The impact of school closures on rural villages in the Northern Netherlands. A precursor of demographic decline?

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1. Summary

This paper investigates the impact of the closure of the last primary school on villages in the Northern Netherlands between 2001 and 2018. Is the expected ‘demographic death’ of the village after a school closure, suggested by local residents and politicians, empirically valid? As the number of closures has increased in the Netherlands and will continue to do so, it is crucial to check if these presumptions are true. Furthermore, the thesis aims to contribute to the field of rural geography by looking into the current importance of services, in this case schools, for the demographic development of villages. This was examined on the basis of two demographic indicators and data on housing transactions. Novel methods were used to analyze the data. Evidence for a negative effect of the closure of a primary school on the number of households with children has been found. However, the impact is fairly small. The availability of a school may influence some relocating decisions, as is reflected in the results of the panel regression. But, there is no evidence for the ‘demographic death’ of villages that see their school close. Similar results have been found in the analysis of the housing transactions.

Therefore, the conclusion of this paper contradicts popular sentiment, but is in line with the results of similar studies by Amcoff (2012) in Sweden and Barakat (2014) in Germany. The lack of evidence for a demographic decline is partly explained by the distinction Thissen (2006) made between residential and autonomous villages. Thus, the results of this thesis are an incentive for policymakers to reconsider the large amounts of money and effort currently used for keeping primary schools open in rural villages.

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2. Introduction

> "And if there is no primary school anymore, there will be no more families with small children. If that happens I would also look for a village where it was still standing...The moment the school disappears, is the deathblow to the countryside."[1]

(A concerned citizen on the possible closure of a primary school in De Marne, Groningen. *Het beste van twee werelden; plattelanders over hun leven op het platteland*, 2007 (translation from Dutch, original quote below))

The closure of the last primary school in a rural village is always an event of great concern to parents, local politicians and the media. This is a natural reaction given the popular notion that the existence of a primary school is deemed essential to keep a village alive. Closing the last school will lead to the 'demographic death' of the village. Young parents will be encouraged to move out of the area and much less families will move in. This reasoning has a 'common sense ring' about it. People often refer to the importance of the local primary school for the viability of the village and claim that the closure of the last school marks the beginning of the end. Numerous examples of this reasoning can be found in the media, including in the Dutch press (Volkskrant, 2019 & Dagblad van het Noorden, 2014).

One argument against the closure of rural schools is that it has serious effects on the local demography, particularly on the share of families with children. This is the argument that will be examined in this paper. My aim is to detect whether the closure of a rural school indeed enforces this demographic decline.

Over the last decade the Netherlands has witnessed a decrease in the number of primary school pupils, especially in rural areas (CBS, 2016). Moreover, the demography of Dutch rural villages is marked by ageing and dejuvenation, resulting in a declining population. Dejuvenation -the decline of the number of 0-18-year-olds in an area- is caused by a low fertility rate and a continuous flow of young people moving from rural to urban areas. The decrease in pupils is expected to continue the following years in the whole of the Netherlands. This decline, however, will especially be felt in rural areas (Elshof, 2014). Schools in rural areas tend to be smaller than those in urban areas, and are therefore more at risk of closing. Also the distance between people's home and the school is already larger in more rural areas (CBS, 2016). School closures are fundamentally changing the geography of school availability in those regions.

As the number of school closures increases in the Netherlands, it is important to investigate whether the apprehensions of the 'demographic death' of the village are empirically valid. If the closure of a primary school indeed has these far reaching consequences, it should be an issue of great importance to local and regional governments. Furthermore, it is crucial to look into the validity of policies that are currently in place. In 2018 the Dutch Ministry of Education, Culture and Science decided to set aside extra funds to keep primary schools in rural areas open. Arie Slob, the minister of Primary and Secondary Education and Media, explained this decision by saying that schools are of great importance for the liveability of

[1] Original: "En als er geen lagere school is, dan komen er ook geen gezinnen met kleine kinderen meer. Tenminste, ik zou dan ook een dorp zoeken waar die nog wel stond…Op het moment dat een school verdwijnt, is dat de doodsteek voor het platteland"

these villages. He stated that when the school closes, young families will leave (AD, 2018). Also the EU Rural Development Policy 2014-2020 is supporting local services to stay open to combat depopulation in rural villages (Amcoff, 2011). Thereby, both the minister and EU adhere to the popular notion that certain services are essential for the future of villages.

However, research on this topic is scarce (Barakat, 2014). More investigation is needed to indicate what the exact impact is on the demography of villages. With this thesis I want to address these presumptions. The study will investigate the demographic impact of primary school closures in the Northern Netherlands. My research question is: 'What is the demographic impact of the closure of the last primary school in rural villages in the Northern Netherlands in the period of 2001 to 2018?'.

Three sub-questions have been formulated to help answering the main research question:

1. To what extent do villages in the Northern Netherlands differ in their demographic development based on the absence or presence of a primary school?
2. Is the closure of a primary school in a village the end or beginning of a period of demographic decline?
3. Does the age differ between people selling and buying houses in villages, due to the presence or absence of a primary school?

The first sub-question will attempt to answer whether there are any notably distinctions between villages that saw their school closed and those that still have a school. Both the starting situation of these villages and the development that took place over the past two decades will be investigated. The second sub question pays attention to the possible lagged effect of a school closure. Forward looking parents with children, attending the primary school, may relocate once the continued presence of a school in a village is questioned, years prior to its actual closure. Others may await the new situation first, before relocating after all. Therefore, changes in the demographic indicators could spread out over multiple years. The third research question looks into the impact of school closures on the characteristics of people buying and selling houses in these areas. Do they change after or before the closure of a school? Furthermore, the thesis aims to contribute to the field of rural geography by looking into the importance of services, in this case schools, for the demographic development of villages. Currently, due to the increased mobility of people, the level of services might be less important for the future of the village.

The remainder of this research is organized as follows. In the first part of this paper the conceptual framework will be defined and literature on the demographic impact of school closures will be discussed. In the second section information on the data collection and methodology used in the analysis will be given. By using demographic indicators of the Statistics Netherlands and housing transaction data of the Dutch Land Registry and Mapping Agency –in short Cadastre–, two regression models are estimated. The third section will present the results and connect them with previous literature. The last part provides the conclusion and a critical reflection on the relevance and quality of the results.

3. Theoretical framework

The demographic consequences of service closures, let alone school closures, do not receive much attention in population studies. Irwin and Seasons (2012) note that there has been little evaluation of the economic, social and environmental impacts of school closures. The demographic impact does not even make that list. Research on the demographic impact is necessary to investigate the popular assumption of the relative importance of school availability in villages in migration decisions. However, empirical evidence is rather scarce. A substantial part of the research on school closures focuses on schools being a symbol of the community identity, resulting in qualitative case studies. These studies investigate how people experience the closure of a school and how it might influence their sense of place. For example, Haartsen (2015) concluded that, after a short period of time, the quality of life in these villages was just as good as it was before the school closed. First, the classic migration theory of push and pull factors will be discussed. The second part looks into the current literature on school closures. The third section will present a conceptual framework, derived from theory and empirical research. The last part provides information on the Dutch school system.

3.1 Push and pull factors

Push and pull factors are often used to explain moving behavior of people (Lee, 1966). Figure 1 shows a representation of the push and pull model. Migrants move away from places because of factors that drive or push people away from that place, for example the lack of amenities or unemployment. These factors are referred to as push factors. The factors that attract people to live in a particular region are called pull factors (for example access to a particular job or the attractiveness of a community). Community attractiveness, partly represented by the amount of services in a village, is an important driver of moving behaviour. People tend to be pulled towards places where the circumstances meet their needs and pushed out of places, where those are not met (Elshof et al., 2015). The closure of a school can therefore, if there is no alternative nearby, be an incentive for people, especially families with children, to leave the village. The absence of a school is also a disincentive for families to move to that particular village. The plus-sign for the destination or origin region can, in the case of a closure, become a minus-sign and for that reason an incentive to move away or to decide not to move to a particular place. However, there are also intervening obstacles, that can obstruct moving. It might be difficult to sell your property. Also having children that go to the local school can force parents to stay at their location, although they are able to get a more interesting job with higher income by moving. Therefore, the closure of a school can result in a family’s decision to move away from the village. Primary schools are an important amenity for families with school-aged children. Suburbanization is common in the early phases of family formation. The in-migration effects of school availability are therefore interesting to look at, as that group is more sensitive to school provision. The decision to migrate is, obviously, not solely made on the fact of the presence of a school (Barakat, 2014). There are, as the push and pull model shows, a lot of more factors involved. To analyze the effect of a school closure, it is therefore needed to include all these factors in a model.

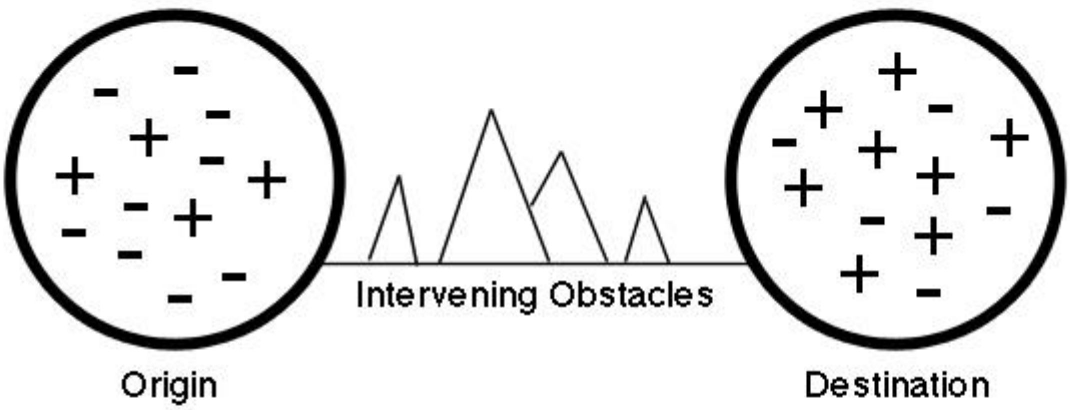


Figure 1: theoretical framework of the push and pull model of migration (based on Lee, 1966).

