	-0.01	207.13
13	Ski	37.10	191.00	6.10	914.00	0.00	62.89
14	Førde	36.80	24.00	5.80	752.00	0.00	96.49
15	Ås	44.80	199.00	3.60	899.00	0.01	37.74
16	Bodø	36.70	39.00	7.70	801.00	0.01	117.40
17	Vågan	26.30	21.00	5.80	644.00	0.00	191.14

18	Nannestad	24.00	41.00	5.10	833.00	0.03	47.28
19	Stryn	25.80	5.00	3.90	616.00	0.00	250.31
20	Moss	30.90	562.00	9.70	932.00	0.00	53.92
21	Nedre Eiker	25.10	219.00	4.00	897.00	0.00	22.68
22	Hobøl	26.20	40.00	6.70	845.00	0.00	4.27
23	Enebakk	23.90	56.00	6.30	817.00	0.01	4.11
24	Eidsvoll	25.60	64.00	7.10	847.00	0.01	30.92
25	Vestby	34.10	130.00	5.60	880.00	0.02	103.11
26	Melhus	24.60	25.00	4.30	778.00	0.01	19.36
27	Aurskog-Høland	20.20	18.00	5.50	799.00	0.01	23.06
28	Ringerike	26.90	21.00	8.70	815.00	0.01	58.71
29	Øvre Eiker	25.80	45.00	3.90	856.00	0.01	32.18
30	Stjørdal	28.00	26.00	6.10	799.00	0.00	111.75
31	Frogn	37.50	185.00	6.90	906.00	0.00	52.30
32	Fredrikstad	29.40	285.00	7.40	884.00	0.01	63.72
33	Nesodden	46.10	316.00	4.20	855.00	0.01	26.55
34	Spydeberg	24.40	44.00	7.40	865.00	0.03	16.74
35	Sørum	30.90	90.00	3.70	869.00	0.02	25.47
36	Nes	22.10	36.00	5.30	817.00	0.01	9.18
37	Lillehammer	40.60	62.00	4.10	823.00	0.00	135.87
38	Skaun	28.30	38.00	2.70	745.00	0.01	8.47
39	Askim	22.50	240.00	7.60	893.00	0.00	40.54
40	Tønsberg	37.40	416.00	8.90	891.00	0.01	92.75
41	Klæbu	25.60	35.00	2.80	793.00	0.00	7.06
42	Sande	26.80	56.00	3.60	851.00	0.02	24.26
43	Sarpsborg	24.50	150.00	8.70	887.00	0.01	56.44
44	Rygge	28.10	230.00	4.60	890.00	0.00	67.77
45	Oppdal	24.60	3.00	5.20	668.00	0.00	175.04
46	Trysil	21.10	2.00	4.20	609.00	0.01	195.83
47	Våler	24.70	23.00	3.80	822.00	0.02	10.60
48	Ålesund	35.50	511.00	7.50	827.00	0.01	104.02
49	Tynset	28.90	3.00	4.70	660.00	0.00	79.21
50	Klepp	24.10	188.00	5.20	854.00	0.01	38.46
51	Hå	22.10	76.00	5.40	786.00	0.00	33.21
52	Gol	23.10	9.00	5.00	697.00	0.00	298.07
53	Røyken	34.80	202.00	4.20	883.00	0.01	16.61
54	Os	30.80	155.00	5.50	788.00	0.01	57.94
55	Kristiansand	36.90	353.00	9.60	857.00	0.01	109.98
56	Stange	28.70	32.00	4.30	814.00	0.01	29.26
57	Meland	28.60	92.00	4.60	768.00	0.01	11.14
58	Nittedal	36.50	132.00	2.90	885.00	0.02	23.66

