Rural Vitality in the Netherlands

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1 Introduction

The vitality of rural areas has been of concern for policy makers in most countries as a result of depopulation trends, when rural residents leave the countryside and move to urban areas in search for jobs, amenities not available in rural areas etc. The phenomenon of people migrating from rural to urban areas is mostly linked with the industrialization of countries, when better employment opportunities lead residents of rural areas to move to cities.

Cities, as a result of high population densities, offer amenities that cannot generally be found in rural areas. For example, a city resident is in close proximity to a large number of people, which makes it easier to find people with similar interests; and for employers this much larger labor pool (compared to rural areas) means that it is easier to find qualified employees. In addition, there are knowledge spillovers between companies and employees, which lead to quicker progress and increases in productivity. Also, large concentrations of people make it possible for basic facilities to be within close proximity, and they also facilitate the existence of specialized facilities that do not exist in the countryside.

If the quality of life in a rural area is not to the level desired or required by its residents, they might emigrate to other villages or to cities. Given that village populations are not large to begin with, out-migration becomes an important problem. Moreover, the people that emigrate first are the young, leaving behind an aged, less dynamic population.

In order to prevent depopulation and ensure the wellbeing of rural residents, maintaining and boosting rural vitality is one of the main concerns of policy makers. Documents published by the Dutch Government such as “Netherlands’ Rural Development Strategy 2007-2013” and “Agenda for a Living Countryside” reflect the concern of Dutch authorities with maintaining and increasing rural vitality.

The term of rural vitality is a very broad, not well defined, abstract concept that describes how livable an area is. Rural vitality can refer to concrete measures of economic performance, such as average income, employment and unemployment rate, availability of jobs etc. Rural vitality can also refer to the age composition of the population and the skill level. Access to basic facilities is also an important sign of rural vitality. For the wellbeing of its residents, it is important for a village to have easy access to education and medical facilities, as well as retail and cultural facilities. There are also aspects of rural vitality that are very hard to measure, such as social cohesion and cultural diversity.

The conclusion from the previous paragraph would be that rural vitality is not directly measurable, and that it describes many aspects of life in rural areas (enumerated above).

Many national authorities are concerned that the socio-economic vitality of rural areas and consider it at risk. According to Copus et al. (2006) remote rural areas in many parts of the EU show a downward spiraling trend where a decline in population leads to a decline in economic activity, which again feeds back resulting in a further decline in population. In the Netherlands, the "Agenda for a Living Countryside" reflects this concern for preserving rural vitality. Motivated by a concern for the vitality of rural areas, the purpose of this thesis is to assess the state of rural vitality in the Netherlands by answering the following research questions: 1. What are the components of rural vitality and how can it be measured? 2. How did rural vitality perform over time and what is the current state of rural vitality? 3. What factors influence the measures (indicators) of rural vitality indentified in the literature review?

The paper is organized as follows: Chapter 2 gives an overview of the literature on rural vitality. Chapter 3 presents the methodology, data, empirical model and the hypotheses that motivate the choice of the dependent and explanatory variables. Chapter 4 presents and discusses the results. Chapter 5 is the final chapter, which summarizes and concludes the results from the previous chapters.

2 Literature Review

This chapter will present how other researchers measure rural vitality, and intuitively explain how these variables are correlated with rural vitality. Selecting variables to describe the many facets of rural vitality is important in order to evaluate its performance over time. While some authors focus mainly on describing rural vitality, others want to explain through statistical analysis what factors influence the indicators of rural vitality. Determining the coefficients of these explanatory variables in a regression model is important because it can inform policies to boost vitality.

As mentioned in the previous paragraph, rural vitality is a complex concept reflecting how livable a place is that cannot be measured by means of only one variable. One way to measure it would be through the net migration rate, because if the predominant trend is that of new residents migrating to the area, then it means that this place (which can be a settlement, a municipality, or any other geographically delimited area of choice) has characteristics that make it a desirable place to live. Some of the desirable characteristics are of economic nature: job growth, a high employment rate or a high average income per capita.

There are other aspects of rural vitality, such as the level of access to a number of facilities: hospitals, supermarkets, primary schools, post offices, banks, cultural facilities etc. These facilities are important to satisfy basic necessities such as buying food or access to medical care, as well as necessities that are not vital, yet they add to the quality of life: restaurants, cinemas, museums and others.

Furthermore, there are aspects of rural vitality that are very hard to measure, such as the social cohesion within a community, or how strong the cultural heritage of the place is. The next part of the chapter presents some of the measures (or indicators) of rural vitality used in the literature.

2.1 Indicators of Rural Vitality

One of the most often used measures of rural vitality is population growth (either percentage growth, net in-migration or other similar variables). As explained previously, a positive population growth indicates the area has some characteristics that make it a desirable place to live. Out-migration on the other hand is of concern, because the people that emigrate first are generally the young or the skilled, the segment of the population that rural areas need to retain (Copus & Crabtree 1996). Besides changes in population, the age structure of rural communities is also considered an important indicator for rural vitality. As McGranahan (2008) explains, a large share of youth in the population indicates a vital area. This part of the population will increase the labor pool once they reach work age. The segment of the population aged over 64, on the other hand, is less dynamic, does not participate in the labor force and is associated with lower levels of vitality. McGranahan (2008) suggests though that lately larger shares of people aged over 64 are associated with more vital areas, because when they retire they choose areas that provide high amenity levels (beautiful landscapes, low crime rates).

McGranahan (2008) chooses to look at what explains population and job growth, while Agarwal, Rahman & Errington (2009) focus on economic performance as a measure of rural vitality: earnings per worker, employment and labor market participation. Higher earnings per worker indicate that the productivity of workers is high, meaning that the local economy is doing well. A high employment rate is also a sign of rural vitality, because it indicates there are employment opportunities either locally or within commuting distance. The paper by Bolton & Chalkley (1990) points out that one of the main reasons in-migrants chose a particular village/county to migrate to was employment opportunities.

Holland et al. (2009) measure rural vitality in terms of economic performance, GDP per capita growth and percentage of people below the poverty level, and look at how these measures of rural vitality are affected by distance from urban areas. The authors find that economic growth and the level of wages are strongly affected by the distance from urban economic centers and the strength of trade and labor links between urban and rural areas.

Deller et al. (2001) and Kim, Marcouiller & Deller (2005) use as indicators of rural vitality population growth, the rate of employment and income per capita. Lorah & Southwick (2003) look at population and economic growth, while Clark & Hunter (1992) focus strictly on in-migration.

A study by Kilkenny (2010) suggests more measures of rural vitality in terms of economic performance, namely property values, rural incomes and housing vacancy rates. According to this study, property values and incomes are lower, while housing vacancy rates are higher as the county population size decreases (adjusted by proximity to urban centers). The explanation of the author is that "because transportation costs are not negligible, remote locations remain unattractive to residents and non-resource oriented firms, remote land rents remains low, and rural property and less mobile households remain under- or unemployed".

The availability of facilities is another important aspect of rural vitality. Koomen (2011) looks in particular at retail facilities, schools, catering establishments, basic medical services, banks and posts. The intuition behind using the level of facility as a measure of rural vitality is that a reduction in the number of basic facilities means it is harder to reach them, and more difficult to make use of them. This becomes a problem especially in the case of less mobile people, who do not have the time, the money or the means to travel to distant facilities or to move to areas that are better serviced (White, Guy & Higgs 1997). Consequently, if access to services is low, this is detrimental to rural vitality, especially if a high percentage of less mobile people reside there.

There are also indicators for the social vitality of a place, such as community leadership and sense of cohesion. Cook et al. (2009) measure community vitality according to its residents by means of a survey that asks respondents to rate community vitality numerically. Also part of the survey the authors collect valuations of community leadership and sense of cohesion. They find that leadership is the most powerful indicator of community vitality and that communities are most successful when leaders cooperate on local projects. Furthermore, a strong social network and a sense of community have a positive impact on vitality.

Copus & Crabtree (1996) consider the cultural aspects of a settlement also an important part of its vitality. Their study, focusing on rural areas in Scotland,

concludes that the importance of minority languages such as Gaelic is positively correlated with the sustainability (vitality) of an area.

As can be observed, there is a wide variety of variables that can be used as proxy for rural vitality. The next table summarizes indicators that are used to describe rural vitality in the literature reviewed. The table also describes whether the indicators are positively or negatively associated with vitality.

Table 1: Measures of Rural Vitality – Dependent Variables*

Demography	
Population growth (+)	Percentage of people aged over 64 (-)
Economic Performance	
Earnings per worker (+)	GDP per capita growth (+)
Job growth (+)	Percentage below poverty level (-)
Employment rate (+)	Labor market participation (+)
Property value (+)	Housing vacancy rates (-)
Facility Levels	
Access to hospitals, schools, supermarkets, cinemas, museums etc. (+)	
Social Vitality	
Community leadership (+)	Sense of cohesion (+)
Cultural Vitality	
Importance of minority language (+)	

* The signs between brackets indicate that the variables are associated with increasing (+) or decreasing (-) rural vitality (+).

2.2 Factors Influencing Rural Vitality

This subsection will explain the difference between descriptive and explanatory studies and talk in detail about the factors that influence rural vitality. Descriptive studies on rural vitality generally describe the state and the performance over time of rural vitality based on a number of selected indicators. Explanatory studies are more focused on what influences indicators of rural vitality, and quantify the effect of each explanatory variable using regression models. In order to make regression analysis more tractable, only a limited number of rural vitality indicators are selected as dependent variables. Most often these indicators reflect changes in population, number of jobs, employment rates or average income. Table 1 shows that there are more measures to define rural vitality, such as social or cultural aspects. However, accurate data on social and cultural variables is harder to obtain, and the factors that influence them might not even be measurable. Variables on economic performance and changes in population are widely available and comparable across cities, municipalities and countries, which makes them popular to use in regression models.

Studies that explain the changes in rural vitality use a wide range of explanatory variables. This set of variables differs per study and depends on the exact definition of vitality that is applied. In fact, the factors that are used to describe vitality in one study can be used as explanatory variables in another, depending on the focus of the study. For example, a change in number of jobs influences population change and vice versa. For this reason, some of the indicators presented in the previous subsection also appear as determinants of rural vitality in some research papers. Some authors recognize the fact that these indicators influence each other and try to correct for this by using simultaneous equation models (Agarwal, Rahman & Errington 2009).

This subsection gives an overview of the variables that are typically used to explain changes in population and changes in measures of economic performance. The variables are organized into the following categories: 1) Demography; 2) Economic Structure and Performance; 3) Accessibility; 4) Amenities. It should be mentioned that these categories are subjective and not the norm.