The few studies addressing the link between school closure and migration are surprisingly inconclusive. Older studies from the USA found evidence for a negative effect on the demography of a village, due to the closure of primary school. For example, Dreier and Goudy (1994) stated that rural communities without a high school lose population faster compared to all other towns that lose population. Lyson (2002) concluded that villages without a school tended to have a more favourable population development, higher house prices and fewer poor people. However, identifying causal connections in these type of studies is complicated.

Here I will discuss three recent papers that investigate the effect of school closure on migration and demography.

3.2 School closures and demographic decline in Saxony, Sweden and the Netherlands

Barakat (2014) investigated the effect of school closures on in- and out-migration in the rural areas of the German federal state of Saxony. He presented evidence, on the basis of a substantial quantitative research using panel data, that school availability does play a role for some individuals in making migration decisions. However, there is no evidence for a universal depopulating effect of primary school closures. Departures and arrivals in small municipalities in Saxony were dominated by invariant differences between municipalities. Therefore, Barakat concluded that his research showed similar migration and demographic trajectories for municipalities that lost their primary school, those that retained their school, and had no school to begin with.

Amcoff (2012) did a similar research in Sweden, but could not provide evidence of a school closure effect on inward and outward flows of families with children. He made use of Thiessen polygons to identify the catchment areas of schools, instead of municipality borders used by Barakat (2014). Also Amcoff did not find any evidence of an increased population decline in villages that lost their school in comparison to villages that still had a school. He states that this might be related to the excellent bus system that is in place in rural Sweden, therefore students were well connected to other areas, in which schools were still open.

Elshof et al. (2015) investigated the phenomenon in the Northern Netherlands and found mixed effects. The closing of a primary school did not influence inward flows of migration. However, the closure was associated with greater outward flows of families with young children. Elshof et al. explained this by saying that the absence of a primary school pushes people out of the village. Before the closure, families were retained in the village for so long, as their children attended the primary school. The moment the school closes their reason for staying is removed. However, the study is limited, due to the low number of cases used in the analysis, which experienced a closure of a school. Elshof et al. also made use of a linear regression model to estimate the migration flows. Although a panel regression model might be more suited for the type of data at hand, as one can control for unobserved regional characteristics (Allison, 1994). Secondly, dummy variables for each year in the study period were not included in the model. Amcoff (2012) explained that time dummies are essential in such a longitudinal and cross-section analysis as they are able to catch time-specific effects. The number of school closures has increased in the Netherlands over time. That correlates with the general demographic decline happening in nearly all villages in rural regions. The closure effect might therefore be overstated by Elshof et al. (2015).

However, they do come up with a solution to deal with the 'reverse causation' of the relation between school closure and population decline. Is it that the loss of population leads to the closing of a school or that the closure of school leads to population decline? For villages that had experienced a school closure Elshof et al. made a category for the time period before the school closure, as well as a category for the period after the school closure. Thus, they could estimate the impact on migration leading up to the closure and after the school closure. By using Nevertheless, new research is necessary for the Netherlands, as since the publication of Elshof et al. in 2015 more villages have lost their school, resulting in a larger sample to investigate.

It can be concluded from these three articles that it is much harder to find evidence for unfavourable trends in demography because of a school closure, as popular opinion implies. The lack of evidence in the papers of Elshof et al., Barakat and Amcoff might be explained by the transition that rural villages went through over the past decades. Many of these villages went from being an 'autonomous' village, where jobs and the other inhabitant's needs were provided for, to a predominantly 'residential' village. This change happened due to scaling and the increased mobility of people. Currently, only prosperous villages near larger cities, are still 'autonomous'. Nevertheless, residential villages are still attractive to live in. People migrate to these places, because they are attracted by the living environment. The so-called 'rural idyll' of the countryside is an important motivation for people moving to a rural area (Bijker & Haartsen, 2011). Those people want to live in a nice environment and care less about the level of services (Thissen, 2006), as these services can be easily accessed by car in other places. If these 'residential' villages are the locations where schools have closed over the past decade, it could be assumed that impact on migration levels is little. The majority of the population in these villages does not consider the lack of services as a push factor anymore.

3.3 Conceptual model

When considering the push and pull model of Lee (1966) and the research strategies of the discussed papers, a framework can be made that explains the possible impact, in combination with other control variables, of a school closure (figure 2) on the migration rates of a village. The different components of the model were discussed in the previous paragraph and are believed to influence the level of in- and out-migration in a village.

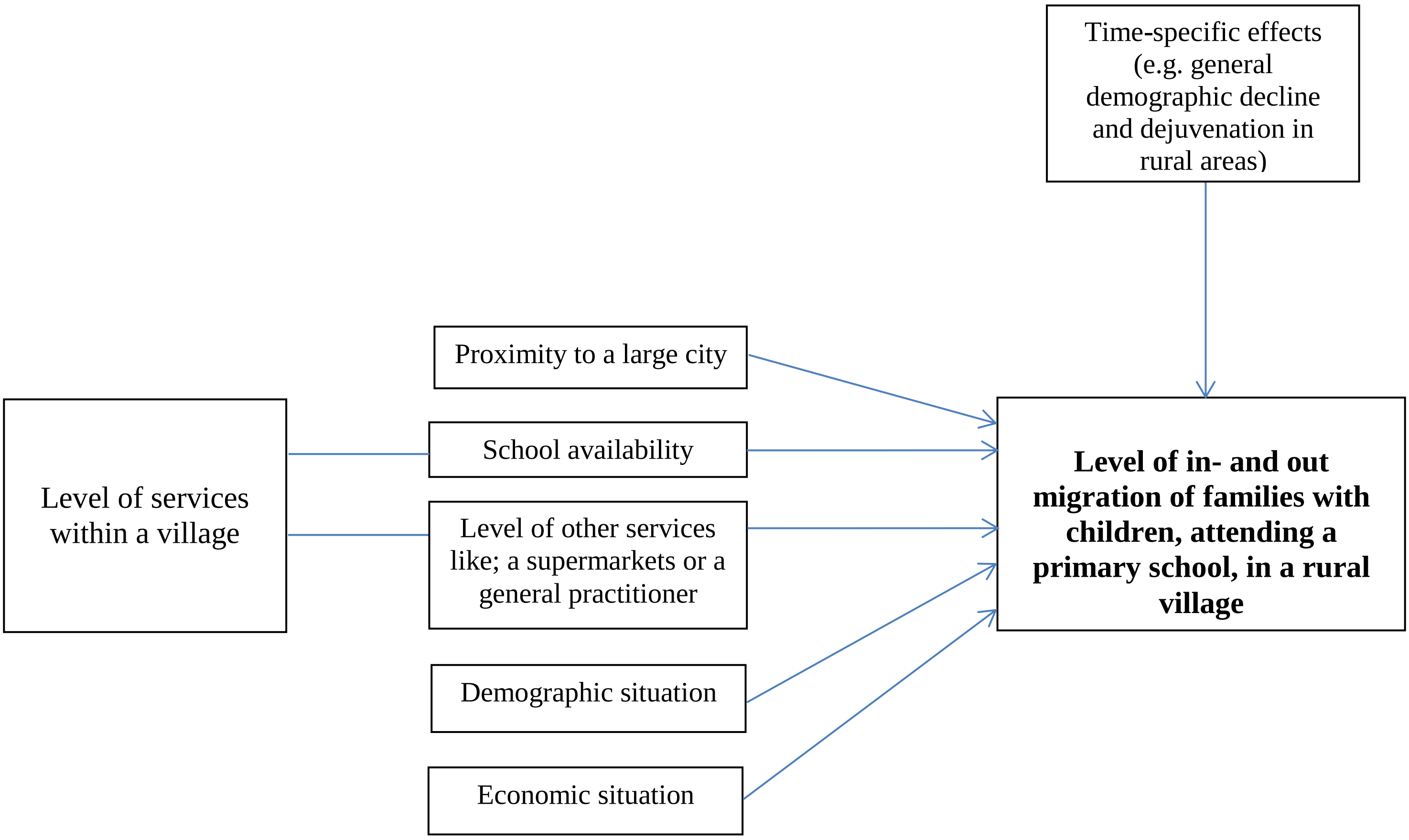


Figure 2: conceptual model on the impact of the availability of a school and control variables on the level of in- and outmigration.

3.4 Dutch school system and trends in pupil numbers

The number of primary schools has been declining in the Northern Netherlands for the last couple of decades (CBS, 2016). In rural areas a primary school is threatened with closure, if there are less than 23 pupils. In cities the threshold to stay open can be as high as 200 pupils. If a school is three years in a row below this threshold, no subsidies will be received from the government (Onderwijsraad, 2013). In most cases this results in an immediate closure. The Statistics Netherlands (CBS, 2016) also states that schools in rural areas do not only close because of the number pupils. Local initiatives and the reputation of a school do play a role in determining if a school stays open. Small schools are remarkably expensive. The expenses per pupil of a small primary school are nearly triple the amount in comparison to a regular school (Ministry of Education, Culture & Science, 2012). Additionally, it is argued that small schools have poorer education quality. They have a hard time keeping up with the national education standards and introducing innovation (Dorpenmonitor, 2013).

The number of pupils, children aged between 4 and 12, has actually increased till 2007, but has declined since then, as shown in figure 3. The sharp decline since 2010 is partly explained by an echo effect of the baby bust in the 1960s and 1970s (Haartsen & Van Wissen, 2012). The current downfall is expected to continue till 2023 (CBS, 2016). After 2023 the number of pupils is expected to increase again, but this will happen predominantly in urban areas, as shown below, in map 1 below. Therefore, the rural areas of the Northern Netherlands will continue to see schools close in the next decades. There might be urgency to introduce policies to deal with undesired consequences. For that reason, it is important to investigate if there is any impact of school closures on villages.