59	Fet	30.20	85.00	8.50	880.00	0.02	17.23
60	Sula	28.10	160.00	3.60	743.00	0.02	13.58
61	Eidsberg	21.20	50.00	8.70	853.00	0.00	29.53
62	Sør-Varanger	29.50	3.00	6.90	640.00	0.00	135.38
63	Svelvik	23.00	119.00	3.60	761.00	0.00	19.18
64	Råde	26.00	71.00	5.60	838.00	0.01	40.46
65	Hamar	38.40	92.00	7.70	876.00	0.01	94.79
66	Re	24.60	43.00	2.20	821.00	0.01	10.91
67	Gjesdal	24.70	21.00	4.50	807.00	0.00	60.34
68	Flora	26.50	19.00	6.60	706.00	-0.01	74.99
69	Lier	35.90	92.00	4.10	896.00	0.02	39.53
70	Voss	29.50	8.00	4.60	737.00	0.00	139.60
71	Skodje	28.10	42.00	5.70	722.00	0.02	39.53
72	Horten	32.30	396.00	7.30	889.00	0.00	58.90
73	Askøy	29.10	309.00	4.70	814.00	0.01	16.37
74	Sortland	25.50	15.00	7.30	683.00	0.01	55.96
75	Time	30.10	109.00	6.70	843.00	0.01	62.52
76	Fjell	27.20	182.00	5.20	814.00	0.02	38.76
77	Gjøvik	30.40	49.00	5.40	803.00	0.00	81.72
78	Molde	37.70	76.00	6.30	774.00	0.00	82.64
79	Orkdal	22.80	21.00	4.60	779.00	0.01	63.19
80	Modum	22.30	30.00	4.40	812.00	0.01	35.95
81	Skiptvet	18.80	41.00	4.70	789.00	-0.01	3.13
82	Midtre Gauldal	19.40	3.00	5.10	662.00	0.00	37.43
83	Hurum	27.40	61.00	5.00	810.00	0.01	78.10
84	Hammerfest	30.70	13.00	9.10	700.00	0.00	109.56
85	Malvik	35.40	86.00	4.10	813.00	0.01	23.07
86	Jevnaker	23.80	35.00	5.70	778.00	0.01	43.23
87	Bærum	53.10	664.00	4.40	971.00	0.01	67.31
88	Gjerdrum	31.80	82.00	4.40	887.00	0.02	16.26
89	Halden	27.70	52.00	11.20	843.00	0.00	61.41
90	Rana	26.00	6.00	8.30	714.00	0.00	75.56
91	Rakkestad	19.10	19.00	5.70	794.00	0.00	22.19
92	Oppegård	44.20	799.00	3.80	929.00	0.01	38.67
93	Ringsaker	24.20	30.00	4.80	786.00	0.01	59.62
94	Hole	38.50	51.00	2.80	800.00	0.00	135.08
95	Hvaler	29.90	50.00	5.90	725.00	0.01	81.72
96	Vefsn	24.30	7.00	9.20	704.00	0.00	71.16
97	Fræna	21.00	27.00	4.50	666.00	0.00	27.11
98	Sandnes	33.90	268.00	6.40	887.00	0.01	72.42
99	Elverum	30.90	17.00	7.30	762.00	0.00	68.31