1. Demography

Copus & Crabtree (1996) look at population density and how it affects rural vitality. The authors argue that a low population density has a negative effect on social and economic development, because it reduces opportunities for interaction between people and between companies, adds the cost of service provision, industrial inputs, and marketing of goods. They show in their paper that population density is also inversely correlated with peripherality (distance from large economic centers). Areas with low population density are far away from urban economic centers, which negatively affects the economic performance of these rural areas.

The skill level of the population (for example the percentage of people aged 16-64 with higher education) is also important and is positively correlated with economic growth. Agarwal, Rahman & Errington (2009) find that the skill level of the population is the main determinant of earnings per worker. They explain that the main reason for low productivity in some rural areas in the U.S. is the low level of education. This would indicate that investing in education for rural residents of all ages is one policy option for increasing rural vitality.

2. Economic Structure and Performance

Copus & Crabtree (1996) look at the level of dependence on the primary sector and conclude that it has a negative effect on the rural vitality of an establishment as a result of the fact that agriculture has a low value added per head. On the other hand, the size of the tourism and service sectors positively affects rural sustainability.

The same authors conclude that the size of monetary transfers from other regions of the country to rural areas is also important for the vitality of a region. If the share of transfers in the local budget is considerable, this means the area is dependent on an influx of money from outside sources, which has a negative impact on its sustainability.

Deller et al. (2001) include explanatory variables that describe the quality of local governments. They find that higher levels of income inequality tend to be associated with lower levels of population growth. Furthermore, property taxes are negatively associated with population and income growth, while increases in government expenditure are positively correlated with population growth, but have a negative impact on income growth.

Clark & Hunter (1992) explain the net in-migration rate using the following independent variables that describe economic opportunity: total employment growth, unemployment rate, median family income and housing value (to proxy for cost of living differences). It is interesting to notice that the variables used as indicators by Deller et al. (2001) are considered by Clark & Hunter explanatory variables. This is as a result of the fact that rural vitality is not described by only one variable, and many of these measures of vitality affect each other. Clark & Hunter find that expected employment growth and low median housing values increase in-migration, while a high poverty rate is a deterrent for migration.

Entrepreneurial spirit is also very important for rural vitality, because entrepreneurs create new companies, new jobs and contribute to local economic growth, as well as population growth if the increased job availability attracts new residents. Cook et al. (2009), in their study focused on a small number of rural communities, find that the number of businesses had a strong influence on community vitality. Agarwal, Rahman & Errington (2009) also look at how the investment driver (capital expenditure) affects wages and find a positive correlation between the two variables. The policy recommendations of Agarwal, Rahman & Errignton (2009) and Cook et al. (2009) is to support new business formation, and to create hubs and clusters in order to pool scarce knowledge and labor in rural areas.

3. Accessibility: Distance from Urban Areas

The study by Holland et al. (2009) focuses on the relationship between urban centers and rural areas, analyzing the relationship between the metropolitan area of Portland, OR, USA and the surrounding rural areas. The authors start with the hypothesis that urban economic growth is the main influencing factor in the economic growth of rural areas, which they confirm through empirical work.

The study introduces possible factors that can influence rural vitality, such as the strength of the trade links between rural and urban areas, as well as the labor links between these two areas (how many or what percentage of the rural population commutes between the rural and urban areas). The reason why trade links are important for economic growth and rural vitality are quite intuitive. Trade links lead to spillover effects, meaning that growth in urban areas also leads to growth in rural areas. Economic growth leads to economic vitality, more jobs, more diversity in

possible employment, as well as a higher demand for cultural and recreational services – this can create services that did not exist before or trigger a growth in existent services. All this translates into increased rural vitality.

The results of Holland et al. (2009) are confirmed by the study of Partridge & Rickman (2008), who find that economic distress in rural areas (the unemployment rate) increases with distance from urban areas. They explain this result as arising from the attenuation of urban agglomeration effects at greater distances and incomplete commuting and migration responses to lower labor demand in rural areas.

Agarwal, Rahman & Errington (2009) also look at how road infrastructure and measures of accessibility and peripherality affect earnings per worker and find that an increase in the length of roads relative to the area of a county positively affects wages, while distance from urban centers depresses wages.

4. Amenities

Lorah & Southwick (2003) investigate the relationship between environmental protection, population change and economic development. The study uses as explanatory variable the area of protected land around a 50-mile radius around the centroid of a county and computes the relationship between percentage of protected land, population and economic growth. The findings of the study are that amenities attract residents, tourists and firms.

Deller et al. (2001) look at 2243 rural US counties in order to better understand the relationship between amenities, quality of life and local performance in terms of population, employment and income per capita. The authors use five broad indices for amenity value and quality of life attributes: climate, land, water, winter recreation and developed recreational infrastructure. It is found that rural areas classified as "recreational" have a consistently higher rate of economic growth compared to the rest of the rural counties. Warm climate has a positive effect on population growth, while areas with a high water amenity score are associated with higher levels of population and income growth. According to this study, amenities have a positive effect on economic growth. McGranahan (2008) focuses on the relationship between net migration and natural amenities, and finds that the percentage of forestland within a county is positively correlated with in-migration, while the coefficient on percentage of cropland is negative.

These articles suggest that in order to promote growth, local governments can invest in amenities, thus increasing rural vitality. Here investing in amenities might involve protecting the environment or developing recreational infrastructure. Deller et al. (2001) conclude that focusing on amenities rather than primary industries is a viable way to promote economic growth.

Other authors look at how amenity value is incorporated into wages and land rents. Blanchflower & Oswald (1996) find that areas with higher amenity values have statistically lower wages and higher rents. The same authors suggest that people accept longer spells of unemployment in order to live in areas with a high level of amenities. This finding is supported by Roback (1988).

However, not all studies find amenities to have a significant impact on economic performance indicators. Kim, Marcouiller & Deller (2005) look at three states in the US near the Great Lakes in order to determine the impact of natural amenities on growth in population, employment and per capita income at the county level. After correcting for spatial autocorrelation, the authors do not find strong associations of amenities with the dependent variables. Only one amenity – lakes – from the five they use was positively correlated with retail and service sector employment.

Agarwal, Rahman & Errington (2009) also look at natural amenities and how they affect economic performance, and find that the regression coefficients are not statistically significant.

Besides natural amenities (which are the focus of a considerable number of papers), some authors, such as Clark & Hunter (1992) consider also: neighborhood quality, outdoor recreational quality and cultural amenities, as well as local taxes and government services (such as health services, per pupil expenditures on education and unemployment payments). All these variables increase the quality of life of a location, or describe how attractive an area is to live in (for example, high property taxes will decrease the propensity of people to move there). The authors find that amenities influence most the decision of middle-aged and older people, and less the decision of younger people (who are constrained by monetary considerations and have less economic freedom to choose areas with high amenity values).

The table below summarizes the explanatory variables used in the literature and their expected effect on rural vitality according to previous economic research: positive (+), negative (-) or neutral (*).

Table 2: Measures of Rural Vitality - Explanatory Variables

Demography	
Population density (+)	Percentage of people aged 0-14 years (+)
Percentage of people aged 65 and over (-)	Education level (+)
Economic Structure and Performance	
Dependence on primary sector (-)	Share of tourism & services (+)
Size of monetary inter-regional transfers (-)	Income inequality (-)
Government expenditure (*)	Employment growth (+)
Median housing value (-)	Property tax (-)
Level of entrepreneurial activity (+)	Poverty rate (-)
Spatial Variables	
Distance from urban areas (-)	Road density (+)
Amenities	
Percentage of protected land (+)	Warm climate (+)
Variation in topography (+)	Percentage water (+)
Percentage land with forest (+)	Percentage cropland (-)
Recreational infrastructure (+)	Neighborhood quality (+)

The literature enumerates a large number of factors that affect rural vitality, which indicate a number of policy measures. The skill composition of rural areas significantly affects economic performance. This suggests that improving education in rural areas or providing practical training for employees can boost economic growth.

Employment in industries with high value added per capita increases measures of rural vitality such as earnings per worker, so attracting the right type of companies in the area can be beneficial for the local economy. Entrepreneurs also have an important positive contribution to rural economies, so facilitating new businesses through money incentives or tax breaks is another policy option.

Proximity to urban areas is another factor that is a positive predictor for rural vitality. Ensuring that the road network efficiently connects rural and urban areas can strengthen the trade and labor links and lead to better economic growth in rural areas as a result of spillover effects from urban areas.

Amenity value is also important for rural vitality. This means low crime rates, sufficient provision of basic and cultural services, or an attractive landscape. Natural amenities have been of particular interest for researchers, and the results are mixed. Some studies indicate that areas labeled as “recreational” have higher than average population growth, while others find no relationship between vitality and natural amenities. Preserving the natural beauty of the environment and developing man-made recreational facilities can be another way to attract residents, create jobs and improve rural vitality.

Lastly, community cohesion and preservation of cultural heritage should not be neglected. Although these variables are hard to quantify and formally include the in regression models, they are important for the vitality of a settlement.

3 Methodology & Data

3.1 Selection of Indicators

The literature review in Chapter 2 suggests a wide range of indicators to measure the performance of rural vitality. Out of the indicators present in Table 1, for the goal of analyzing the changes in rural vitality in the Netherlands, I select the following variables: population size, age structure, number of jobs, job availability, average income per household and provision of basic facilities (schools, general practitioner's offices, post offices, banks, retail and catering facilities). I chose these indicators because they cover a number of aspects of rural vitality; in addition, these variables are easy to measure and readily available.

3.2 Motivation for Selected Indicators

Change in population is one of the main indicators of rural vitality. In particular, a declining population indicates that an area is not vital, and that other areas can provide the out-migrating residents a better quality of life. The underlying reasons for out-migration might be low availability of jobs, not high enough paid jobs, low provision of key facilities etc. Population growth or decline will be a result of changes in other indicators of rural vitality, and for this reason it is a key indicator of rural vitality. Age structure is also important, as explained by Copus & Crabtree (1996) and McGranahan (2008). In particular, a high percentage of people aged 65

and over indicates an aging, less active population that is most likely to perform poorly based on indicators such as average income or GDP growth rate.

The number of jobs and job availability are important because many people are influenced in their migration decisions by the availability of employment. A high job growth rate or a high level of job availability indicate there are more employment opportunities for residents locally (relative to other regions), which will make the place more attractive for current and prospective residents.