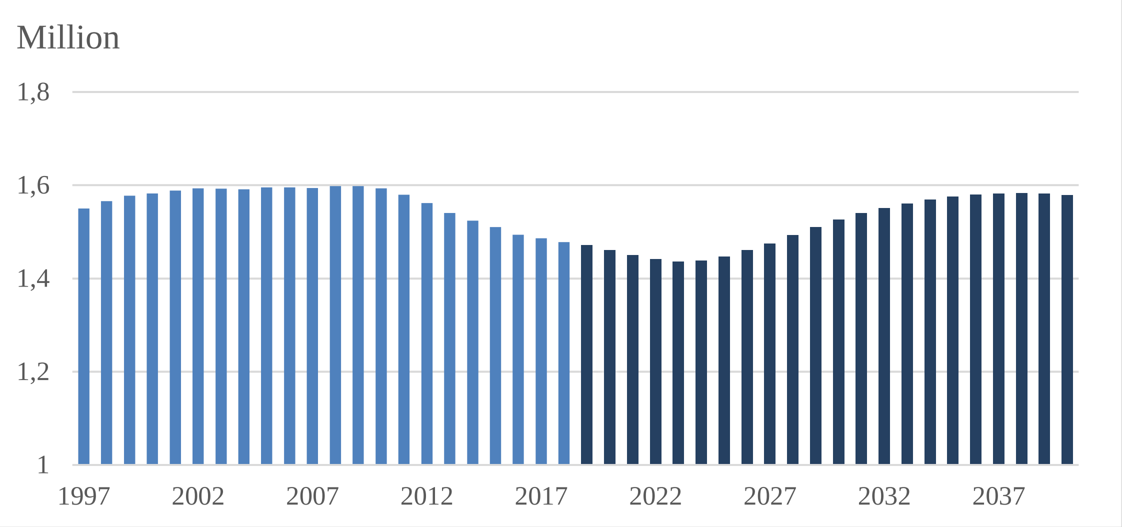
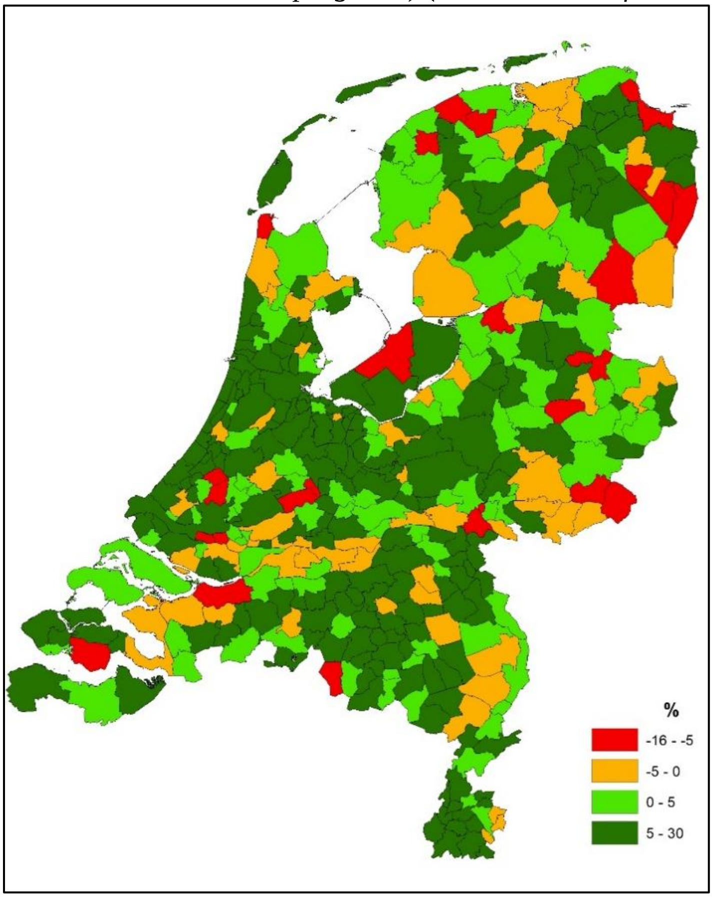


Figure 3: number of 4- to 12-year-olds (millions) in the Netherlands from 1997 to 2040 (light blue: observations, dark blue: prognosis) (based on data of CBS, 2016).



Map 1: change in the number of 4- to 12-year-olds between 2023 and 2030 per municipality (based on data of CBS, 2016) .

4. Data and methodology

This study will assess 376 villages in the Northern Netherlands, consisting of the three provinces of Friesland, Groningen and Drenthe, to investigate the demographic impacts of the closure of the last primary school in a village. The Northern Netherlands is well suited as an area for this investigation, as it experienced a decline in enrolments, and saw many schools being closed. In several instances this was also the last existing school in a village, which are the cases this research is interested in. This section discusses the data collection, sampling strategy and methodology. In the first part the data collection of the three main variables will be explained. In the second part the sampling strategy, used to make a balanced set of villages for the analysis, will be discussed. The last section elaborates on the methods, namely a panel regression and logistic regression, used to answer the research question.

4.1 Regression variables

School availability

Data on school availability has been provided by the Dienst Uitvoerend Onderwijs (DUO, 2019a), the Dutch executive education organisation of the Ministry of Education, Culture and Science. DUO has information on every public school that closed since 1997 up until 2018. Next to that, they provide information on all the schools that were still open in 2018. It is assumed that a school, which was open in 2018, was open for the whole period of 2001 to 2018. The risk is that these schools might have opened somewhere in this period. However, the number of new primary schools that opened over the past two decades is low, especially in the area this paper is investigating. There are strict regulations in place for opening a new school (DUO, 2019b). In case of a school merger, assuming that the new school locates in one of the villages of the merged schools, the data will not be affected. The location of the newly merged school will be indicated as having a school during the studied period and villages that saw their school disappear will be marked as having experienced a closure. The influence of this assumption is therefore expected to be negligible.

The dataset of the open schools provide information on the exact address of the school. Therefore, the dataset has been joined with the BAG-index, provided by NLextract (2018), to add the correct coordinates. Unfortunately, the information on the schools that closed does not contain their addresses. The dataset only includes the village or city that the school was located in. However, the LISA-foundation, the Dutch employment register, collects location data of firms and public buildings, including schools, yearly. The names of the closed schools have been matched with the schools that existed in the LISA-dataset to provide the location. If this method did not give a result, the coordinates were added, by matching the schools with their corresponding village in ArcMap. The centre of these villages was then used as the location of those schools.

Although it could have been a great source, the LISA-dataset could not be used to check the continued existence or disappearance of schools over time. The data was of poor quality, as it was nearly impossible to follow the location of schools over time. In the LISA-dataset, the unique ID of schools and the spelling of the streets, changed in inexplicable ways over the years.

Demographic indicators

The impact of school closures on demography is, in the first analysis, measured by looking at change in the number of households with children and the change in the number of people aged 65 and older. The two variables are collected from the Statistics Netherlands (CBS, 2019a). The first variable gives insight into the presumed effect of school closure on encouraging out-migration and discouraging in-migration of families with children. However, this variable only partly reflects this, as it also includes families with children that do not go the a primary school anymore. The Statistics Netherlands defines 'households with children' as: a household (can be one or two persons) that has at least one child, regardless of their age, living at home (CBS, 2019b). For example, the number of households with children could decrease after a school closure, although there is no significant change in migration levels of families with children, that are in the age of attending a primary school. It could just be the result of a large share of families with children or just the children moving out, that are not in this age category. Nevertheless, the variable is able to capture a substantial part of the popularity of the village for families with children.

The second variable gives insight into how the population in a village, where a school closes, might be ageing faster than other villages where a school is still located. The Statistics Netherlands provide annual information on an extensive amount of neighbourhood characteristics. The lowest geographical scale the Statistics Netherlands provide these characteristics on is the neighbourhood level. These areas overlap with the villages that are used in the analysis. Therefore, it is possible to follow the sample of villages over time and analyse what happened to these indicators in relation to the school availability. The Statistics Netherlands provide a dataset, which allows to follow villages over time from 2001 to 2009. The years after that have been connected using the neighbourhood code (unique indicator statistics Netherlands adds to neighbourhoods). The year 2002 is missing, as the Statistics Netherlands calculated these variables only every two years before 2003. The variables in 2002 have therefore been calculated by using the mean of the sum of 2001 and 2003.

Housing transaction data

The second part of the analysis is based on housing transactions that took place in the Northern Netherlands between 2006 and 2018, provided by Cadastre. Due to data constraints it was not possible to use data on in- and out-migration on a village level for this research. A suitable alternative was found in the housing transactions data of Cadastre. The dataset of Cadastre includes information on the exact location of a house bought, the age of the seller and buyer and the origin location of the buyer. By using this information, the presence of a demographic shift can be identified in the age of the sellers and buyers. However, the dataset does not give any information on if the buyer or seller has children. Therefore, it is assumed that buyers and sellers, aged between 30 and 45, are in the age of having children who attend a primary school. The average age of the mother, when the first child is born, is currently 29.9 years in the Netherlands (CBS, 2019c). The age criterion seems therefore as a decent estimate of the population of interest, also when considering second-born children. An analyse is done on if the number of buyers and sellers in this age group changes, due to a school closure.

Also, by using the location of the house and the origin location of the buyer, the likelihood of someone to move in the same area can be estimated. A large number of people move within their own area, as indicated by the Statistics Netherlands (CBS, 2017). The closure of a school might lead to a larger amount of people moving to another place, instead of moving within the village. To investigate this possible relationship, the origin location of a buyer is matched with the corresponding village in our sample and the destination by the location of the purchased the house. A dummy variable indicates if the village was the same or not. By using the origin location, both people in a rental property who buy a house and people who were already in an owner-occupant house and buy a new house are included. Only buyers aged between 30 and 45 are included.

A large number of the housing transactions (16%) missed the postcode of the origin location of the buyer. Information on the home address of the buyer is not always available in the data of Cadastre due multiple reasons. These transactions have been dropped, decreasing the number of housing transactions included in the research. There is no indication that dropping these cases influences the analysis. However, the number of missing cases is higher in later years.

The two variables created out of the Cadastre dataset can offer an interesting insight into the housing market in rural areas. However, this novel approach on measuring the impact of a school closure cannot capture the impact of primary school closures as precisely as migration rates would do. Amcoff (2012), Elshof et al. (2015) and Barakat (2014) all had access to precise migration data for their research. The housing transactions of the Cadastre provide a less clear view on the popularity of villages with or without a school for families, as there is no information on in- and out-migration. Also it is not known if the seller or buyer in the rural village has children. Furthermore, the housing transactions, obviously, only include owner occupant housing, of course. The impact of school closures may therefore be underestimated, as people who buy houses are less likely to migrate in comparison to people who rent (Barakat, 2014). However, most of the housing market (around 70%) in the sample villages consists of owner occupant properties (CBS, 2019).