100	Grimstad	34.20	85.00	6.50	812.00	0.01	77.07
101	Harstad	32.40	58.00	8.90	744.00	0.00	100.48
102	Lillesand	32.80	60.00	7.30	787.00	0.01	68.07
103	Nord-Aurdal	24.20	8.00	5.30	672.00	0.00	145.74
104	Søgne	29.00	79.00	5.10	785.00	0.01	31.56
105	Lindås	24.80	35.00	5.60	742.00	0.00	35.02
106	Kragerø	25.00	36.00	10.50	741.00	-0.01	132.97
107	Ørland	23.80	73.00	7.90	646.00	0.00	116.05
108	Volda	39.80	18.00	5.30	727.00	0.00	33.30
109	Bø	35.80	25.00	7.20	747.00	0.03	114.86
110	Giske	28.10	207.00	2.50	720.00	0.01	47.27
111	Ørsta	26.70	14.00	5.10	725.00	0.00	49.11
112	Narvik	30.50	10.00	7.90	711.00	0.00	95.40
113	Vikna	20.10	14.00	6.80	612.00	0.02	71.91
114	Lenvik	23.10	14.00	8.00	645.00	0.00	73.08
115	Asker	50.40	628.00	4.10	936.00	0.01	69.23
116	Strand	24.30	65.00	5.00	722.00	0.01	41.62
117	Vestvågøy	24.70	28.00	9.10	637.00	0.01	69.58
118	Lyngdal	23.40	23.00	9.90	713.00	0.00	131.26
119	Levanger	35.00	33.00	4.50	762.00	0.01	61.74
120	Trøgstad	19.60	28.00	7.10	799.00	0.00	5.62
121	Songdalen	21.60	32.00	5.10	764.00	0.01	27.19
122	Løten	22.30	21.00	5.00	792.00	0.01	32.17
123	Vestre Toten	22.20	58.00	5.30	769.00	0.01	37.63
124	Vennesla	20.30	40.00	6.20	765.00	0.01	17.55
125	Gran	22.20	21.00	5.10	784.00	-0.01	74.51
126	Verdal	22.80	10.00	5.90	750.00	0.00	54.67
127	Østre Toten	24.00	31.00	4.10	731.00	0.00	19.68
128	Øygarden	18.80	76.00	2.90	695.00	0.00	33.42
129	Risør	26.50	38.00	6.60	704.00	0.00	68.00
130	Gloppen	31.70	6.00	2.20	637.00	-0.01	38.13
131	Hol	26.50	3.00	4.00	640.00	-0.01	447.57
132	Stavanger	43.30	1958.00	8.00	908.00	0.01	115.99
133	Steinkjer	28.40	16.00	5.30	736.00	0.00	69.88
134	Øyer	25.80	8.00	3.50	699.00	0.00	246.98
135	Randaberg	31.00	457.00	4.30	877.00	0.01	25.25
136	Mandal	29.40	74.00	7.70	783.00	0.00	73.89
137	Frøya	22.30	22.00	4.50	559.00	0.02	67.11
138	Skien	28.60	76.00	10.40	846.00	0.00	52.49
139	Kvinesdal	19.70	7.00	6.90	657.00	0.00	49.97
140	Sør-Odal	19.90	16.00	4.40	779.00	0.00	45.79

141	Hitra	21.50	7.00	6.20	562.00	0.01	77.24
142	Arendal	31.00	175.00	9.60	803.00	0.00	63.05
143	Birkenes	23.60	8.00	6.70	711.00	0.00	15.81
144	Kongsvinger	23.40	19.00	7.20	799.00	-0.01	37.19
145	Nordre Land	18.80	7.00	3.40	683.00	-0.01	40.15
146	Hurdal	21.70	11.00	3.10	730.00	-0.01	85.77
147	Alstahaug	28.00	40.00	9.70	668.00	0.00	73.56
148	Rennesøy	26.60	75.00	3.90	730.00	0.00	51.56
149	Gausdal	21.70	5.00	3.80	686.00	-0.01	27.81
150	Eigersund	23.40	38.00	6.10	753.00	0.00	70.75
151	Stord	31.10	137.00	8.60	734.00	0.00	91.96
152	Leirfjord	24.00	5.00	6.00	568.00	0.01	8.24
153	Bjerkreim	21.20	5.00	5.30	697.00	-0.01	46.71
154	Kongsberg	37.80	36.00	3.70	850.00	0.00	70.85
155	Porsgrunn	28.80	224.00	9.50	860.00	0.00	56.30
156	Radøy	20.10	48.00	4.10	677.00	-0.01	9.16
157	Fauske	23.70	9.00	9.60	681.00	0.00	58.01
158	Hjelmeland	25.80	3.00	5.20	540.00	-0.01	87.40
159	Ål	26.30	4.00	4.50	662.00	0.01	77.17
160	Porsanger	25.30	1.00	13.20	567.00	-0.01	85.27
161	Hadsel	26.30	15.00	5.20	601.00	0.01	39.92
162	Tysvær	25.20	28.00	4.30	723.00	0.00	35.20
163	Evje og Hornnes	23.50	7.00	8.50	691.00	0.00	90.21
164	Ulstein	32.40	90.00	6.00	732.00	0.01	72.71
165	Hemnes	19.90	3.00	4.20	575.00	0.00	42.19
166	Sola	36.40	381.00	4.50	872.00	0.01	134.21
167	Flekkefjord	25.60	19.00	6.00	690.00	0.00	68.50
168	Kristiansund	26.90	283.00	7.80	766.00	0.00	79.34
169	Marker	19.20	10.00	3.10	742.00	0.01	28.03
170	Froland	21.00	10.00	5.10	701.00	0.01	20.21
171	Haugesund	32.90	547.00	12.30	831.00	0.00	118.65
172	Rauma	23.40	5.00	3.70	629.00	0.00	82.06
173	Bjugn	21.10	14.00	4.90	591.00	0.01	14.80
174	Nesna	30.70	10.00	7.30	520.00	-0.01	64.27
175	Namsos	29.20	17.00	6.30	723.00	0.00	62.93
176	Tvedestrand	26.00	30.00	6.80	711.00	0.00	66.38
177	Åfjord	19.50	4.00	2.70	546.00	0.02	103.14
178	Flesberg	20.90	5.00	3.30	703.00	0.00	89.66
179	Balsfjord	17.40	4.00	6.40	571.00	0.00	68.81
180	Haram	23.70	37.00	2.60	653.00	0.00	31.57
181	Nord-Odal	17.10	11.00	5.40	718.00	-0.01	21.58