Average income is another indicator for vitality that is commonly used in the literature. At larger levels of aggregation, such as counties in the US, average income is generally earned within the same county. In the Netherlands, however, as a result of an efficient transportation system and due to the small size of the country and municipalities, the place of residence and the place where the income is earned can be a couple of municipalities away. For this reason average income is not necessarily a measure of the economic vitality of the place, but it is indicative of the type of residents the area attracts, and most often wealthy people choose to reside in more vital areas, because they are move flexible in their location decisions and prefer vital areas (which have a higher quality of life).

Koomen (2011) and White, Guy & Higgs (1997) point out the importance of access to basic facilities. As mentioned in the literature review, access to basic facilities such as doctor's offices, post offices, banks and retail stores are most important for less mobile people that cannot travel over long distances in order to make use of these facilities. Schools are another important facility, especially for families with children of school age. Besides basic facilities, there is also a need for recreation facilities, such as restaurants, cafes, cinemas etc. Looking at the evolution of facilities at the settlement level can provide an evaluation of how easily accessible these facilities are.

3.3 Levels of Aggregation

The analysis of rural vitality in terms of the above-mentioned indicators can be performed at two levels of aggregation. The first one is the municipality level, and the second is the settlement level (continuous built-up areas as defined in the CBS* 2008 Bevolkingskernen). These two levels of aggregation provide complementary insights. The municipality level offers accurate information on all rural vitality indicators enumerated in the beginning of the chapter, except for number of facilities. The settlement level data does not have information on age structure or average income, yet it is a more natural level of analysis for number of facilities, because for residents the most important and easy to access are the facilities available in their own settlement. For this reason both levels of aggregation are included, in order to compensate for missing variables and to describe the evolution of all selected rural vitality indicators.

3.4 Definition of Rural

The next step is to define what is rural in the context of the Netherlands. Based on data from the CBS, there are two ways to select rural areas. The first classification is at the settlement level, where there is data on number of residences, which can be used to create categories of settlement size. In this paper settlements of 11-5000 residences will be considered as rural. Figure 1 shows settlements of 11-5000 residences in the Netherlands.

* Centraal Bureau voor de Statistiek

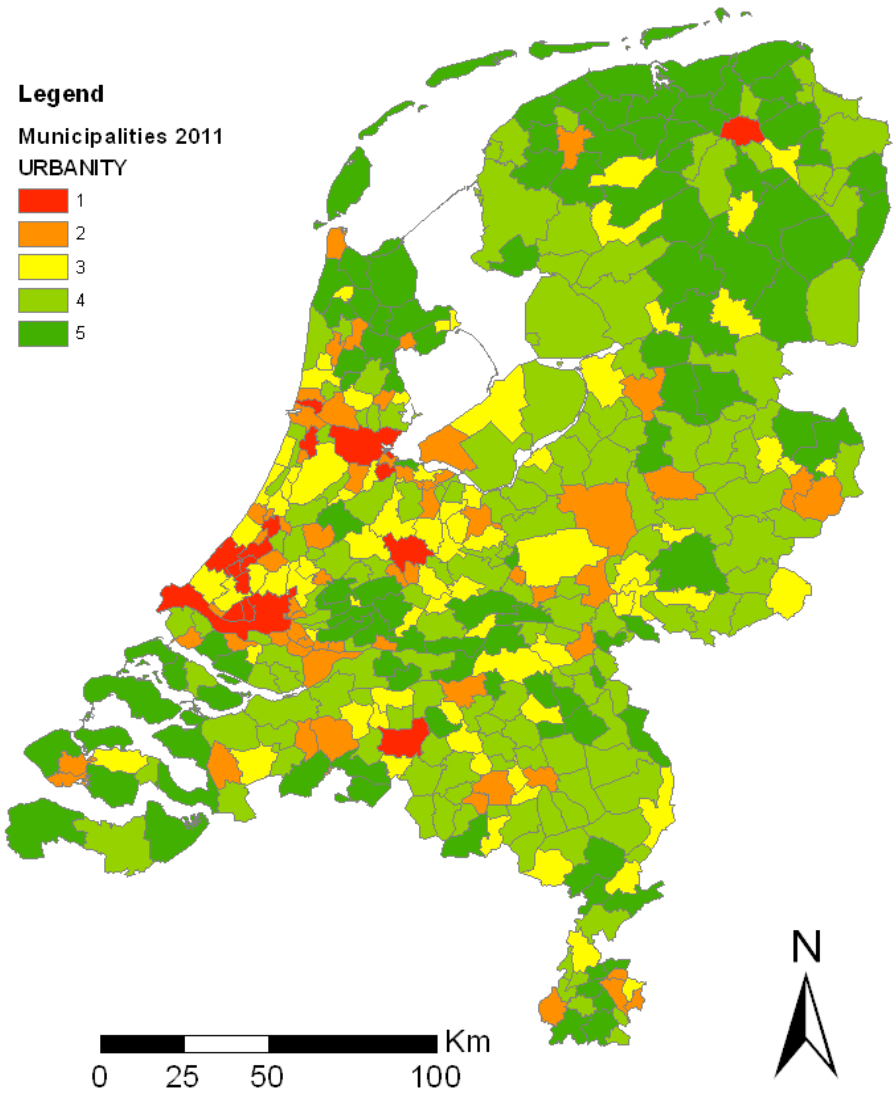
Figure 1: Small settlements of 11-5000 residences in the Netherlands

At the municipality level, the CBS data includes a variable called "urbanity", which categorizes municipalities according to the average address density, on a scale of 1 (high) to 5 (low). A city such as Amsterdam would fall into the urbanity category 1. I chose to group municipalities of urbanity 1 and 2 as urban, and urbanity levels 3 to 5 as rural. In the table below are the criteria used by the CBS to define urbanity levels, together with my own labels (on the left). Figure 2 presents the five categories of urbanity in a visual manner.

Table 3: Descriptions of categories of urbanity/rurality

	Urban	*CBS Definition*
1	Urban	Average area density larger than 2500 addresses per square kilometer
2	Suburban	Average area density between 1500 and 2500 addresses per square kilometer
	Rural	
3	Mildly rural	Average area density between 1000 and 1500 addresses per square kilometer
4	Moderately rural	Average area density between 500 and 1000 addresses per square kilometer
5	Very rural	Average area density lower than 500 addresses per square kilometer

Figure 2: Categories of Urbanity at the Municipal Level
(2011 administrative borders)



3.5 Data Sources

For the rural vitality analysis, the majority of the data comes from CBS, which provides information at both the municipality and settlement level. At the municipality level, the CBS provides information on population, age structure and average income. In order to supplement this data I collected from LISA* (lisa.nl) information on number of jobs by municipality. At the settlement level, the data on population numbers is provided by the CBS, while information on number of jobs and number of facilities comes from the LISA database. As a result of the fact that the data comes from a number of sources, indicators might be presented across different time intervals because some data is available only for specific years.

3.6 Descriptive Analysis

The purpose of the first part of the empirical analysis is to present the performance over time of rural vitality indicators and compare them to urban and national values. These indicators are presented at two levels of aggregation, namely at the municipality and settlement level. Not the same indicators are presented at both levels for reasons of data availability.

Population

At the municipality level, there is data from the CBS on population numbers in 2000 and 2009, aggregated based on the 2009 administrative borders (441 municipalities in total). At the settlement level, the population data comes from the 2001 and 2008 Bevolkingskernen. Both datasets come in shapefile formats.

* LISA is a database containing information on all establishments in the Netherlands where paid work is conducted. The data for establishments has a spatial component (address and coordinates) and a socio-economic component (employment and economic activity).

Some settlements in these datasets are situated very close to each other and they can be considered part of the same settlement. In order to merge adjoining settlements, I start with the 2008 Bevolkingkernen shapefile and apply a 250 m buffer in ArcGIS to merge settlements that are within 500 m of each other. Based on these new settlement borders the population numbers for 2001 and 2008 are aggregated. In total there are 1560 settlements.

Age Structure

Data on age structure is available only at the municipality level, for the years 2000 and 2009, aggregated based on 2009 municipality administrative borders (441 municipalities in total). Of interest is the distribution of the population by percentage shares of each age group: 0-14, 15-24, 25-44, 45-64 and 65 years and over.

Jobs

At the municipality level, data on number of jobs is available from lisa.nl for the years 2007 - 2011, aggregated based on the 2011 municipality administrative borders. In this paper data from the first and last year will be used to look at the performance of rural vitality in terms of jobs.

At the settlement level, the data on number of jobs is obtained from the LISA dataset, which provides information on the location of each business, together with information on number of employees and type of activity based on the Standaard Bedrijfsindeling – SBI – 2008. Using the contours of settlements described in *Population* the businesses located within the borders of the settlements are selected and the total number of jobs aggregated at this level for the years 2000 and 2010. This method of selecting the data implies that businesses and jobs outside the settlement borders are not included in the analysis.

Job Availability

It is important to know how many jobs are available at the municipal level, but even more informative it is to know the availability of jobs relative to the working age population. For this reason an additional statistic is presented, namely the ratio of number of jobs to the population aged 20 to 64 years. The data on number of jobs is

as mentioned in the previous paragraph. The data on population matches the years for number of jobs and is aggregated based on the municipality borders from 2011, available from CBS. Although there are a total of 418 municipalities according to the 2011 division, due to missing data on population the job availability statistics can be computed only for 408 municipalities.

Average Disposable Income per Household

The data on average disposable income per household is from CBS, for the years 2000 and 2009, aggregated based on the 2009 municipality administrative borders. Due to missing data there is information on income for 405 out of a total of 441 municipalities.

Availability of Facilities

Data on the level and change in facilities at the settlement level is presented for the years 2000 and 2010. The same method to obtain aggregate number of jobs is used. Namely, the businesses located within the borders of settlements are selected. Next, the number of facilities is aggregated by settlement and type of business. The SBI* 2008 business types included for each type of facility are available in Table 5. Again, this method of selecting data does not include businesses situated outside the settlement borders. Two types of statistics are used to describe the level of facilities. The first statistic is the average number of facilities per settlement. The second statistic shows the average number of facilities relative to the number of residences.