4.2 Sampling strategy

As this paper investigates the impact of the closure of the last primary school on a village, not all villages in the Northern Netherlands are included. The sampling strategy, is based on the method put forward by Elshof et al. (2015) to create a balanced set of villages, that can be compared in a statistical analysis. Only villages are selected that had:

1. One school continuously open between 2001 and 2018
2. Experienced the closure of their last primary school between 2001 and 2018
3. No school during 2001 and 2018

If only villages would be included that experienced the closure of a primary school, the sample would be biased. For example, similar decreases in the number of households with children might also take place in rural villages that still have a school, like Barakat (2014) found in south-east Germany. The observation might be also correct for of the Northern Netherlands, as rural municipalities experience similar demographic developments (CBS, 2018).

Villages that experienced for example the closure of their penultimate school are not included. The reason for this is that in these villages their might be different forces at play, than in villages where the last school closes. Subsequently, villages are selected with an address density below 500 per km2. Villages in urban areas, which often have an alternative school close by, are therefore excluded. Also islands and villages that have a predominantly agricultural or industrial use, as indicated by the Statistics Netherlands, are excluded (because they are unlikely to have a school). Villages below 100 inhabitants are also deleted from the sample as the number of movers on this spatial scale can fluctuate significantly (Elshof et al., 2015). Too allow for a proper comparison all villages with more than 1300 inhabitants are deleted from the sample, as this is the largest village without a school. Villages that experienced a population increase of more than 400% (e.g. newly built housing or immigration detention centres) during the studied period are left out of the sample. A few villages remained that had two or more school open. These cases were excluded from the analysis too. They would have made the analysis more complicated, by creating a different category of villages than the ones that continuously had one school open. All in all this strategy resulted in a sample of 376 villages; 141 with one primary school, 40 that experienced the closure of the last primary school and 195 without a primary school (shown in map 2).

By using this selection of villages two regression models are estimated, which will be elaborated further on below.

4.3 Model I: Demographic indicators

The first model looks at the development of the two demographic indicators in the sample of villages between 2001 and 2018. As cross-sectional (between villages) and time-series data were combined, a panel regression model is used. Thereby, it is possible to control for variables that are not observed or are difficult to measure. Panel data can take account of region-specific heterogeneity (economic and demographic situation) and is better suited than cross-sectional data to investigate the impact of an event, like a school closure. As time-invariant variables, such as the distance to a large city, are also included in the model, random effects are used instead of fixed effects. There are reasons to suppose that these variables have an influence on the two dependent variables, the number of households with children and the number of the population aged 65 and older (Amcoff, 2012).

The most important independent variable in the model is school availability. Four categories are considered: those villages without a school, those where the last school was about to close, those where the last school recently closed and those which had at least had one school open during the whole period. By using these categories it is possible to estimate the ‘blurred’ effect of a school closure. Forward looking parents may relocate once the continued existence of a school in a village is questioned, years prior to its actual closure. While others try out the situation first, before relocating after all. Therefore, changes in the demographic indicators easily spread out over multiple years. Similar to Barakat (2014) and Elshof et al. (2015), different time lags are used. Model 1 one assumes closure effects to happen up to three years before and after the closure, while Model 2 assumes an additional lag of six years. Model 3 marks the whole period before a school closes as ‘before school closure’ and the whole period after that as ‘after school closure’. The year of the closure is indicated as ‘after school closure’. By using these three categories it is also possible to look into school closure being the result of a decline in families with children versus closure as an incentive for (further) demographic decline. Figure 4 shows how the three models categorise the years before and after a school closure, for the hypothetical situation of a closure in 2008. To account for the fact that a complete overview before and after the closure is needed in all models, only villages are included, where there is data on at least three years prior or after the closure available. For example, a village where a school closes in 2002 is therefore not included, as there is only one year of data before the closure available.

Model/year	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9	10
Model A	Open				Before closure			After closure				No school						
Model B	Open	Before closure						After closure							No school			
Model C	Before closure							After closure										

Figure 4: overview of the division of the school availability variable, if a school closes at time 0, year 2008.

In both models a set of control variables is included, to deal with other possible explanations of demographic decline in village, as shown in table 1. The total number of households in a village was used as a proxy for the level of services. Villages with more households are expected to have more services (Elshof et al., 2014). The distance from the school to the nearest city is included in the model as well. Villages which are closer to a large city tend to be more attractive to people than more remote villages (Steenbekkers & Vermeij, 2013). The third variable indicates if the region is currently experiencing population decline, is expected to experience population decline in the near future, or is not expected to experience population decline in the near future. In 2001, the Dutch Ministry of interior Affairs presented a geographic division of regions in the Netherlands on municipality level based on these three criteria, as part of a new national policy on the consequences of population decline (Interbestuurlijke Voortgangsrapportage Bevolkingsdaling, 2012). By adding that variable we can control for the different demographic dynamics happening in regions in the Northern Netherlands. Also dummies for every year are added, to correct for the demographic decline happening in most rural areas in the Northern Netherlands over the past two decades (Haartsen & Van Wissen, 2012). Otherwise the correlation between school closure and the dependent variables in the two models might be overstated. The demographic decline happening in most of the rural areas in the Northern Netherlands, correlates with the increase in school closures. A variable that is missing in the regression is the proximity of a village without a school to a village with a school. A village, where a school closed, that is near a village with a school, might be impacted differently than a village that is located in a more remote area. Due to the sampling of the villages and statistical difficulties it was problematic to include this variable in the regression analysis.

Variable	Description	Level	Source
School availability	Categorical variable that describes the school situation of a village in particular year. This can be either after or before the closure of a school, no school or school open.	Village level	DUO and LISA(register of business, government and education locations)
Demographic decline	Categorical variable that describes the demographic situation of the villages. The village can either be in a region that already experiences population and household decline, a village that is expected to face it in the near future, or a village that will not face this.	Municipality level	Statistics Netherlands
Households	Number of households in a village.	Village level	Statistics Netherlands
Distance to nearest city	Ratio variable that captures the Euclidian distance from the village to the nearest city, with more than 30000 inhabitants, in kilometers.	Village level	Calculated with Near function in ArcMap
Year dummies	The year, in which the demographic indicator is	/	/

	measured, is included to control for time-specific effects.		

Table 1: overview of the independent variables used in the regression.

4.4 Model II: Housing transactions

This second model uses housing transaction data from 2006 to 2018, obtained from Cadastre, as the dependent variable. As explained above, by using the transaction data a variable can be created that gives insight into a possible demographic shift taking place. The housing transaction data does not provide any information on if the buyer or the seller of the house has children. Therefore, we use age to select the transactions that are of interest. The effect of school closure will be estimated on transactions made by people between the age of 30 and 45. Although, this group does not perfectly resemble the group that is affected by the school closures (families with young children), it is a proper alternative.

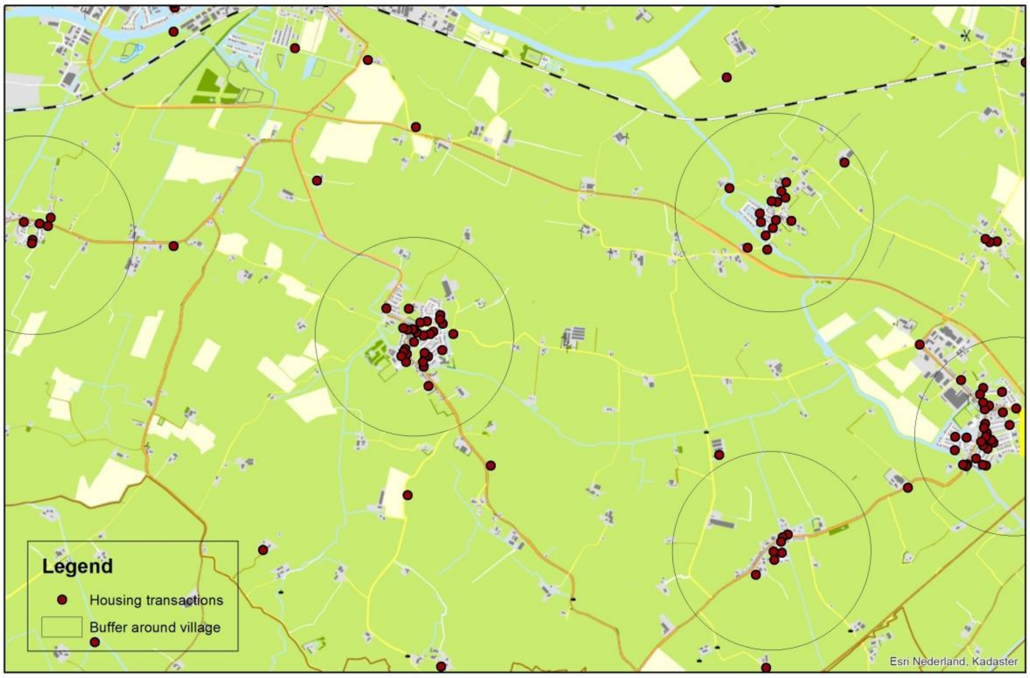
Firstly, with descriptive statistics the possible change in age of the buyer and seller in the housing transactions will be investigated. Therefore, all the housing transactions are marked by the type of age change happening. There are four options possible:

New: house is sold by someone who is **not** in the 30-45 age group and bought by someone who is in the 30-45 age group
No change: house is sold by someone who is in the 30-45 age group and also bought by someone who is in the 30-45 age group
Leave: house is sold by someone who is in the 30-45 age group and bought by someone who is **not** in the 30-45 age group
Residual: house is sold by someone who is **not** in the 30-45 age group and bought by someone who is also **not** in that age group

By checking this categorical variable per school situation, it provides an insight into how the housing market could be affected by a closure. It might be expected that in a region were a school just closed the percentage of housing transactions in category 1 and 2 is lower in comparison to a village that has a school.

Secondly, a logistic regression model, using the same set of independent variables as in model I, will look into the likelihood of the buyer of purchasing a house in the same village as he or she is lives in. The price of the purchased house is also included as an control variable in the regression. The price of the house reflects the financial situation of the buyer, which could influence the decision to stay or leave the village.