182	Vindafjord	23.70	15.00	4.20	658.00	-0.01	17.86
183	Nordreisa	24.70	1.00	7.70	581.00	-0.01	64.52
184	Lindesnes	21.30	17.00	6.10	686.00	0.00	51.03
185	Aukra	25.80	60.00	4.00	623.00	-0.01	56.23
186	Bamble	23.50	50.00	6.70	775.00	-0.01	75.94
187	Nesset	17.50	3.00	5.80	557.00	0.00	11.54
188	Vaksdal	21.20	6.00	2.70	650.00	-0.02	20.11
189	Bardu	28.90	2.00	5.50	600.00	0.01	67.86
190	Sel	19.90	7.00	4.30	637.00	-0.01	114.10
191	Saltdal	23.30	2.00	6.00	606.00	-0.01	113.20
192	Farsund	22.50	39.00	6.20	695.00	0.00	101.79
193	Moskenes	18.50	10.00	7.70	462.00	-0.03	343.63
194	Karmøy	23.40	192.00	6.50	764.00	0.00	31.93
195	Kvam	26.50	15.00	2.60	677.00	0.00	46.01
196	Nærøy	19.70	5.00	4.90	547.00	-0.01	24.04
197	Forsand	22.40	2.00	5.90	651.00	-0.04	77.05
198	Siljan	23.80	12.00	3.40	666.00	-0.01	10.21
199	Kvæfjord	25.80	6.00	4.20	593.00	-0.02	19.47
200	Austrheim	18.50	51.00	7.60	660.00	-0.01	6.20
201	Hemne	18.70	7.00	5.40	638.00	0.00	32.90
202	Øksnes	19.20	15.00	5.40	568.00	-0.02	75.31
203	Inderøy	29.80	19.00	2.20	676.00	0.00	23.58
204	Sigdal	17.20	4.00	3.20	662.00	0.00	67.37
205	Ringebu	20.50	4.00	3.40	658.00	-0.01	133.81
206	Eidskog	16.80	10.00	5.90	698.00	0.00	26.86
207	Søndre Land	21.00	9.00	4.80	676.00	0.00	20.35
208	Målselv	26.40	2.00	5.90	602.00	0.00	102.82
209	Krødsherad	22.60	7.00	2.20	622.00	-0.02	378.57
210	Kvinnherad	23.70	13.00	3.80	593.00	0.00	42.87
211	Vestnes	21.10	19.00	3.20	653.00	0.00	43.91
212	Nome	23.40	17.00	8.10	713.00	-0.01	37.37
213	Lærdal	28.30	2.00	3.70	563.00	0.00	102.18
214	Sør-Fron	20.30	4.00	1.90	620.00	-0.01	146.85
215	Skånland	24.90	6.00	3.30	566.00	0.01	55.11
216	Vestre Slidre	22.10	5.00	3.70	598.00	0.00	35.06
217	Surnadal	21.90	5.00	2.70	615.00	-0.01	44.16
218	Bømlo	23.60	51.00	2.90	645.00	0.00	25.46
219	Grue	18.50	6.00	5.00	668.00	-0.02	37.55
220	Averøy	23.10	34.00	2.70	632.00	0.00	37.38
221	Meldal	18.90	7.00	4.60	641.00	-0.01	17.56
222	Åsnes	19.20	7.00	5.00	669.00	-0.01	15.25