* Standaard Bedrijfsindeling

Table 4: Municipality Level Data

Variable	*Description*	*Obs*	*Source*
Pop_2000/2009	Population in 2000 and 2009	441	CBS
P_0_14_2000/2009	Percentage of the population aged 0 to 14 years in 2000 and 2009	441	CBS
P_15_24_2000/2009	Percentage of the population aged 15 to 24 years in 2000 and 2009	441	CBS
P_25_44_2000/2009	Percentage of the population aged 25 to 44 years in 2000 and 2009	441	CBS
P_45_64_2000/2009	Percentage of the population aged 45 to 64 years in 2000 and 2009	441	CBS
P_over_65_2000/2009	Percentage of the population aged 65 and older in 2000 and 2009	441	CBS
Jobs_2007/2011	Number of jobs (full time, part time and temporary) by municipality in 2007 and 2011	418	LISA
Job_pop_2007/2011	The ratio of jobs to population aged 20-65 in 2007 and 2011	408	computed using data from CBS and LISA
Income_2000	Average disposable income per household in 2000	405	CBS
Income_2009	Average disposable income per household in 2009	405	CBS

Table 5: Settlement Level Data

Variable	*Description*	*Obs*	*Source*
Pop_2001	Settlement population in 2001	1560	CBS Bevolkingskernen 2001
Pop_2008	Settlement population in 2008	1560	CBS Bevolkingskernen 2008
Res_2001	Number of residences by settlement in 2001	1560	CBS Bevolkingskernen 2001
Res_2008	Number of residences by settlement in 2008	1560	CBS Bevolkingskernen 2008
Jobs_2000/2010	Number of jobs by settlement in 2000 and 2010	1560	LISA 2010
Retail_2000/2010	Retail facilities (shops) by settlement in 2000 and 2010. SBI08 codes: 47.1, 47.2	1560	LISA 2010
Schools_2000/2010	Basic education facilities by settlement in 2000 and 2010. SBI08 code: 85.20.1	1560	LISA 2010
Doctor_2000/2010	Practices of general practitioners by settlement in 2000 and 2010. SBI08 code: 86.21	1560	LISA 2010
Post_2000/2010	Post offices by settlement in 2000 and 2010. SBI08 code: 53	1560	LISA 2010
Bank_2000/2010	General banks by settlement in 2000 and 2010. SBI08 code: 64.19.4	1560	LISA 2010
Catering_2000/2010	Catering facilities (restaurants, hotels, cafes, bars) by settlement in 2000 and 2010. SBI08 codes: 55.1, 55.2, 55.3, 56.10.1, 56.10.3, 56.3	1560	LISA 2010

3.7 Regression Analysis

The second part of the analysis selects as dependent variables a limited number of the indicators presented in the descriptive analysis, and attempts to explain with the help of regression models what factors influence these measures of rural vitality. Out of the indicators enumerated in the previous section, changes in population, number of jobs and average income per household are selected. Changes in population

indicate whether the area is attractive to current and prospective residents, while the change in number of jobs and average income describe how well the local economy is doing and how well off are its residents.

One additional indicator is included, namely the employment rate of people aged 15 to 64. The change in number of jobs is indicative of the state of the local economy, while the employment rate shows if there are employment opportunities locally or within commuting distance.

The analysis will be performed at the municipality level, using four separate time series regressions to quantify the effect of explanatory variables on the four rural vitality indicators of interest. The 2011 administrative borders are used to aggregate the data. There are 418 municipalities in total, out of which 342 rural (see Table 3) and 76 urban. The years covered are 2007 through 2011. For population and jobs data is available for all five years. The employment rate is available for all years except 2011, and average income is available only for 2007-2009.

The regression models are presented below:

$$\Delta P = \beta_0 + \beta_1 * P_{t-1} + \beta_2 * D_{t-1} + \beta_3 * L_{t-1} + \beta_4 * S + \beta_5 * A + \varepsilon$$
$$\Delta J = \beta_0 + \beta_1 * J_{t-1} + \beta_2 * D_{t-1} + \beta_3 * L_{t-1} + \beta_4 * S + \beta_5 * A + \varepsilon$$
$$E = \beta_0 + \beta_2 * D_{t-1} + \beta_3 * L_{t-1} + \beta_4 * S + \beta_5 * A + \varepsilon$$
$$I = \beta_0 + \beta_2 * D_{t-1} + \beta_3 * L_{t-1} + \beta_4 * S + \beta_5 * A + \varepsilon$$

Where the dependent variables are absolute change in population between two consecutive years (ΔP), absolute change in number of jobs between two consecutive years (ΔJ), the employment rate for people aged 15-65 years (E) and the average income per household (I).

In order to explain the changes in the four measures of rural vitality, I include a number of variables that describe each municipality from the point of view of demography (D_{t-1}) - percentage of the population over 64, the percentage of non-western foreigners and population density; the labor market (L_{t-1}) - percentage of the population with university studies, and from the point of view of location (S) - distance to 100,000 jobs and distance to the Randstad. In order to explain the effect of landscape amenity value (A) on rural vitality, a numerical measure of "landscape attractiveness" is included. "Landscape attractiveness" is measured on a scale of 1 (low) to 9 (high). The demography and labor force variables are from the previous period (in this case from the previous year) in order to establish a clear causality

between the explanatory and dependent variables. The size of the population (P_{t-1}) and total number of jobs (J_{t-1}) from the previous period are also included because they influence the magnitude of the dependent variables.

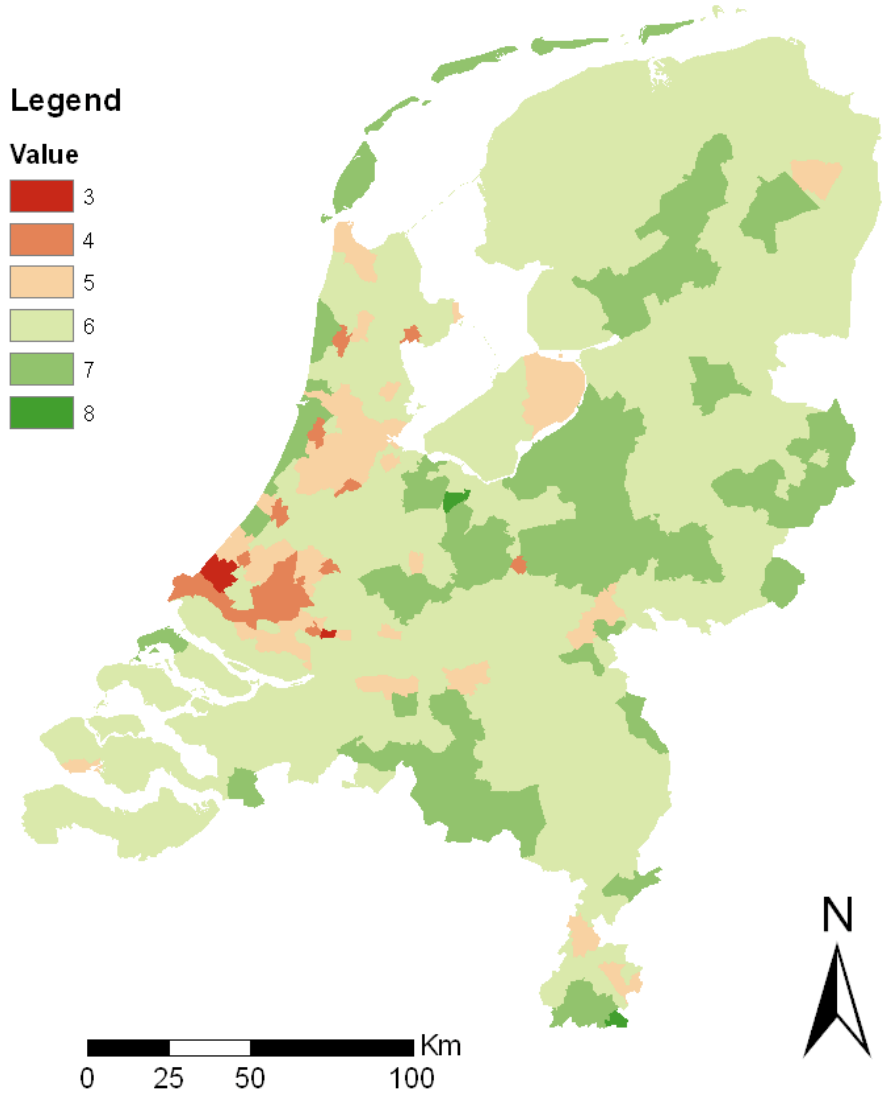
The data on population numbers, percentage of people over 64, percentage of non-western foreigners, population density, percentage of population with university studies, employment rate and average income comes from CBS. The data on number of jobs by municipality comes from the LISA website.

To obtain the variable distance to 100,000 jobs, a raster file of 500 m grid cell resolution is used, with each cell containing distance in km to 100,000 jobs. The file is provided by the PBL Environmental Assessment Agency Netherlands. Using this raster, the mean distance to 100,000 jobs within the borders of each municipality is calculated in ArcGIS.

Distance to the Randstad is also calculated with the aid of ArcGIS. First the urban agglomerations forming the Randstad are selected (Amsterdam, Utrecht, Rotterdam and ‘s-Gravenhage). Next a raster of 100 m grid cell resolution with the Euclidean Distance to the selected urban areas is created. Based on this raster file, the mean distance to the Randstad for each municipality is calculated.

The landscape attractiveness variable is based on the raster file of 100 m grid cell resolution from Alterra, with values of landscape attractiveness – valued by the general public on a scale of 1 (very negatively) to 9 (very positively). The median value within a municipality is calculated, resulting in landscape attractiveness values from 3 to 8 (see Figure 3). Areas inside cities figure as “No Data”, only the area outside cities is taken into consideration.

Figure 3: Median Landscape Attractiveness by Municipality



The percentage of people aged over 64 has been generally associated with a decrease in rural vitality (Copus & Crabtree 1996) and a loss in youth. However, McGranahan (2008) suggests that lately people aged over 64 are attracted to vital locations. This variable is included as an explanatory variable to test these two opposing hypotheses. The expected coefficient sign can be either positive or negative.

The percentage of non-western foreigners is included as a control variable. The sign of the coefficient on this variable depends on what places are attractive to this segment of the population, and what is their contribution to the vitality of the place. If non-western foreigners move to areas that are less economically vital, the expected sign of the coefficient is negative. If, on the other hand, they choose more vital locations, the coefficient on this variable will be positive.

Population density is included because higher population densities lead to economies of scale that positively influence job growth and the employment rate. As Copus and Crabtree (1996) explain, high population densities offer companies a more varied employment pool while at the same time resulting in an agglomeration of services and jobs.

The next category of explanatory variables describes the labor force (L). The variable in this category is the percentage of people aged 15 to 64 with university education. The skill level of the population is known to be a strong predictor of income. Furthermore, it is assumed that a highly skilled population will also lead to companies locating in the area, which should lead to creation of jobs. This should increase the employment rate and also attract new residents to the area.