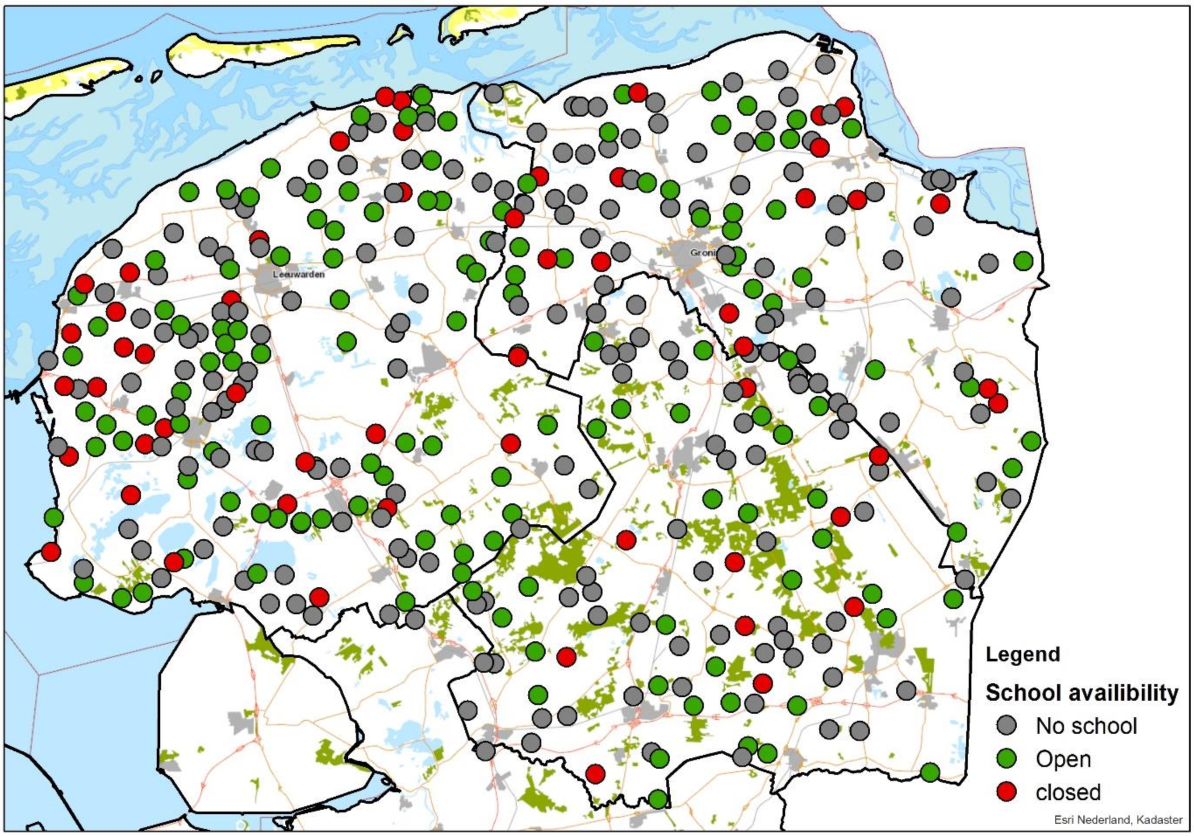
In both models the housing transactions are connected with the sample of villages by the use of buffers. A buffer of 1 kilometre around the school connects the houses that are sold within the village. These buffers are intended to approximately represent the size of the village and the areas within walking and biking distance of the schools (Amcoff, 2012). Also, an analysis has been done with a buffer of 0.5 kilometre, reflecting a smaller catchment area of schools. Map 2 shows an example of a buffer around a village and the housing transactions it captures. There are some situations where the buffers partly overlap. In these rare situations the housing transactions, that fall into both buffers were considered for both buffers. ArcMap has been essential in creating these buffers and connecting them with the housing transactions.



Map 2: example of buffers around villages and the housing transactions for the period of 2006 to 2018 that are captured by it.

5. Results

Map 3 provides an overview of the villages and their primary school status. Villages, where a school closed, seem to be located in the more peripheral areas like north-west Friesland and north-east Groningen. Also villages closer to cities are not in the sample, as they are excluded due to their size or the presence of multiple schools.



Map 3: overview of the rural villages in the Northern Netherlands used in this research and their school availability in 2018.

5.1 Model I: Descriptive statistics

Table 2 displays the descriptive statistics for all villages based on their school availability. There are 40 villages in the Northern Netherlands that experienced the closure of their last primary school somewhere between 2001 and 2018. The population in these villages is considerably smaller than the population in villages that had one school continuously open in the studied time period. Villages with no school are even smaller. In both categories a small decline in population occurred between 2001 and 2018, while population slightly increased in the villages that had one school. Furthermore, the descriptive statistics seems to confirm the idea that the villages that were going to be threatened with a closure, where already different in their demographic characteristics from villages where the school presence was not in danger.

Regardless of the school availability, in all villages the number of households with children declined, both as an absolute number and as a percentage of total households. The percentage of households that had children in 2001 was more or less similar in all types of villages. However, there was a considerably larger decrease, namely 18.1%, in the number of households in villages where a school closed, than in those that had no school or one school open. The distance to a large city does not seem to differ between the categories of school availability. The descriptive statistics seem to confirm the idea that closure indeed had an impact on the percentage of households with children. However, a more in-depth analysis is needed to identify a clear impact of school availability.

Variable/Village type	School continuously open	No school	School closure between 2001-2018	Total sample
N	141	195	40	376
Mean population (2001)	621	319	426	443
Mean population (2018)	629	313	398	438
Population growth 2001-2018 in %	+1.3	-1.8	-6.6	-1.1
Mean number of households with children, 2001 (% of total households)	102 (42.0)	53 (42.8)	72 (44.2)	73 (42.7)
Mean number of households with children, 2018 (% of total households)	97 (36.7)	46 (35.5)	59 (34.3)	66 (35.7)
Household with children growth between 2001-2018 in %	-4.9	-13.2	-18.1	-9.6
Mean distance to a large city in kilometers*	15.0	15.9	16.6	15.6

Table 2 :Descriptive statistics of the four village types over the period of 2001-2018
**city with more than 60.000 inhabitants*

5.2 Model I: Regression results

Table 3 shows the result of the panel regression model with random effects trying to explain the change in the number of households with children between the period of 2001 and 2018. The main independent variable is the school situation of the villages. In contrast with table 2, the villages that experienced a school closures are now categorized as no school, school open, after school closure or before school closure, depending on the year of the event and type of model used. The table shows that the period after a school closure has a significant negative impact on the change of the number of households with children, in comparison to a village where a school remains open, for model B and C. As model A is not significant, there seems to be a lag of a more than three years before the closure has an impact on the number of households with children. Being in the run-up to a closure, in comparison to villages with a school open, also leads to a negative change in the number of households with children for model A and C. Surprisingly, when using a six year time lag in model B, before school closure is not significant anymore. A village that does not have a school, in comparison to a village that does have a school, does not significantly impact the change of number households with children. It may be that these villages, without a school, have reached a stable situation and the decrease is predominantly explained by the influence of time, similar to the villages that still have a school. The location of the village in a region in decline, does effect the number of households significantly, with a negative coefficient of -0.625 in model 1a. The distance from the village to a large city, in contrast to the findings of other research (Amcoff, 2012), does not affect the number of families with children significantly. The effect of the proximity to a large city might be underestimated, as mainly villages further away from cities are included in the sample. Villages closer to cities tend to have a more favourable demographic development (Amcoff, 2012). Elshof et al. (2015), which used a similar sample of villages as this research, also did not found any impact in the Northern Netherlands of the distance of the village to a large city for migration levels. The coefficients of the year dummies, in comparison to the reference year 2001, are predominantly negative over time. Therefore, indicating a negative demographic trend happening in all villages. Model A, B and C do not differ extremely. The coefficients and their significance are similar, except for school availability. As the data of CBS neighborhood statistics is measured on the first of January of the year, the change in the number of households between 2004 and 2005 is attributed to 2004. For that reason 2018 is not a category of the year variable.

Table 3: panel regression on the change of the number of households with children and the percentage of the total population that is above 65 in the Northern Netherlands during 2001 and 2018. Model A uses a time-lag of 3 years, model B a time-lag of 6 years and C a time-lag of the complete period before and after a closure.

VARIABLES	Model 1A %▲Households	Model 1B %▲Households	Model 1C %▲Households	Model 2A %▲64+	Model 2B %▲64+	Model 2C %▲64+
School availability						
After school closure	-1.191	-1.349**	-1.263*	0.236	-0.491	1.008
Before school closure	-1.431*	-0.971	-1.023**	1.345	0.759	1.602***
No school	-0.212	-0.217	-0.338	0.159	0.209	0.401
Demographic situation						
Region expected to decline	-0.281	-0.285	-0.291	-0.545*	-0.548*	-0.532
Region in decline	-0.625*	-0.642**	-0.663**	-0.558	-0.576	-0.488
Households	-0.001	-0.001	-0.002	-0.005***	-0.005***	-0.005***
Proximity to large city	0.014	0.015	0.017	-0.051**	-0.050**	-0.057***
Year						
2002	-0.330	-0.330	-0.330	-0.652	-0.652	-0.652
2003	-0.062	-0.069	-0.069	0.263	0.270	0.270
2004	0.137	0.127	0.123	1.733**	1.743**	1.745**
2005	-1.141*	-1.148*	-1.155*	1.217	1.225	1.229
2006	-1.932***	-1.912***	-1.943***	-0.090	-0.100	-0.082
2007	-1.299**	-1.266**	-1.316**	1.251	1.235	1.264
2008	-0.919	-0.877	-0.939	1.649**	1.627**	1.665**
2009	-1.425**	-1.398**	-1.478**	2.815***	2.810***	2.862***
2010	-0.732	-0.711	-0.805	2.312***	2.323***	2.380***
2011	-1.212*	-1.203*	-1.296**	5.230***	5.259***	5.315***
2012	-3.071***	-3.075***	-3.171***	4.196***	4.253***	4.293***
2013	-1.398**	-1.415**	-1.509**	3.833***	3.907***	3.939***
2014	-1.137*	-1.146*	-1.235*	2.443***	2.515***	2.541***
2015	-1.749***	-1.744***	-1.836***	2.368***	2.442***	2.457***
2016	-1.912***	-1.875***	-1.968***	2.307***	2.382***	2.388***
2017	-0.819	-0.770	-0.857	2.697***	2.766***	2.775***
Constant	1.189**	1.198**	1.384**	3.771***	3.715***	3.435***
R^2 (overall)	0.01	0.01	0.01	0.03	0.03	0.03
Observations	6,348	6,348	6,348	6,335	6,335	6,335
Number of villages	374	374	374	374	374	374

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Notes: reference category: School availability = School open, Demographic situation=normal region and Year=2001. Two villages do not have data available for all years, therefore 376 villages are included.