223	Våler	19.10	5.00	10.00	669.00	0.01	32.88
224	Notodden	26.40	15.00	7.80	762.00	0.00	45.64
225	Åmot	23.10	3.00	7.00	627.00	-0.02	49.55
226	Selbu	22.10	4.00	4.20	663.00	0.00	39.09
227	Odda	23.60	5.00	7.40	659.00	-0.01	97.00
228	Sauherad	27.00	15.00	4.70	709.00	-0.02	66.07
229	Lurøy	20.50	7.00	3.20	368.00	-0.01	71.35
230	Sokndal	17.60	12.00	3.60	664.00	-0.01	40.23
231	Austevoll	23.90	46.00	3.60	595.00	0.00	61.28
232	Meløy	19.30	8.00	6.00	495.00	0.00	49.32
233	Vadsø	30.10	5.00	8.80	643.00	-0.02	62.82
234	Dovre	19.80	2.00	3.10	580.00	-0.01	262.30
235	Sveio	24.70	26.00	4.20	679.00	0.00	7.34
236	Etne	23.10	6.00	4.70	613.00	0.00	65.39
237	Sørfold	18.40	1.00	7.60	563.00	0.00	46.49
238	Aure	21.00	6.00	2.30	513.00	-0.01	50.38
239	Hareid	24.20	67.00	6.20	698.00	0.00	11.46
240	Vågå	21.00	3.00	3.10	623.00	-0.01	131.39
241	Nord-Fron	20.40	5.00	6.80	652.00	0.00	86.07
242	Stranda	23.50	5.00	2.60	629.00	0.00	181.38
243	Seljord	26.40	4.00	9.50	638.00	-0.01	111.52
244	Vågsøy	23.70	35.00	4.50	632.00	-0.01	44.16
245	Nordkapp	22.30	4.00	5.90	535.00	-0.01	198.83
246	Årdal	22.00	6.00	3.60	606.00	-0.01	37.52
247	Sunndal	24.20	4.00	4.80	645.00	0.00	41.86
248	Snåsa	27.20	1.00	3.80	546.00	0.00	85.96
249	Stor-Elvdal	23.50	1.00	5.70	552.00	-0.01	51.41
250	Herøy	22.30	76.00	4.00	679.00	0.00	34.36
251	Verran	17.10	4.00	2.90	585.00	-0.01	27.09
252	Sauda	22.90	9.00	5.40	632.00	-0.01	64.34
253	Tinn	21.40	3.00	4.50	599.00	-0.01	111.51
254	Høyanger	22.50	5.00	4.40	565.00	-0.02	55.61

Appendix C

Figure C1: QLI index and housing price index regression

	Dependent variable:
	QLI Index (Q^j)
House Price Index (p^j)	2.169***
	(0.074)
Constant	-21.513***
	(0.734)
Observations	254
R^2	0.774
Adjusted R^2	0.773
Residual Std. Error	0.477 (df = 252)
F Statistic	860.938*** (df = 1; 252)
Note:	*p<0.1; **p<0.05; ***p<0.01

Appendix D

Figure D1: Full list of omitted municipalities with their respective population density and population.

Omitted Municipalities	Population density	Population
Eid	15	6,157.00
Luster	2	5,223.00
Andøy	8	4,902.00
Suldal	2	3,849.00
Bremanger	5	3,767.00
Vinje	1	3,709.00
Ullensvang	3	3,363.00
Lund	9	3,237.00
Øystre Slidre	4	3,221.00
Finnøy	31	3,197.00
Fitjar	24	3,194.00
Vanylven	9	3,187.00
Tingvoll	10	3,078.00
Askvoll	10	3,052.00
Jølster	5	3,043.00
Sør-Aurdal	3	3,014.00
Gaular	6	3,006.00
Kautokeino	0	2,946.00
Skjervøy	6	2,925.00