The spatial variables are included in order to control for the location of each municipality within the Netherlands. The distance to the Randstad is included in order to proxy for how close job opportunities are. The Randstad is the most vital economic area in the Netherlands, which concentrates a large number of jobs. It is expected that this variable will be positively correlated with change in number of jobs, employment rate and average income. Furthermore, given the employment and wage opportunities offered by this area, it is expected that it will attract a large number of people. However, given that there is a high demand for housing close to the Randstad, the high cost of housing and the limitations on available housing might limit the increase in population. Consequently, the expected sign on this coefficient for the regression equation explaining changes in population can be either positive or negative.

I include distance to 100,000 jobs to account for the importance of economic centers outside the Randstad.

The last explanatory variable attempts to quantify the effect of landscape quality on the dependent variable. It is assumed that people prefer to live in areas with more scenic landscapes, so the population should increase faster in areas with a high level of landscape quality, if the assumption is correct. Other studies (Johnson & Rasker 1995) indicate that businesses might choose to locate in areas with attractive scenery, leading to an increase in jobs and higher employment rate. Lastly, if landscape quality is a scarce good, it means that the price on landscape will be embedded in housing prices, making these areas accessible mainly to families with high incomes.

Table 6: Summary statistics for rural municipalities*

Variable	*Description*	*No. Obs.*	*Mean*	*Min*	*Max*
ΔP	Absolute change in population between two consecutive years	1,335	107	-570	15,507
ΔJ	Absolute change in number of jobs between two consecutive years	1,368	44	-3,650	3,790
Population	Population at municipality level for years 2007-2011	1,677	25,080	942	143,374
Jobs	Number of jobs at municipality level for years 2007-2011	1,710	11,046	380	128,590
Employment rate	The employment rate for the two-year period centered around the year of reference; years covered: 2007-2010	1,148	96.1	89.6	100
Average Income	Average disposable income per household at municipality level for years 2007-2009 (x1000 euros)	989	35.2	25.7	59.6
Population Density	Number of residents per km^2	1,677	442	21	2,199
% over 64	Percentage of people aged 65 and older	1,677	16	6.9	26.9
% non-western foreigners	Percentage of people categorized by the CBS as non-western foreigners	1,677	3.6	0.7	18.7
% university education	Percentage of the people aged 15-64 with a university degree	1,334	4.37	1.5	25.6
Distance to 100,000 jobs	Mean distance within the municipality to 100,000 jobs in km	1,710	18	8	65
Distance to Randstad	Mean distance within municipality to the Randstad in km	1,710	62	1.4	168
Land_attract	Median landscape attractiveness valued by the general public on a scale of 1(low) to 9(high)	1,710	6.15	3	8
2007	year dummy equal to 1 if the year=2007 and 0 otherwise	1,710		0	1
2008	year dummy equal to 1 if the year=2008 and 0 otherwise	1,710		0	1
2009	year dummy equal to 1 if the year=2009 and 0 otherwise	1,710		0	1
2010	year dummy equal to 1 if the year=2010 and 0 otherwise	1,710		0	1
2011	year dummy equal to 1 if the year=2011 and 0 otherwise	1,710		0	1

* Urbanity levels 3, 4 and 5

4 Results

4.1 Performance at municipality level

This first part of the empirical analysis describes the state of the selected indicators at two moments in time and evaluates their performance over time, and also compares them to urban and national values.

4.1.1 Population

The first indicator of interest is population growth. In order to eliminate biases that might result due to outliers, I compare the total population for each rurality group in 2000 and 2009.

Table 7: Population growth by municipality from 2000 to 2009

Rurality	***No****	***Population 2000***	***Population 2009***	***Percentage Change % (yearly)***
Mildly rural	83	3,009,190	3,160,350	0.55
Moderately rural	155	3,470,110	3,560,540	0.28
Very rural	128	1,959,720	1,996,260	0.20
Rural (all)	366	8,439,020	8,717,150	0.36
Urban	75	7,429,540	7,771,950	0.51
Netherlands	441	15,868,560	16,489,100	0.43
Source: CBS statline				

As can be seen from the table above, mildly rural municipalities grew fastest in terms of population, while moderately rural and very rural municipalities grew much

* Number of municipalities

slower relative to urban and national values. This is most probably as a result of the fact that mildly rural municipalities do not suffer from the problems of highly urbanized areas, yet they have the advantages that result from higher population densities, such as good provision of basic and specialized facilities. Furthermore, these municipalities are most often situated in the proximity of urban centers, making them an attractive place to live for commuters.

4.1.2 Age Structure

Table 8: Age distribution performance from 2000-2009

Rurality	***0-14 years***	***15-24 years***	***25-44 years***	***45-64 years***	***65 years and over***
Mildly rural	-0.82	-0.06	-4.44	3.17	2.16
Moderately rural	-1.05	0.06	-5.06	3.23	2.81
Very rural	-1.23	0.07	-5.25	3.91	2.49
Rural (all)	-1.01	0.02	-4.87	3.36	2.50
Urban	-0.63	0.62	-3.38	3.13	0.25
Netherlands	-0.84	0.30	-4.16	3.24	1.44
Source: Statistics Netherlands (CBS Statline)					

At the country level we observe an ageing trend – the share of young people is decreasing while the share of people over 64 is increasing. This is a matter of concern for the Netherlands because with an ageing population, there are less people to work and contribute taxes, and more people that receive pensions from the government.

The same trend is observed at the rural level also, only more pronounced. This can be the result of either young people moving out of the rural areas in search of better employment opportunities, for education or urban specific amenities, or as the result of older people leaving the urban areas and moving to rural areas because with age their preferences change. This hypothesis, of preferences that change with age, is supported by Rees et al. (1998), who find that older people prefer less urbanized areas.

4.1.3 Job Growth

The availability of jobs in an area is important because it is reflective of its general economic performance, and also how attractive it is for future residents. In Table 9 I look at the growth of the aggregated number of jobs by type of rural area.

Table 9: Job growth by municipality from 2007 to 2011

Rurality	***No****	***Jobs 2007***	***Jobs 2011***	***Percentage Change % (yearly)***
Mildly rural	79	1,581,710	1,603,710	0.34
Moderately rural	152	1,512,470	1,538,100	0.42
Very rural	111	622,130	635,250	0.52
Rural (all)	342	3,716,310	3,777,060	0.40
Urban	76	4,155,210	4,288,210	0.80
Netherlands	418	7,871,520	8,065,270	0.61
Source: LISA www.lisa.nl				

The table above indicates that, among rural municipalities, as the degree of rurality increases, the rate of job growth is also higher. This is most probably as a result of the fact that very rural municipalities count low job numbers, making increases in number of jobs lead to higher percentage growth rates. This indicates that from the point of view of job growth, very rural areas are more vital relative to the other two rural categories.

Comparing job growth rates in rural areas with urban and national numbers, the job growth rate in urban areas is about two times larger, indicating that urban areas are still the economic engines of the country. The results from Table 9 are not very concerning though, because Dutch people commute over long distances, and residents of rural areas can access jobs in urban areas.

* Number of municipalities

4.1.4 Job Availability

In the previous table job growth rates were presented. However, this does not take into account changes in population. The following measure is more indicative of access of residents to jobs within the municipality (the ratio of jobs to the population aged 20-65 – a measure similar to the employment rate).

The results below are obtained by averaging the ratios of jobs to population at the municipal level over the categories in the first column.

Table 10: Average of ratio of number of jobs to population aged 20-65 years

Rurality	***Job/Pop Ratio year 2007***	***Job/Pop Ratio year 2011***
Mildly rural	0.85	0.83
Moderately rural	0.74	0.72
Very rural	0.60	0.59
Rural (all)	0.75	0.73
Urban	0.85	0.85
Netherlands	0.80	0.79
Source: LISA, Statistics Netherlands (CBS)		

At the national level, according to the results above, for every 10 people aged 20-65 there are about 8 jobs. While in urban areas the ratio of jobs to working age population is the highest, it decreases as the degree of rurality increases. In very rural areas, there are about 6 jobs for every 10 people of working age. This supports the well-known fact that there are more jobs in urban areas, more opportunities to be employed and find the desired type of job. Also, between 2007 and 2011, the ratio of jobs to working age population decreases only slightly in rural areas and it stays the same in urban areas. From the point of view of rural vitality, rural areas have lower job availability, but this seems to be a constant trend in time, meaning that rural areas are less vital by this indicator, but the absolute vitality of rural areas did not decrease from 2007 to 2011.

4.1.5 Average Income

The next table presents the evolution of average disposable income per household from 2000 to 2009.

Table 11: Average income in 1000 euros

Rurality	***Income 2000***	***Income 2009***	***Income Growth (% yearly)***
Mildly rural	25.8	35.9	4.34
Moderately rural	26.7	37.2	4.36
Very rural	25.5	35.8	4.48
Rural (all)	26.1	36.4	4.38
Urban	24.7	34.1	4.22
Netherlands	25.8	36	4.39
Source: Statistics Netherlands (CBS)			

As can be seen from the table above, the highest average incomes per household are in moderately rural areas, while income grew most in very rural areas. This indicates that more wealthy households live in rural areas in the Netherlands. This is not surprising, given that distances in the Netherlands are small and Dutch people are known to commute between municipalities for work. It is quite possible that richer families prefer areas with lower population density, more open space and large houses, and for this reason choose to locate in rural areas, which provide all these attributes.

The difference in average incomes per household might also be as a result of the fact that in urban areas there are more single-person households. Data on average income per worker would be more informative. However, this data is not available for the years of interest. Nonetheless, it appears that in terms of average income per household, rural areas are more vital. Although the ratio of jobs to the population of working age (Table 9) is lower in more rural areas, the average income per household is not. This indicates that in the Netherlands it is not that important for jobs to be in the same municipality as the employees, because they are willing to travel outside municipalities for work. Compared to US counties though, municipalities in the

Netherlands are much smaller in terms of area, which explains the high mobility of Dutch employees between municipalities.

4.2 Performance at Settlement Level

The analysis at the municipality level presented statistics on indicators of rural vitality such as population, age structure, number of jobs, job availability and average income. The settlement level descriptive analysis does not have information on age structure and average income, but it does have data on number of facilities, making these two levels of aggregation complementary.

4.2.1 Population

Table 12: Average population size and growth by settlement size

Settlement size	***N***	***Population 2001***	***Population 2008***	***Percentage Change % (yearly)***
11-250 (avg)	441	349	368	0.77
251-500 (avg)	305	878	914	0.58
501-1000 (avg)	248	1,655	1,698	0.37
1001-2500 (avg)	273	3,787	3,895	0.40
2501-5000 (avg)	117	8,404	8,612	0.35
11-5000 (avg)	1384	2,059	2,119	0.41
5001-10,000 (avg)	85	16,242	16,690	0.39
> 10,000 (total pop)		10,130,420	10,485,030	0.50
Total*		14,360,710	14,856,965	0.49
Source: LISA 2010, Statistics Netherlands The settlement size is based on number of residences per settlement in 2008				

* This is the total population for all settlements larger than 5 ha included in the analysis, excluding the population that is outside the population nuclei.