Regression 2A, 2B and 2C use population ageing, measured by the change in the number of people aged 65 and older, as the dependent variable using the same set of independent variables. In model 2A and 2B school availability does not have a significant influence on the dependent variable. Only in model 2C, where the complete period before and after a school closure is categorized as ‘before school closure’ and ‘after school closure’, before school closure has a significant positive impact of 1.602. All villages in the sample, regardless of the school availability, are experiencing population ageing. The distance to a city, surprisingly has a negative significant effect on the change in the number of people aged 65 and older in model A, B and C. In the studied period villages further located from a city actually saw a larger decrease of the number of people aged 65 and older, then villages more closely. This relates to other papers, which concluded that especially less mobile people need to be close to cities for the dependence on certain services. The year dummies are positive and significant for all years after 2006, indicating a strong increase in the number of people aged 65 and older for all villages in the sample.

The R^2, the proportion of the variance in the dependent variable that is explained by the independent variables, is fairly low. The change in the number of households with children and people aged 65 and older has not been used in similar researches as an dependent variable. Therefore, it is difficult to compare the level of the R^2 with other findings. Furthermore, the R^2 should be interpreted with caution in a panel data regression. Generally, the R^2 is low in panel data research in comparison to cross-sectional research. It is more meaningful to look at the coefficients, their significance and the overall model significance (Torres-Reyna, 2007).

The Hausman test was done in order to see whether a panel regression with a random effects model was appropriate to use. The Hausman test was statistically significant, indicating that a fixed effect model is preferred to use. Although a fixed model is therefore more consistent, due to possible omitted variables in the random effects model, a random model is still used. Time-invariant variables cannot be included in a fixed effects model, as that type of model is only interested in the net effect of time-variant predictors on the outcome variable (Torres-Reyna, 2007). However, the reviewed literature on school closures points to the importance of several variables that do not vary over time, namely the distance to a large city (Amcoff, 2012). Therefore, as it is assumed that time-invariant differences across the sample of villages have an influence on the change of the number of households with children and people 65 and older, a random effects model is chosen. The regression model has also been done using a fixed effects approach (Appendix A). The direction of the coefficients did not change. However, the coefficients were not significant anymore at a 0.01 level.

5.3 Model II: Housing transactions

Part II of the analysis made use of the housing transaction data of Cadastre as an alternative to migration data. The first part of this paragraph focuses on the possible shift in age between buyers and sellers of housing transactions in a village where a school closes. The second part uses the likelihood of a house buyer to buy a house in the village they were already living in to measure the impact of a school closure.

Age Shift

Table 4 shows the descriptive statistics of the demographic shift of housing transactions, detailed below the diagram, per housing transaction and school availability. The overview does not present a clear conclusion. One interesting observation is that the percentage of houses that are sold by someone who is not in the age group of 30 to 45 and bought by someone who is in that age group is considerably lower in villages in the years before the school closure, in comparison to villages where a school was present. Also the percentage of houses sold by 30- to 45-year-olds and bought by 30- to 45-year-olds is lower before and after a school closure in comparison to villages with and without a school. Indicating a possible lower interest of people, that are in the age of having children that attend a primary school. A multinomial logistic regression estimating the impact of the school availability on the type of age shift did not give any significant results (Appendix B). The 500 meter buffer model is not included as it showed similar results. Also the time lag of six years and the complete period before and after the school closure did not change the results considerably.

School availability/ Type of shift	After school closure (%)	Before school closure (%)	No school(%)	School open (%)	Total (%)
1. New	253 (25)	350 (29)	4,294 (32)	3,672 (29)	8,569 (30)
2. No change	92 (9)	93 (8)	1,417 (11)	1,348 (11)	2950 (10)
3. Loss	151 (14)	189 (16)	1.857 (14)	2,099 (17)	4296 (15)
4. Residual	524 (51)	564 (47)	5931 (44)	5520 (44)	12,539 (44)
Total	1020	1196	13499	12639	28354

Table 4: overview of the housing transactions and the difference or similarity of the age of the buyer and seller using a time lag of three years before and after the closure (model A) and a buffer of 1 kilometer around the centre of the village. The four categories are defined as follows:

1. ***New**: house is sold by someone who is not in the 30-45 age group and bought by someone who is in the 30-45 age group*
2. ***No change**: house is sold by someone who is in the 30-45 age group and also bought by someone who is in the 30-45 age group*
3. ***Loss**: house is sold by someone who is in the 30-45 age group and bought by someone who is not in the 30-45 age group*
4. ***Residual**: house is sold by someone who is not in the 30-45 age group and bought by someone who is also not in that age group*

Local moves

The results of the logistic regression model of local moves estimated the impact of school availability on the likelihood of buying a house in the same village, that the buyer was living in before, are presented in table 5. Again only the outcome of the analysis with a one kilometer buffer are presented, as the 500 kilometer buffer showed similar results. The number of cases is lower in the analysis of local moves in comparison to the age shift model, as now only people aged 30 to 45 are included in the model.

In model 3A the likelihood to move within the village seems to decrease in the years after a school closure in comparison to a village with an open school. The same applies to villages that have no school. In these situations people aged 30 to 45 are less likely to move within the village, if they move. Similar results are found in model 3C. This indicates a possible negative effect of a school closure on the likelihood of people buying a house in the same area as where they live. People who live in an area that is termed ‘in decline’ also seem to be more likely to move outside of their region when buying a new house in comparison to people in ‘normal’ regions. Surprisingly, people who live in an area that is expected to be declining are more likely to buy a house within their region. Comparable to model 1 and 2 in paragraph 5.2, the R^2, the variance of the dependent variable explained by the model, is considerably low. The dependent variable is also tricky to interpret, as it does not say something about the total inflow or outflow of families into villages that have a school, no school or experienced a school closure.

Table 5: logistic regression for the likelihood of a person aged 30 to 45 to buy a house in the same village that he/she is currently living in, using housing transaction data for the period of 2006 to 2018.

Model A uses a time lag of three years and model C indicates the complete period before and after a closure.

VARIABLES	Model 3A Buying a house within the current living area or outside (Yes=1 and No=0)	Model 3C Buying a house within the current living area or outside (Yes=1 and No = 0)
School availability		
After school closure	-0.589**	-0.541**
Before school closure	-0.389*	-0.144
No school	-0.333**	-0.379**
Demographic situation		
Declining region	-0.300***	-0.292***
Region expected to decline	0.092**	0.119**
Distance to large city	0.002	0.001
Households	0.001***	0.001***
Year		
2007	0.082	0.083
2008	0.095	0.091
2009	0.049	0.043
2010	0.064	0.060
2011	0.045	0.042
2012	0.166	0.167
2013	-0.100	-0.095
2014	0.056	0.069
2015	-0.081	-0.068
2016	0.095	0.105
2017	-0.112	-0.092
2018	-0.390***	-0.364***
House price	-0.000***	-0.000***
Constant	-1.032***	-1.009***
R2	0.02	0.02
Observations	11,327	11,327

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Notes: reference category: school availability = school open, demographic situation=normal region and year=2006. A one kilometer buffer was used to connect the housing transaction to the villages.

6. Conclusion and reflection

Firstly, the concluding remarks to the research questions are presented, based on the results of my research. The findings will also be linked to existing research and literature to provide a wider perspective on this study. Subsequently, a critical reflection will be given on the data quality and choice of methods. Lastly, directions for further research are provided.

6.1 Conclusion and discussion

The thesis investigated the impact of the closure of the last primary school in villages in the Northern Netherlands in the last 20 years. I researched if the expected ‘demographic death’ of the village after a closure, suggested by citizens and politicians, was empirically valid. This was examined on the basis of two demographic indicators and housing transaction data. As the number of primary school closures has increased in the Netherlands and will continue to do so, it is crucial to check if these presumptions are true. Furthermore, the thesis aims to contribute to the field of rural demography by looking into the current importance of services, in this case schools, for the demographic development of villages.

The sample of villages, suitable for the research, was established, based on the method of Elshof et al (2014). The descriptive statistics showed that the villages where a school closure happened differed considerably in their population size and number of households with children from the villages that retained their school. More interesting, this provides evidence that these schools ‘died before they have been officially closed’ (Bell and Sigsworth, 1987,61). This seems to contradict with the statement of Statistics Netherlands that a possible closure of a school, also depends on the reputation and local initiatives.

The decrease in households with children, which happened in all villages, was clearly larger for villages that lost their school. This result indicates a possible impact of a school closure. The results of the panel regression on the change of households with children indeed showed a negative effect on the development of the number of households with children in the short period before a school closes. For longer periods significant negative effect were also found for the period after the school closure. This resonates with the idea, that it takes time for people to move to another place, due to intervening obstacles, as described in the push and pull model (Lee, 1966). However, the coefficients of the school availability variable are small and the variance explained by the model is low.

For the population ageing variable, no impact was found for school availability. Interestingly, the higher the distance to a large city from the village, the higher the decrease of the number of people 65 and older. This could be explained by the necessity of this, generally less mobile, age group to live in proximity to city centers, due to the dependence on certain services.

However, the impact of the closure of a school is small. Also, the year dummies show a decline of both variables happening in all villages regardless of the presence of a school. The evidence of an impact seems thin, especially considering the fact that no significant results were found in the fixed effects regression. Also the data of Cadastre does not give any conformations for a large change happening on the housing market in my sample of villages. The analysis did show that people who bought a house where less likely to buy it in the area where they lived after a school closure. However, the results have to be interpreted carefully as emphasized throughout the paper. Also no compelling evidence was found for a possible age shift of buyers and sellers after a school closure.

The conclusions of this paper may contradict popular sentiment, but they are in line with the results of similar studies by Amcoff (2012) and Barakat (2014). School location may influence some relocating decisions, as is reflected in the findings of both the descriptive statistics and the regression models. But, there is no evidence for a massive decrease of the number of families with children or an increase in the population aged 65 and older, due to the closure of a school. Also no large effect is found for the number of houses bought by people the age group of 30 to 45. Over the last decades rural villages in the Northern Netherlands experienced similar demographic trajectories of decline, regardless of the fact that a village lost a school, retained it or had no school to begin with.