Tana	1	2,922.00
Lyngen	4	2,877.00
Tysnes	12	2,857.00
Fjaler	7	2,846.00
Naustdal	8	2,825.00
Selje	13	2,757.00
Karasjok	1	2,701.00
Vik	3	2,674.00
Bø, Nordland	11	2,623.00
Frosta	35	2,616.00
Rennebu	3	2,541.00
Ballangen	3	2,522.00
Nore og Uvdal	1	2,482.00
Meråker	2	2,469.00
Gjerstad	8	2,467.00
Hemsedal	3	2,457.00
Alvdal	3	2,424.00
Grong	2	2,400.00
Kviteseid	4	2,397.00
Gulen	4	2,345.00
Lom	1	2,331.00
Marnardal	6	2,308.00
Ørskog	18	2,267.00
Båtsfjord	2	2,263.00
Karlsøy	2	2,263.00
Tokke	2	2,236.00
Salangen	5	2,226.00
Skjåk	1	2,179.00
Gáivuotna – Kåfjord – Kaivuono	2	2,132.00
Vardø	4	2,110.00
Lødingen	4	2,102.00
Vegårshei	6	2,087.00
Midsund	22	2,049.00
Rindal	3	2,039.00
Lesja	1	2,038.00
Holtålen	2	2,028.00
Sømna	11	2,020.00
Gildeskål	3	1,998.00
Tysfjord	1	1,953.00
Os	2	1,936.00
Storfjord	1	1,856.00
Åmli	2	1,845.00
Sirdal	1	1,842.00
Rendalen	1	1,827.00

Hamarøy	2	1,801.00
Herøy	28	1,790.00
Aurland	1	1,778.00
Masfjorden	3	1,730.00
Hægebostad	4	1,699.00
Agdenes	6	1,684.00
Norddal	2	1,670.00
Vang	1	1,601.00
Hjartdal	2	1,587.00
Namdalseid	2	1,585.00
Halsa	5	1,571.00
Folldal	1	1,569.00
Tolga	1	1,553.00
Tranøy	3	1,536.00
Nissedal	2	1,489.00
Bindal	1	1,486.00
Grane	1	1,463.00
Hattfjelldal	1	1,411.00
Rollag	3	1,411.00
Dønna	8	1,403.00
Evenes	6	1,387.00
Ibestad	6	1,380.00
Lierne	1	1,379.00
Hyllestad	6	1,378.00
Etnedal	3	1,352.00
Lebesby	0	1,349.00
Iveland	5	1,330.00
Fyresdal	1	1,320.00
Flakstad	8	1,301.00
Engerdal	1	1,294.00
Høylandet	2	1,268.00
Sandøy	60	1,263.00
Balestrand	3	1,262.00
Tjeldsund	4	1,259.00
Rødøy	2	1,249.00
Måsøy	1	1,231.00
Valle, Norway	1	1,225.00
Kvænangen	1	1,224.00
Vega	7	1,221.00
Bygland	1	1,207.00
Hornindal	7	1,175.00
Dyrøy	4	1,165.00
Gamvik	1	1,153.00
Gratangen	4	1,117.00

Ulvik	2	1,117.00
Flatanger	3	1,105.00
Jondal	5	1,096.00
Flå	2	1,069.00
Lavangen	4	1,061.00
Beiarn	1	1,029.00
Kvalsund	1	1,027.00
Hasvik	2	1,022.00
Snillfjord	2	987.00
Berlevåg	1	983.00
Stordal	4	972.00
Osen	3	967.00
Bykle	1	958.00
Roan	3	953.00
Nesseby	1	944.00
Torsken	4	943.00
Åseral	1	943.00
Loppa	1	941.00
Granvin	5	931.00
Eidfjord	1	931.00
Namsskogan	1	902.00
Berg	3	902.00
Bokn	19	844.00
Tydal	1	834.00
Solund	4	807.00
Værøy	39	746.00
Rømskog	4	682.00
Fosnes	1	618.00
Leka	5	582.00
Fedje	62	561.00
Kvitsøy	90	542.00
Røst	52	517.00
Vevelstad	1	506.00
Røyrvik	0	474.00
Træna	28	454.00
Modalen	1	380.00
Utsira	35	208.00