It appears that the smallest settlements have the highest growth rates in terms of population, but it decreases fast as the settlement size increases. Settlements with less than 500 residences grow faster than large settlements and the average for all settlements in the dataset, while settlements with 500-5000 residences have the lowest rate of population growth.

Koomen (2011) finds that between 1996 and 2000 small settlements in the Netherlands grew on average faster than the national average at a rate of about 3% per year, a considerably larger number compared to the observed 0.41% average yearly growth. However, the population for all Netherlands grew slower also.

4.2.2 Jobs

Table 13: Number of jobs and growth by settlement size

Settlement size	***N***	***Jobs 2000***	***Jobs 2010***	***Percentage Change % (yearly)***
11-250 (avg)	441	83	92	1.08
251-500 (avg)	305	203	214	0.54
501-1000 (avg)	248	409	443	0.83
1001-2500 (avg)	273	1,028	1,180	1.47
2501-5000 (avg)	117	2,999	3,212	0.71
11-5000 (avg)	1384	601	660	0.98
5001-10,000 (avg)	85	6,389	7,013	0.97
> 10,000 (total)		5,003,351	5,489,403	0.97
Total (total)*		6,423,789	7,051,307	0.97
Source: LISA 2010, Statistics Netherlands				

The table above shows job growth between 2000 and 2010 by settlement size. What can be noticed is that two categories of settlements have job growth rates larger than on average (these categories are 11-250 and 1001-2500 residences), while the other three categories have growth rates below average. In conclusion, some types of

* This is the total number of jobs for all settlements larger than 5 ha included in the analysis, excluding the jobs outside the population nuclei.

settlements are more vital, while others less, from the point of view of number of jobs. On average, settlements of 11 to 5000 residences have a job rate growth similar to that of large settlements and the Netherlands as a whole. Also, compared to the results for municipality job growth rate from 2007 to 2011, the table above indicates higher job growth rate, which is expected given that 2007-2011 starts just before the economic crisis that started in 2008. What can be inferred from the table above is that from the point of view of job growth, some types of settlements are more vital, while others less. On average, settlements of 11-5000 residences perform the same as large settlements. Koomen (2011) also looks at job growth in small settlements from 1996-2000 and finds that settlements smaller than 2000 residences experience a yearly job growth of around 3%, a number much larger than that observed in Table 13. It appears that growth in population will reflect growth in jobs and vice-versa. The lower job growth rate from 2000 to 2010 is not necessarily a sign of decreasing rural vitality, but more a reflection of the lower population growth.

4.2.3 Facility Levels

The next part of the analysis looks at provision of key facilities by settlement size. Facilities such as schools, doctor's offices, posts, banks and shops are essential for the vitality of settlements and people need access to them on a daily basis. Inadequate provision of facilities makes a settlement less attractive for new residents, and can lead to current residents leaving. For this reason it is important that in small settlements the level of facilities provided does not decline.

The table below shows that smaller settlements have lower levels of facilities, which is expected, given that they also have a smaller population. For retail facilities, there seems to be a decline in the number of facilities between 2000 and 2010 for all types of settlements. This could mean also mean that facilities are bigger so fewer of them are needed to provide the same service. For smaller settlements though, this decrease in the level of facilities means that there are more small settlements with 0 retail facilities. The main settlements affected are the ones with less than 500 residences. From 2000 to 2010, the number of small settlements with no retail facilities increased by more than 100 (there are 1384 settlements analyzed).

The same decreasing trend can be observed for schools, although for large settlements and in total there does not seem to be any large change in number. For

settlements with less than 500 residences, there are 3 more in 2010 with no schools. This is not a large number though. From the point of view of access to schools, there is a negligible decline in provision.

Table 14: Average Number of Facilities by Settlement Size

	Facilities											
Settlement Size	Retail 2000	Retail 2010	Schools 2000	Schools 2010	GP 2000	GP 2010	Post 2000	Post 2010	Bank 2000	Bank 2010	Catering 2000	Catering 2010
11-250	0.65	0.36 (-0.29)	0.91	0.88 (-0.03)	0.08	0.07 (-0.01)	0.08	0.13 (**0.05**)	0	0 (0)	1.51	1.45 (-0.06)
251-500	1.92	1.27 (-0.65)	1.28	1.26 (-0.02)	0.44	0.48 (**0.04**)	0.27	0.26 (-0.01)	0.04	0 (-0.04)	2.74	2.80 (**0.06**)
501-1000	3.55	2.51 (-1.04)	1.62	1.55 (-0.07)	0.91	0.94 (**0.03**)	0.53	0.51 (-0.02)	0.08	0.03 (-0.05)	4.71	4.72 (**0.01**)
1001-2500	6.86	5.21 (-1.65)	2.57	2.51 (-0.06)	1.55	1.77 (**0.22**)	1.23	1.08 (-0.15)	0.54	0.16 (-0.38)	7.06	6.81 (-0.25)
2501-5000	15.40	12.69 (-2.71)	4.97	4.75 (-0.22)	3.01	3.23 (**0.22**)	2.35	2.48 (**0.13**)	1.48	0.83 (-0.65)	14.05	14.27 (**0.22**)
11-5000	3.92	2.95 (-0.97)	1.79	1.73 (-0.06)	0.84	0.92 (**0.08**)	0.62	0.61 (-0.01)	0.26	0.11 (-0.15)	4.51	4.48 (-0.03)
5001-10000	27.12	22.62 (-4.5)	9.43	9.22 (-0.21)	5.35	6.32 (**0.97**)	4.04	5.17 (**1.13**)	2.49	1.83 (-0.66)	27.50	27.43 (-0.07)
>10000 (total)	16,677	13,822	4,470	4,473	3,164	4,281	2,456	3,736	1,337	910	18,052	17,973
Total	24,414	19,825	7,753	7,658	4,794	6,101	3,664	5,026	1,909	1,219	26,633	26,503

Source: LISA 2010, Statistics Netherlands

GP stands for general practitioner

Between brackets is the change in average number of facilities. Positive numbers in bold.

The average number of general practitioner's offices seems to have increased from 2000 to 2010. Looking at small settlements with no GP offices though, there are 581 settlements with no GP in 2000 and 580 in 2010. It appears that the number of doctor facilities increased where there already were general practitioner's offices.

For post offices, there does not seem to be a clear trend in the case of settlements with less than 5000 residences. In total the number of such facilities has increased. What should be mentioned though is that this category of facilities includes specialized postal services such as couriers. An increase in number of courier companies can hide a decline in the number of traditional post offices.

In the case of banks, it seems that in 2000 there was poor provision of bank facilities in very small settlements, and the number of banks per settlement further declined over the next ten-year period. Settlements with less than 2,500 residences rarely have any banks. This does not count though for bank facilities available inside other types of shops, which is quite common. The lack of banks indicates that not all types of bank services are available in small settlements.

The type of banks included is a very narrow category - universal banks. I chose this narrow category because generally in large cities there are more types of banks. Including a very general type of bank attempted to make the numbers comparable across settlement size. This seems to be the type of bank whose provision declined significantly.

The provision of catering facilities also seems to have decreased from 2000 to 2010 both at the small settlement level and in total. In terms of averages, catering facility levels decreased only slightly, but that means that 30 more small settlements have no catering facilities.

The analysis of facility levels by settlement size has been informative, but given the population differences between settlements, it makes more sense to look at number of facilities per 1000 residences.

The numbers in Table 15 are obtained by aggregating number of facilities and population by settlement size, and then computing the ratio of the two numbers. This is done with the purpose of eliminating the effect outliers might have.

Table 15: Average number of facilities per 1000 residences by settlement size

	Facilities											
Settlement Size	Retail 2000	Retail 2010	Schools 2000	Schools 2010	GP 2000	GP 2010	Post 2000	Post 2010	Bank 2000	Bank 2010	Catering 2000	Catering 2010
11-250	4.81	2.42 (-2.39)	6.73	5.93 (-0.8)	0.60	0.51 (-0.09)	0.61	0.88 (**0.27**)	0.06	0 (-0.06)	11.13	9.76 (-1.37)
251-500	5.63	3.44 (-2.19)	3.75	3.41 (-0.34)	1.29	1.32 (**0.03**)	0.79	0.70 (-0.09)	0.12	0 (-0.12)	8.04	7.59 (-0.45)
501-1000	5.38	3.55 (-1.83)	2.45	2.19 (-0.26)	1.38	1.34 (-0.04)	0.80	0.72 (-0.08)	0.12	0.04 (-0.08)	7.13	6.68 (-0.45)
1001-2500	4.60	3.26 (-1.34)	1.73	1.57 (-0.16)	1.04	1.11 (**0.07**)	0.83	0.67 (-0.16)	0.36	0.10 (-0.26)	4.74	4.26 (-0.48)
2501-5000	4.62	3.56 (-1.06)	1.49	1.33 (-0.16)	0.90	0.90 (0)	0.70	0.69 (-0.01)	0.44	0.23 (-0.21)	4.21	4.00 (-0.21)
11-5000	4.83	3.38 (-1.45)	2.20	1.98 (-0.22)	1.04	1.06 (**0.02**)	0.76	0.70 (-0.06)	0.32	0.12 (-0.20)	5.55	5.13 (-0.42)
5001-10000	4.22	3.28 (-0.94)	1.47	1.33 (-0.14)	0.83	0.91 (**0.04**)	0.63	0.75 (**0.12**)	0.38	0.26 (-0.12)	4.28	3.98 (-0.30)
>10000	3.76	2.94 (-0.82)	1.00	0.95 (-0.05)	0.71	0.91 (**0.20**)	0.55	0.79 (**0.24**)	0.30	0.19 (-0.11)	4.07	3.82 (-0.25)
Netherlands	4.00	3.05 (-0.95)	1.27	1.17 (-0.10)	0.78	0.93 (**0.15**)	0.60	0.77 (**0.17**)	0.31	0.18 (-0.13)	4.36	4.08 (-0.28)

Source: LISA 2010, Statistics Netherlands

GP stands for general practitioner

The number of facilities is from the years 2000 and 2010, while the number of residences is from 2001 and 2008.

Between brackets is the change in average number of facilities per 1000 residences. Positive numbers in bold.

The number of retail facilities per 1000 residences is higher for settlements with less than 5000 residences, compared to large residences and the entire dataset. However, provision of retail facilities in small settlements has decreased more than for settlements with more than 10,000 residences. In 2010 settlements with less than 250 residences have a lower level of retail facilities than any other settlement.