The lack of evidence may be related to the transition rural villages have been going through, as described in the theoretical framework. The villages that saw their schools being closed in, may already have transformed into a so-called residential villages. The closure of the school could have been one of the final steps of that lengthy process. The current residents and families, who moved to those villages, do not care about the presence or absence of a school. They probably moved there because of the nice and peaceful living environment, as Thissen (2006) concluded.

Thereby, these results oppose a common way to argue against the closure of the last primary school. Especially, in combination with the findings of Haartsen (2015); that in the long run the quality of living in those villages is also not affected by the closure of school. Furthermore, small schools have more problems reaching acceptable levels of education in comparison to larger schools. Therefore, these results should be an incentive for policymakers to reconsider the large amounts of money and effort currently spend on keeping primary schools open in rural villages. However, this paper is by no means an encouragement to close the last school without fear of adverse consequences. A negative impact on children's time, due to longer travelling to school, or the concerns of parents are not necessarily reflected in the change of the number of households with children. Politicians and policymakers should handle the problem with care and look beyond the popular sentiment.

6.2 Reflection

Due to data constraints this research used two demographic indicators and housing transactions, instead of numbers on in- and out-migration in villages. The number of families with children and the level of population ageing are important indicators of what is happening in these villages. However, this novel approach does not capture the impact of primary school closures as precisely as migration rates would do. For example, the variable households with children also includes families with children that do not attend a primary school (anymore). Still, this research found a similar effect of the period after the closure of a school, as the research of Elshof et al. (2015) found in the Northern Netherlands using migration rates. Nonetheless, the low R^2 of the regression models in this paper imply that these demographic indicators, in comparison to migration rates, might be hard to explain by the set of independent variables.

The analysis of the Cadastre data creatively used housing transactions to make an interesting dependent variable. The two variables offered a new approach to the housing market in rural research. But both the likelihood to stay in a neighbourhood and the age shift were difficult to predict. Future research could focus on finding a better approach to apply these variables to draw more thought-provoking conclusions.

The significant coefficients found in model I need to be interpreted with caution. The negative effect on the number of households with children after the closure of a school in model 1B and 1C, does not imply a causal relationship. A school may close in anticipation of the future decline of families. Therefore, the decline would have taken place inevitable of the school closure.

The limited number of villages that experienced a school closure resulted in a small sample, although it was larger than the research of Elshof et al. (2015). The small number of observations also influenced the housing transaction data. The number of housing transactions, especially in areas where a school closed, were low, therefore decreasing the power of the study. Subsequently, the housing transactions cannot provide evidence on an increase or decrease of families with children in my sample of villages. Therefore, it is difficult to identify an impact of school closure. Another downside of the housing transaction database was that for a large number housing transactions (16%) the postcode of the origin location was missing. Information on the origin of the buyer is not always available in the sales contract due various reasons. These transactions have been dropped, decreasing the total number of housing transactions. There is no indication that dropping these cases influences the research. However, the number of missing cases is higher in later years. Finally, the housing transactions, obviously, only include owner occupant housing. The impact of school closures may therefore be underestimated, as people who buy houses are less likely to move in comparison to people who rent (Barakat, 2014).

Moreover, this thesis, similar Elshof et al. (2015), assumes that a school is of equal importance to all households with children in a village. However, in the Netherlands schools can have different denominations. Families might therefore be forced to move, if their preferred type of education is not offered anymore in their village. This could mean that the closure of the penultimate school also influences migration levels.

6.3 Further research

As discussed above, an interesting direction for future research might be looking into the penultimate closure of schools in villages. This research also found evidence that the distance to a large city has a negative influence on the change of people aged 65 and older. Future research could focus on the suggested dependence of older people on services in larger villages. Furthermore, this research focused on the quantitative side of the topic of school closure. It would be interesting to use a more qualitative approach and investigate the individual push pull and keep factors of movers and stayers in villages were a school closed. Moreover, conducting interviews with real estate agents in these specific areas could give insight into possible changes in the housing market.

7. Literature

Allsion, P.D. (1994). Using Panel Data to Estimate the Effect of Events. *Sociological Methods & Research*, 23 (2), 174-199.

Amcoff, J. (2012). Do Rural Districts Die When their Schools Close? Evidence from Sweden around 2000. *Educational Planning,* 20 (3), 47–60.

Amcoff, J. (2011). The (un)importance of the closure of village shops to rural migration patterns. *The international Review of Retail, Distribution and Consumer Research*, 21 (2), 129-143.

Barakat, B. (2014). A ‘Recipe for Depopulation’? School Closures and Local Population Decline in Saxony. *Population, Space and Place*, 21 (8), 735-753.

Bell, A.B. & Sigsworth, A. (1987). *The Small Rural Primary School: A Matter of Quality*. Routledge: London.

Bijker, R. & Haartsen, T. (2011). More than counter-urbanisation: migration to popular and less-popular rural areas in the Netherlands. *Population, Space and Place*, 18 (5), 643-657.

Centraal Bureau voor Statistiek (2016). *Aantal leerlingen blijft dalen behalve in grote steden.* Retrieved at 20-04-2019 from https://www.cbs.nl/nl-nl/nieuws/2016/38/aantal-leerlingen-blijft-dalen-behalve-in-grote-steden.

Centraal Bureau voor Statistiek (2017). *Verhuiskaart Drenthe, Friesland, Groningen en Overijssel.* Retrieved at 07-08-2019 from https://www.cbs.nl/nl-nl/achtergrond/2017/47/verhuiskaart-drenthe-friesland-groningen-en-overijssel.

Centraal Bureau voor Statistiek (2019a). Wijk- en buurtstatistieken. Retrieved at 06-06-2019 from https://www.cbs.nl/nl-nl/dossier/nederland-regionaal/wijk-en-buurtstatistieken.

Centraal Bureau voor Statistiek (2019b). *Begrippen*. Retrieved at 28-08-2019 from https://www.cbs.nl/nl-nl/onze-diensten/methoden/begrippen.

Centraal Bureau voor Statistiek (2019c). *Leeftijd moeder bij eerste kind stijgt naar 29,9 jaar*. Retrieved at 29-08-2019 from https://www.cbs.nl/nl-nl/nieuws/2019/19/leeftijd-moeder-bij-eerste-kind-stijgt-naar-29-9-jaar.

Dagblad van het Noorden (2014). *Einde Scholen Stadskanaal Nabij*. Retrieved at 08-05-2019 from https://www.dvhn.nl/archief/Einde-scholen-Stadskanaal-nabij-20844763.html.

Dienst Uitvoerend Onderwijs (2019a). *Scholen en adressen in het primair onderwijs*. Retrieved at 06-06-2019 from https://duo.nl/open_onderwijsdata/databestanden/po/adressen/.

Dienst Uitvoerend Onderwijs (2019b). *Stichten school. Retrieved at 20-06-2019 at https://duo.nl/zakelijk/primair-onderwijs/stichten-en-opheffen/stichten-school/index.jsp.*

Elshof, H. (2014), *Sterke Daling Leerlingen Basisscholen in Landelijk Gebied*. NIDI-Webartikel. Retrieved on 20-06-2019 at https://www.nidi.nl/nl/publications/webart/nidi-webart-2014-01.

Elshof, H., Haartsen, T. & Mulder, H.C. (2015). The effect of Primary School Absence and Closure on Inward and Outward Flows of Families. *Tijdschrift voor Economische en Sociale Geografie,* 106 (5), 625-635.

Elshof, H., Van Wissen, L. J. G. & Mulder, C.H. (2014). The Self-reinforcing Effects of Population Decline: An Analysis of Differences in Moving Behaviour between Rural Neighbourhoods with Declining and Stable Populations. *Journal of Rural Studies*, 36, 285–299.

Haartsen, T. & Van Wissen, L.J.G. (2012). Causes and Consequences of Regional Population Decline for Primary Schools. *Tijdschrift voor Economische en Sociale Geografie,* 103 (4), 487–496.

Haartsen, T. (2015). *School closure does not affect depopulating village*. Rijksuniversiteit Groningen. Retrieved at 10-05-2019 from https://www.rug.nl/about-us/news-and-events/news/archief2015/nieuwsberichten/1111-unifocushaartsen.

Irwin, B. & Seasons, M. (2012). School closure decision- making processes: problems and prospects. *Canadian Journal of Urban Research*, 21 (2), 45– 67.

Keultjes, H. (2018). Kleine basisscholen krijgen extra geld om kwaliteit onderwijs op te krikken. *Algemeen Dagblad*, 13-03-2018.

Lee, E.S. (1966). A Theory of Migration. *Demography,* 3 (1), 47–57.

Lyson, T.A. (2002). What does a school mean to a community? Assessing the social and economic benefits of schools to rural villages in New York. *Journal of Research in Rural Education*, 17, 131– 137.

Ministry of Education, Culture & Science (2012). Overdrachtsdossier OCW. The Hague: Ministry of Ministry of Education, Culture and Science.

NL Extract (2018). *Index of bag/csv.* Retrieved at 06-06-2019 from https://data.nlextract.nl/bag/csv/.

Onderwijssraad (2013). *Grenzen aan kleine scholen*. The Hague: Onderwijsraad.

Reier, W.H. & Goudy, W. (1994). *Is there Life in Town after the Death of the High School? Or High Schools and the Population of Midwest Towns*. Paper presented at the annual rural and small schools conference, Manhattan, 24 October 1994.

Simon, C., Vermeij, L. & Steenbekkers, A. (2009). *Het beste van twee werelden*. Den Haag: Sociaal en Cultureel Planbureau.

Spies, J.W.E. (2012). *Interbestuurlijke Voortgangsrapportage Bevolkingsdaling.* Algemene commissie voor Wonen en Rijkdienst.

Steenbekkers, S,A. & Vermeij, L. (2013). *De Dorpenmonitor*. Den Haag: Sociaal en Cultureel Planbureau.

Thissen, F. (2006). *Leefbare dorpen: van raamwerk tot ontwikkelingsmodel*. Amsterdam: Universiteit van Amsterdam.

Torres-Reyna, O. (2007). *Panel Data Analysis Fixed and Random Effects using Stata.* Retrieved at 10-05-2019 from https://www.princeton.edu/~otorres/Panel101.pdf.

Von Piekartz, H. (2019). De dorpsschool gaat dicht. 'Jammer, maar beter voor de kinderen'. *De Volkskrant*, 15-07-2019.