In terms of retail facilities per 1000 residences the number is bigger for smaller settlements. However, according to this measure, provision of retail facilities in small settlements has decreased more than for settlements with more than 10,000 residences. Number of retail facilities per 1000 residences is still higher for settlements with 11-5000 residences than the national level in 2010.

In the case of school facilities the story is similar. On average provision of school facilities is higher for small settlements compared to the national level, but the decline in provision of this type of service is larger for settlements with less than 5,000 residences (compared to the decline in school facilities for the entire dataset).

The level of doctor facilities increased slightly for small settlements and more for settlements larger than 10,000 residences. The number of post facilities decreased slightly for small settlements while it increased as the national level. In the case of post services, the number of facilities per 1000 residences is smaller for settlements with less than 5000 residences than the national average.

The level of bank facilities for small settlements is close to zero, because most do not have any banks at all. For most small settlements the level of bank facilities is smaller than the national average (and the decline in facilities from 2000 to 2010 is also bigger), with one exception. For settlements with 2501-5000 residences, the number of banks per 1000 residences is bigger than the national average.

Lastly, there is a decline in catering facilities for all types of settlements. However, the number of catering facilities per 1000 residences is higher for settlements smaller than 5000 residences.

In conclusion, it is of concern that more small settlements have no access to facilities such as retail and catering and that bank provision in the smallest settlements is close to non-existent. It is a good sign though that access to basic education and medical care does not appear to have declined (compared to access to other services), given that these are two of the more important services included in the analysis.

Furthermore, there seems to be a general declining trend in provision of services for all settlement sizes. However, this trend is more pronounced in the case of small settlements. From the point of view of access to facilities, rural vitality declines from 2000 to 2010. This does affect less mobile people that have to go to other settlements for shopping or bank services. It is important for rural vitality to maintain access to basic services in order to prevent population decline.

4.3 Explanatory Analysis

This section of the thesis presents four regression models that attempt to determine what factors influence four indicators of vitality previously selected: absolute change in population, absolute change in number of jobs, the employment rate for people aged 15 to 64 years and the average income per household. The analysis is done at the municipality level.

Table 16: Regression Results

Dependent variable	Absolute Change in Population		
	b	t	p
Population (t-1)	0.0055***	4.10	0.0000
Population density (t-1)	-0.0348	-0.52	0.6053
% over 64 years (t-1)	-20.5403**	-2.56	0.0105
% of non-western foreigners (t-1)	14.8605	1.51	0.1309
Distance to 100,000 jobs	-0.2562	-0.09	0.9295
Distance to Randstad	-0.8226*	-1.71	0.0880
Landscape Attractiveness	-39.0172	-1.03	0.3012
2008	(dropped)		
2009	42.0838	0.77	0.4422
2010	99.9648*	1.82	0.0694
2011	110.0754**	1.98	0.0479
_cons	490.0044*	1.96	0.0503
R squared	0.0462		
No observations	1335		

* p<0.10, ** p<0.05, *** p<0.01

Dependent variable	Absolute Change in Jobs		
	b	t	Pr>|t|
Jobs (t-1)	0.0005	0.58	0.5648
Population density (t-1)	-0.0153	-0.50	0.6147
% over 64 years (t-1)	-12.4532***	-3.13	0.0018
Distance to 100,000 jobs	0.4831	0.34	0.7363
Distance to Randstad	0.0161	0.07	0.9453
Landscape Attractiveness	-0.4274	-0.02	0.9816
2008	(dropped)		
2009	-289.8400***	-10.68	0.0000
2010	-374.5892***	-13.73	0.0000
2011	-254.5733***	-9.24	0.0000
_cons	464.2238***	3.79	0.0002
R squared	0.1524		
No observsations	1335		

* p<0.10, ** p<0.05, *** p<0.01

Dependent variable	Employment Rate		
	b	t	p
Population density	-0.0007***	-4.85	0.0000
% over 64 years (t-1)	-0.0808***	-4.88	0.0000
% of non-western foreigners	-0.1683***	-9.33	0.0000
% with university education	-0.0194	-1.22	0.2233
Distance to 100,000 jobs	-0.0322***	-4.35	0.0000
Distance to Randstad	-0.0169***	-17.16	0.0000
Landscape Attractiveness	0.1888***	2.66	0.0080
2007	(dropped)		
2008	0.1805*	1.69	0.0922
2009	-0.0930	-0.87	0.3846
2010	-0.4253***	-3.95	0.0001
_cons	99.0394***	194.98	0.0000
R squared	0.3904		
No observations	1023		

* p<0.10, ** p<0.05, *** p<0.01

Dependent variable	Average Income per Household		
	b	t	p
Population density	-0.0018***	-6.17	0.0000
% over 64 years (t-1)	0.1870***	5.28	0.0000
% of non-western foreigners	-0.2779***	-7.27	0.0000
% with university education	0.0803**	2.34	0.0195
Distance to 100,000 jobs	-0.2547***	-16.41	0.0000
Distance to Randstad	-0.0544***	-25.89	0.0000
Landscape Attractiveness	0.4352***	2.88	0.0040
2007	(dropped)		
2008	2.3978***	12.17	0.0000
2009	3.0254***	15.38	0.0000
_cons	37.1564***	34.49	0.0000
R squared	0.6791		
No Observations	762		

* p<0.10, ** p<0.05, *** p<0.01

4.3.1 Explaining absolute change in population

The first regression has as dependent variable absolute change in population between two consecutive years and uses as explanatory variable the population from the previous period, given that net migration is proportional to the initial population size. This variable has the expected positive sign, which is statistically significant. In addition, *population density* has been included in order to account for people's preferences for areas more or less densely populated. Although the coefficient on this variable is negative, it is not statistically significant, indicating that *population density* does not significantly influence migration flows.

The demographic variable *percentage of people over 64 years* is included in order to test the hypothesis that a large share in the population of older people negatively influences vitality. The first regression shows that this variable is negatively correlated with net migration, confirming in this case the assumption that a large share of retirees indicates a less vital area.

The *percentage of non-western foreigners* was included as a control variable. Its coefficient is not statistically significant, suggesting that is does not play an important role in migration dynamics.

The variables *distance to 100,000 jobs* and *distance to Randstad* where included to account for people's preference to be located near where the jobs are. Both variables have the expected negative signs, meaning that in municipalities situated far away from jobs and the Randstad, the population grows at a slower rate or is even in decline. However, only the second explanatory variable is also statistically significant, and only at the 10% level.

Landscape attractiveness was included in order to test the hypothesis that beautiful scenery attracts residents. The coefficient on this variable is not statistically significant though, suggesting that in particular this measure of the quality of landscape does not play any significant role in people's decision to relocate.

Lastly, the year dummy variables have been included to control for any time trend not explained by the rest of the independent variables. Relative to the base year 2008, the rate of population growth appears to increase in 2010 and then in 2011 the growth rate is even higher.

Looking at the R^2 for this regression, it appears that the explanatory variables account for about 4-5% of the observed variation in the data. This is a very small number, and together with the small number of statistically significant variables, it indicates that this regression model explains poorly changes in population. One reason for this result might be that population flows are not influenced so much by local factors, but are as a result of macroeconomic factors and changing preferences throughout their life time, as indicated by Rees et al. (1998). Another explanation might be that given the relatively small size of the Netherlands as a country, the municipalities do not differ so much in their characteristics and as a result there is not enough variation in the data to explain net migration. Lastly, it is well known that the

Netherlands has a very high population density and as a result the supply of housing is centrally planned, making an increase in population limited by available housing.

4.3.2 Explaining absolute change in number of jobs

The second regression seeks to explain changes in number of jobs, starting from the assumption that an increase or decrease in number of jobs is influenced by local factors. The regression has an R^2 that is significantly higher than for the previous one, explaining about 15% of the variation in the data. However, almost none of the key explanatory variables is statistically significant. The number of jobs in the previous year has the expected positive sign, yet the t value is too small to reject the hypothesis that the coefficient is equal to zero. The *percentage of people over 64* is the only statistically significant variable except the time dummies, reinforcing the result from the previous regression, that an aging population is a sign of declining rural vitality. Although some authors (Lorah & Southwick 2003, Deller et al. 2001) find that natural amenities have a positive influence on the local economy, the *landscape attractiveness* variable used in this empirical analysis does not seem to be correlated with job growth. The main statistically significant variables that also explain most of the changes in number of jobs (according to the t values) are the time dummies, which show a very clear downward trend starting with the year 2008. Job growth declines until 2010, yet in 2011 it seems to be picking up, with a rate of job increase higher than in 2009 and 2010. Again, it appears that the variables describing local characteristics of municipalities are poorly correlated with changes in number of jobs. It is possible that macroeconomic changes play a bigger role in determining number of jobs than variables describing local characteristics.

4.3.3 Explaining employment rate

The third indicator of interest is the *employment rate*. Especially now with the current economic crisis the employment rate and most often its reverse, the unemployment rate are a hot topic of debate for politicians. The concern for this measure of economic performance indicates it as one of the more important indicators of vitality.

A surprising result is the negative coefficient on the *percentage of people aged over 64*. It would be expected that a higher percentage of people that are not in the labor market would lead to a higher employment rate (because they create demand for goods and services, thus creating jobs), yet the regression results indicate the opposite. A possible explanation would be that areas with a high percentage of older people have some unobserved characteristic, and that the variable *percentage of people over 64* might act as a proxy for this unobserved variable.

A number of variables have a coefficient sign opposite to what was expected. A high *population density* would also imply a higher supply of jobs and a larger pool of possible jobs. This should facilitate employment rather than reduce it. The variable for *percentage with university education* also has a negative sign, although the coefficient is not statistically significant. One explanation could be the fact that the correlation between *percentage of non-western foreigners* and *percentage with university education* is 0.53. Another explanation would be that there is high spatial correlation between variables, which affects the regression results. It is possible that areas with high density have a high percentage of non-western foreigners and also a high percentage of people with university education, without any direct causality between the variables.

The variables describing the proximity to economic centers are both statistically significant and have the expected sign. The further away from jobs and the Randstad, the lower the *employment rate*, an intuitive result given that as these two variables increase in value, there are reduced employment opportunities and a smaller number of jobs that can match the skills and experience of the prospective employee. The *distance to Randstad* variable in particular has the highest t value, meaning it has the highest explanatory power when it comes to the dependent variable *employment rate*.

The variable describing quality of landscape has a statistically significant, positive coefficient, indicating that areas with better scenery also perform better by this economic measure. One thing to bear in mind though is that the dependent variable measuring the employment rate focuses on residents, who do not necessarily work in the same municipality. Consequently, even if a municipality has few employment opportunities, the rate of employment of the people living there can still be high.

Lastly, the year dummies capture the now well-known world economic crisis effect, namely an increase in the employment rate before 2008, followed by a large decrease in 2009 and 2010. The coefficients on the time dummies are also statistically significant.

4.3.4 Explaining average disposable income

The fourth regression models average disposable income per household. At a larger scale of aggregation this variable would also be a measure of the income earned within the administrative borders of the region. However, given the small size of the Netherlands and of its municipalities, this variable reflects mainly the location decisions of more wealthy people. Nonetheless, it does have positive implications for the local economy as well because these wealthy residents will also spend money on goods and services within the municipality.

According to the results below, it appears that wealthier families prefer less densely populated areas, situated not far away from economic centers. Also, households with high incomes locate in areas with high levels of landscape quality, indicating that a beautiful scenery is important in the location decision, yet the access to this scarce good is limited, meaning that the costs of living in attractive areas are also higher, leading to a self selection of the households that move there.

Most of the coefficients on the explanatory variables have the expected sign. People with higher education earn higher incomes, and proximity to 100,000 jobs and the Randstad indicate that the residents have access to higher paid jobs. The *percentage of non-western foreigners* is a negative predictor of household income for reasons that might have to do with the skill level of this population group.

One variable though has a surprising coefficient sign, namely the *percentage of people over 64*. It would be expected that this segment of the population has lower incomes because they no longer actively participate in the labor force. However, this age group does not have unemployment spells and generally does not have to make payments such as mortgage, which can be a possible explanation for the observed positive regression coefficient. Another explanation would be that both wealthy households and retirees prefer to locate in the same areas.

It should be noted that the R^2 of this regression model is quite high, explaining about 67% of the variation in the dependent variable.

4.3.5 Conclusion

The first two regression models lead to results with very little explanatory power; the R^2 values are low, and in addition very few explanatory variables are statistically significant. The year dummies are some of the few variables that are statistically significant in the regression models explaining changes in population and jobs. These results indicate that the studied phenomena are not strongly related to local spatial characteristics. This may be because they are dependent on a certain randomness of events. Employment may, for example, grow in one municipality because of a successful company or new start-up, while it may decline in another because of a bankruptcy or retiring entrepreneur.

Another potential explanation for the low explanatory power of the first two regression models might be that there is not enough variation in the dependent variable. Compared to the US, where there are large differences in terms of how rural counties are, Dutch municipalities are more homogenous, and generally have a more suburban character. Furthermore, the small size of the Netherlands limits the data available for analysis to a total of 418 municipalities (2011 administrative borders), both rural and urban.

Omitted variables can also be the reason behind the low explanatory power in the regression analysis of changes in population and number of jobs. Some variables have a large effect on the dependent variables, yet they are hard to measure and include in regression models. For example, some locations might be considered more appealing to people, because of a perceived liveliness or provision of status that is difficult to define or quantify. Housing supply is another variable not included in the regression, but that can influence the opportunity for increases in population.

Average income and the employment rate, on the other hand, can be explained much better at the municipality level through the explanatory variables included, indicating that this variable is more related to local spatial characteristics such as landscape quality.

The statistical significance of some of the explanatory variables leads to expected, yet still interesting results. The *percentage of people over 64* has been confirmed as a variable indicating a less vital area, having negative coefficients in all regression models except the average income one. The variables that describe distance to economic centers played an important role in explaining the employment rate and average income, and even changes in population. Municipalities located further away from economic centers and the Randstad in particular have a relative poor economic performance, which seems to affect the location decision of people also.

One of the more interesting results is the positive coefficient on *landscape attractiveness* in the regression for employment rate and average income. This indicates that more appealing areas are chosen as a place of residence by people that are financially well off, while the unemployed are less likely to reside in areas with a high quality landscape. This is most likely as a result of the fact that quality landscape is a limited good, and the people with relatively higher financial means manage to take advantage of it. So *landscape attractiveness* does influence the type of residents the area attracts (wealthy, employed), but it does not affect local measures of economic performance such as job growth.

5 Conclusion

The present thesis attempted to determine whether the vitality of rural areas has increased or declined over the time periods studied. The first part was to select a number of rural vitality indicators and, based on these measures, assess the changes in vitality. The second part was aimed at explaining the changes in some of the rural vitality indicators, with the purpose of possibly informing policy to boost rural vitality.

The conclusion of the descriptive analysis would be that there are no large decreases in rural vitality in the Netherlands. However, some trends are worth mentioning. First, regarding population, some types of rural areas show population growth rates higher than the national average. However, on average, rural areas are experiencing slower population growth. Furthermore, the age structure of rural areas indicates an ageing population, where the share of people aged 15-45 decreases and the share of people aged 45 and over increases. This ageing trend is also observed at the national level, yet in rural areas the trend is more pronounced. A study by Koomen (2011) finds no difference between the age structure of small and large settlements between 1996 and 2000. A similar study by Hodge & Monk (2004), analyzing rural vitality in England, finds that rural areas can be compared to non-rural ones in terms of vitality. The British authors do find variation within rural areas, suggesting that it might be more important for each rural area to be evaluated in terms of vitality in order to take decisions that match the particularities of that area. This can also be applied to the Netherlands, where there is variation in terms of vitality between rural areas.

In terms of job growth, looking at individual categories of rurality, some perform better than the national average and others worse. When averaging the statistics over all small settlements though, there are no big differences between job growth in small or large settlements. Furthermore, at the municipality level the ratio

of jobs to population aged 20-65 is lower in rural areas, but these ratios did not change over the time period studied. It can be concluded that from the point of view of job growth rural areas are not less vital than urban ones, while from the point of view of job availability rural areas have a lower job to population ratio, yet over time the level of vitality did not change. Koomen (2011), studying job growth in the years between 1996-2000, also finds that there are no large differences between job growth in small settlements and the entire country.

This study on rural vitality also includes statistics on average income per household, which leads to a surprising result. Given that some rural areas perform worse in terms of population growth, age structure and job growth, relative to urban areas, it would be expected that these areas would have average incomes at most as high as urban areas. However, rural areas have average incomes consistently higher than urban and national levels. Given that these incomes are most probably earned in more urban areas, it appears that rural places have a more residential character.

The analysis of facility provision in settlements smaller than 5000 residences indicates that there is a need to ensure that availability of services does not further decline. The decline observed in number of schools by Koomen (2011) between 1996 and 2000 seems to have stopped. Between 2000 and 2010 there is only a small decline in provision of schools in small settlements. The number of general practitioner's offices shows a small increasing trend, present in the analysis of Koomen (2011) as well. The measure used to quantify provision of post services also indicates that there has been no large decline in the provision of this type of facility.

Bank facilities show a sharp decline during the ten-year period studied, but this could be as a result of the narrow choice of bank types included in the analysis. The level of catering and in particular retail facilities declined in both small settlements as well as in the entire Netherlands. This could be a general trend possibly caused by the slowdown in economic growth experienced by many countries in the past years.

Regarding facilities, one main observation would be that although the relative number of facilities in small settlements is still higher than in large settlements, the decrease in provision of facilities (such as retail, catering and banks) is sharper. Further research is needed to understand the reasons behind this decline in services, and determine whether it is a temporary trend, or if this decline will continue. One possible explanation would be that the size of facilities increased, making fewer units

necessary. However, that still posses a problem for very small settlements that do not create the demand necessary to keep open these larger facilities.

The second part of the analysis sought to explain what influences changes in population and number of jobs, the employment rate and average income. The regression models explaining changes in population and number of jobs have low explanatory power in terms of the R^2 value and the statistical significance of the variables. This result is probably due to the fact that variance in the dependent variable is not very large and some relevant driving forces that are hard to measure could not be incorporated in the analysis. The other two regressions on the other hand, explaining changes in employment rate and average income, have much higher R^2, indicating that the regression models are a good fit for the data.

One of the hypotheses was that population density positively influences rural vitality. While the coefficient for population density was not statistically significant in the first two regressions (explaining changes in population and number of jobs), the variable is negatively associated with average income and the employment rate. This is an unexpected income, given that authors such as McGranahan (2008) find that population density is positively correlated with population growth and employment rate. The result observed in the present analysis is most likely due to the fact that the municipality of residence is not the same as the municipality of work, and in this case it appears that employed people with high incomes prefer to reside in less dense areas.

The explanatory variable that appears most often in the literature is the percentage of elderly people. The opinions are divided on the expected sign of this variable. Copus & Crabtree (1996) suggest it is negatively correlated with measures of rural vitality, while McGranahan (2008) argues that the elderly might choose to locate in more vital areas. The result of the regression analysis in Chapter 4 indicates that in the Netherlands, a high share of older people is correlated with lower vitality.

One variable that is particularly important for policy is the share of working age people with a university degree. Deller et al. (2001) find that this variable positively influences rural vitality, indicating that investing in education is one way of increasing the vitality of a place, given that it leads to a better skilled labor force that earns higher wages. The current thesis finds no relation between the skill level of the population and increases in population or number of jobs, but it does find that a higher share of the population with a university degree predicts higher incomes and a higher

employment rate. However, this is not indicative of the local economy, because many people work outside the municipality of residence.

Lastly, one of the more researched themes is the relationship between rural vitality and natural amenity values. As explained in the literature review, the results are mixed. Lorah & Southwick (2003) find that amenities attract residents, tourists and firms, while Kim, Marcouiller & Deller (2005) conclude that after correcting for spatial autocorrelation, there is no statistically significant relationship between amenity value and indicators of rural vitality. In order to test whether landscape attractiveness positively influences measures of vitality, I include it as an explanatory variable in the regression analysis. The results are inconclusive for changes in population and number of jobs. For the employment rate and average income, the coefficient on landscape attractiveness is positive. If the coefficient for this variable were positive and statistically significant in the regression with change in number of jobs as dependent variable, it would mean that an appealing scenery has a positive effect on local economic growth. As mentioned previously, average income and employment rate do not reflect the local economy, so the conclusion of the regression analysis would be that attractive locations are chosen as place of residence by people with higher than average financial means.

The conclusion of this thesis would be that the vitality of rural areas is not at risk, as indicated by "Netherland's Rural Development Strategy". Nonetheless, it should be of concern that rural areas have an aged population, and the level of facilities such as retail, catering and banks is decreasing faster than the national average. Regarding the regression analysis, it did not lead to any policy recommendations for how to attract residents or boost number of jobs. Further research is needed in order to determine what factors subject to public policy also influence rural vitality.

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