8. Appendix

Appendix A

Panel regression with fixed effects of model A explaining the percentage change of the number of households with children between 2001 and 2018 (Reference categories: School availability = 'School open', Demographic situation = 'Normal' and Year = '2001'). The variables 'demographic situation' and distance are omitted from the regression as they do not change over time and therefore cannot be included in regression with fixed effects.

```
. xtreg DeltaHouseholdswChildren i.SchoolAvailability i.DemographicSi
> tuation TotalHouseholds Distance i.Year, fe
note: 1.DemographicSituation omitted because of collinearity
note: 2.DemographicSituation omitted because of collinearity
note: Distance omitted because of collinearity

Fixed-effects (within) regression               Number of obs     =      6,348
Group variable: NAAMCode                        Number of groups  =        374

R-sq:                                           Obs per group:
     within  = 0.0083                                         min =         13
     between = 0.0163                                         avg =       17.0
     overall = 0.0018                                         max =         17

                                                F(20,5954)        =       2.49
corr(u_i, Xb)  = -0.8652                        Prob > F          =     0.0002

------------------------------------------------------------------------------------------
DeltaHouseholdswChil~n |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-----------------------+------------------------------------------------------------------
    SchoolAvailability |
  After school closure |  -.4111824   .2710691    -1.52   0.129    -.9425761    .1202112
 Before school closure |  -.1588696    .281536    -0.56   0.573    -.7107822     .393043
             No school |  -.5181305   .4074713    -1.27   0.204    -1.316922    .2806609
                       |
  DemographicSituation |
        Anticipeerregio |          0  (omitted)
             Krimpregio |          0  (omitted)
                       |
       TotalHouseholds |   .0059041   .0026081     2.26   0.024     .0007913     .011017
              Distance |          0  (omitted)
                       |
                  Year |
                  2002 |  -.0049922   .1897917    -0.03   0.979    -.3770528    .3670684
                  2003 |   .0954213   .1898912     0.50   0.615    -.2768342    .4676768
                  2004 |  -.2900431    .190018    -1.53   0.127    -.6625473     .082461
                  2005 |  -.3611216   .1901057    -1.90   0.058    -.7337978    .0115545
                  2006 |   -.552937   .1902969    -2.91   0.004    -.9259878   -.1798862
                  2007 |  -.3948785   .1903947    -2.07   0.038    -.7681212   -.0216359
                  2008 |  -.6011452   .1906633    -3.15   0.002    -.9749145   -.2273759
                  2009 |  -.3107919   .1914393    -1.62   0.105    -.6860823    .0644984
                  2010 |  -.1721585   .1922213    -0.90   0.370     -.548982     .204665
                  2011 |  -.2607332   .1927754    -1.35   0.176    -.6386429    .1171765
                  2012 |   -.476918    .193158    -2.47   0.014    -.8555777   -.0982583
                  2013 |  -.3989545   .1930334    -2.07   0.039      -.77737    -.020539
                  2014 |  -.1395965   .1935071    -0.72   0.471    -.5189405    .2397475
                  2015 |   -.668237   .1938022    -3.45   0.001    -1.048159   -.2883145
                  2016 |   -.538395    .194484    -2.77   0.006    -.9196542   -.1571358
                  2017 |  -.2700521   .1955213    -1.38   0.167    -.6533448    .1132405
                       |
                 _cons |  -.8610933   .5218588    -1.65   0.099    -1.884126     .161939
-----------------------+------------------------------------------------------------------
               sigma_u |  .88299707
               sigma_e |  2.5896252
                   rho |  .10415446   (fraction of variance due to u_i)
------------------------------------------------------------------------------------------
F test that all u_i=0: F(373, 5954) = 0.39                   Prob > F = 1.0000
```

Appendix B: Multinomial logistic regression on age shift

Multinomial logistic regression explaining the type of age shift happening in housing transactions between 2006 and 2018 (Base = Residual and reference categories are: School availability = 'School open', Demographic situation = 'Normal' and Year = '2006'). The number of observations is slightly lower in this regression than in the descriptive statistics in table 4. Certain cases are excluded from the regression as they miss information on the number of households in the village where the transaction took place.

```
. mlogit AgeShift i.SchoolAvailability i.DemographicSituation Distance TotalHouseholds Price i.Year

Iteration 0:   log likelihood = -34849.142
Iteration 1:   log likelihood = -34528.287
Iteration 2:   log likelihood =  -34526.47
Iteration 3:   log likelihood =  -34526.47

Multinomial logistic regression                 Number of obs     =     27,984
                                                LR chi2(60)       =     645.35
                                                Prob > chi2       =     0.0000
Log likelihood =  -34526.47                     Pseudo R2         =     0.0093
```

AgeShift	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
	(base outcome)					
1						
SchoolAvailability						
After school closure	-.1392215	.0946855	-1.47	0.141	-.3248017	.0463587
Before school closure	.0321365	.100581	0.32	0.749	-.1649987	.2292716
No school	.124852	.0341821	3.65	0.000	.0578563	.1918477
DemographicSituation						
Anticipeerregio	-.1689397	.0352009	-4.80	0.000	-.2379322	-.0999473
Krimpregio	-.2376529	.0414221	-5.74	0.000	-.3188388	-.156467
Distance	-.0133699	.0023384	-5.72	0.000	-.017953	-.0087868
TotalHouseholds	.0003267	.0001173	2.79	0.005	.0000968	.0005566
Price	3.90e-07	1.24e-07	3.15	0.002	1.48e-07	6.33e-07
Year						
2007	-.114721	.0582658	-1.97	0.049	-.2289199	-.0005221
2008	-.2052262	.061886	-3.32	0.001	-.3265206	-.0839318
2009	-.3027572	.0702326	-4.31	0.000	-.4404107	-.1651038
2010	-.2418209	.0701829	-3.45	0.001	-.3793768	-.1042651
2011	-.3793498	.0737	-5.15	0.000	-.5237992	-.2349005
2012	-.4772369	.0749785	-6.36	0.000	-.6241921	-.3302818
2013	-.5298385	.0782848	-6.77	0.000	-.6832738	-.3764032
2014	-.3993524	.068388	-5.84	0.000	-.5333904	-.2653144
2015	-.2940819	.067505	-4.36	0.000	-.4263894	-.1617745
2016	-.3603744	.0640368	-5.63	0.000	-.4858841	-.2348647
2017	-.2068754	.059229	-3.49	0.000	-.3229622	-.0907886
2018	-.3501029	.0716018	-4.89	0.000	-.4904398	-.209766
_cons	-.049498	.0700383	-0.71	0.480	-.1867706	.0877745

2						
SchoolAvailability						
After school closure	-.0395413	.1420765	-0.28	0.781	-.3180062	.2389236
Before school closure	-.2693385	.170708	-1.58	0.115	-.6039201	.0652431
No school	.0778949	.0495457	1.57	0.116	-.0192128	.1750027
DemographicSituation						
Anticipeerregio	-.2143072	.051497	-4.16	0.000	-.3152395	-.1133749
Krimpregio	-.1796295	.0599974	-2.99	0.003	-.2972222	-.0620368
Distance	-.0157913	.0034188	-4.62	0.000	-.0224921	-.0090905
TotalHouseholds	.0010827	.0001673	6.47	0.000	.0007548	.0014105
Price	1.11e-06	1.62e-07	6.83	0.000	7.90e-07	1.43e-06
Year						
2007	-.1912035	.0790008	-2.42	0.016	-.3460422	-.0363647
2008	-.1647261	.0821178	-2.01	0.045	-.3256739	-.0037783
2009	-.3659436	.0966022	-3.79	0.000	-.5552805	-.1766067
2010	-.3989765	.0989152	-4.03	0.000	-.5928467	-.2051063
2011	-.6651985	.1093522	-6.08	0.000	-.8795249	-.4508722
2012	-.6668285	.1089632	-6.12	0.000	-.8803924	-.4532646
2013	-.8186032	.1182341	-6.92	0.000	-1.050338	-.5868686
2014	-.8102019	.104617	-7.74	0.000	-1.015247	-.6051564
2015	-.642392	.1003583	-6.40	0.000	-.8390907	-.4456933
2016	-.6647154	.0937927	-7.09	0.000	-.8485457	-.480885
2017	-.5368411	.0852186	-6.30	0.000	-.7038665	-.3698158
2018	-.6169853	.1037079	-5.95	0.000	-.8202491	-.4137215
_cons	-1.200141	.0979229	-12.26	0.000	-1.392067	-1.008216
3						
SchoolAvailability						
After school closure	-.0874085	.1119978	-0.78	0.435	-.3069202	.1321032
Before school closure	-.0874613	.1250446	-0.70	0.484	-.3325443	.1576217
No school	-.1556831	.0425752	-3.66	0.000	-.2391289	-.0722372
DemographicSituation						
Anticipeerregio	-.0436985	.0448911	-0.97	0.330	-.1316834	.0442864
Krimpregio	.1526647	.0494606	3.09	0.002	.0557236	.2496057
Distance	-.007373	.0028965	-2.55	0.011	-.0130499	-.001696
TotalHouseholds	.00036	.0001448	2.49	0.013	.0000763	.0006438
Price	-3.69e-07	1.68e-07	-2.19	0.028	-6.99e-07	-3.91e-08
Year						
2007	-.1147148	.0728072	-1.58	0.115	-.2574143	.0279848
2008	-.1107673	.0761641	-1.45	0.146	-.2600461	.0385116
2009	-.2516254	.0873562	-2.88	0.004	-.4228405	-.0804104
2010	-.1782154	.0867572	-2.05	0.040	-.3482564	-.0081745
2011	-.3460352	.0925255	-3.74	0.000	-.527382	-.1646885
2012	-.3447592	.0919388	-3.75	0.000	-.524956	-.1645624
2013	-.5648326	.100294	-5.63	0.000	-.7614052	-.3682599
2014	-.5077107	.0887896	-5.72	0.000	-.6817351	-.3336863
2015	-.3270972	.0855526	-3.82	0.000	-.4947773	-.1594171
2016	-.3115739	.0800077	-3.89	0.000	-.4683861	-.1547616
2017	-.1387363	.0733581	-1.89	0.059	-.2825155	.0050429
2018	-.245796	.0886657	-2.77	0.006	-.4195774	-.0720145
_cons	-.6840642	.087972	-7.78	0.000	-.8564861	-.5116424

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