Neighbourhood quality attainment for starters on the housing market: a longitudinal case study of Groningen (2009-2018)

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"Master theses are preliminary materials to stimulate discussion and critical comment. The analysis and conclusions set forth are those of the author and do not indicate concurrence by the supervisor or research staff."

Abstract. Recent literature shows that, resulting from the housing affordability crisis, households frequently settle for homes that were not their primary preference, as it is already difficult enough to get out of the rental sector. Especially, starters are having a difficult time entering the housing market. This study focuses on what happens to starters that do enter the housing market, and aims to investigate the relationship between the neighbourhood quality starters and non-starters attain. The study focuses on the Dutch housing market, specifically Groningen, using data from Kadaster with 41,385 cases. Spanning a 10-year period from 2009 to 2018, the study employs multiple linear regression analysis to examine changes in attained neighbourhood quality disparities between groups. As expected, the findings reveal that starters attain homes in neighbourhoods with lower qualities compared to non-starters. Though, the disparity of neighbourhood quality attainment between starters and non-starters showed a slight decrease over the years, where the attainment of neighbourhood quality for starters went up slightly and for non-starters went down slightly. The findings contribute to neighbourhood attainment literature, by finding empirical evidence for whether and how the changes in neighbourhood attainment between starters and non-starters have changed over time.

Keywords: Neighbourhood attainment, neighbourhood quality, housing market, starters

Preface

Dear reader,

I am thrilled to present to you my master's thesis titled "Neighbourhood quality attainment for starters on the housing market: a longitudinal case study of Groningen (2009-2018)". This work marks the end of my journey as a graduate student in Real Estate Studies at the University of Groningen. My purpose for this study is to add knowledge about the urgent consequences of starters on the housing market, something I myself will also be dealing with in the near future.

I was not able to finish this thesis without the help of others. I would like to thank Sarah Mawhorter, for trusting me with the use of the Kadaster dataset. This opportunity allowed me to delve into a research field which holds personal significance for me, as the province of Groningen is where I was born and lived up until the end of my master (and maybe even after this). I would also like to extend this thank you to her, as she was also my supervisor, whose guidance and attention made me feel really supported throughout the research process. This made that I felt calm and confident about the research I was doing, something I have struggled with in the past.

Finally, I must express my profound gratitude to my family members, friends, and fellow students who patiently listened to me talk about my thesis and giving me advice. They consistently motivated me to keep pushing forward and make progress.

With great enthusiasm, I invite you to read this thesis. I hope that you will find it interesting and insightful.

Anna Mae Langley
Groningen, Augustu 21, 2023

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1. Introduction

1.1. Societal relevance

The housing affordability crisis has emerged as a pressing issue, where housing-related expenses increase more rapidly than wages (Wetzstein, 2017). The growing housing supply shortage is a key reason for this crisis (Maye and Moore, 2022). Therefore, many people are forced to stay in the rental sector. When they are able to buy a house, households often find themselves residing in dwellings that were not their primary preference, such as overcrowded or poorly maintained accommodations (Wetzstein, 2017).

The crisis challenges progressive homeownership and serves as a contributor to growing spatial inequality which has a socio-segregating effect on cities (i.e. social groups tend to cluster together in specific neighbourhoods or areas, leading to the segregation of communities based on social factors; Wetzstein, 2017; Hamnett, 2019; Boelhouwer, 2020; Nijman and Wei, 2020). Previous studies have indicated that spatial inequality and socio-segregation can have detrimental effects on both residents' well-being and the overall functioning of a city (Musterd *et al.*, 2017; Hedman and Van Ham, 2021). Therefore, the United Nations underscores the urgency of tackling this issue as it prioritized the reduction of inequality and sustainable cities and communities in its 2030 Agenda for Sustainable Development (UN DESA, 2022).

Vulnerable groups are most affected by unaffordable houses. These households are those with lower and middle-incomes, those facing material, social, and physical disadvantages and the younger generation (Wetzstein, 2017). This study's focus lies on the latter group; young people entering the housing market (e.g. starters). There is a decline in homeownership amongst young people (Choi *et al.*, 2018; Clark, 2019). When starters are able to buy a home, they are having increasing difficulty finding affordable properties in well-located or high socio-economic status areas (Coulter, Bayrakdar and Berrington, 2020).

According to Hochstenbach and Arundel (2020a), there is limited knowledge on starters in the Netherlands, which is essential for gaining insights into urban dynamics and inequality at the local level (Glaeser et al., 2009). Thus, this paper focuses on the attainment of neighbourhood quality for starters in a single country (the Netherlands) at the local level (Groningen). Neighbourhood quality is defined as the adequacy of social, physical and economic aspects reflected in the price per square meter. For example, neighbourhoods with high qualities have good amenities, high school quality, low crime rates, good employment opportunities, public transportation and well-connectedness, and thus have higher prices (Howley, Scott and Redmond, 2009; Jim and Chen, 2010a; Li and John, 2017; Glaeser and Gyourko, 2018). By assessing how this changes over a 10-year period, the current study provides insight into potential growing disparities over time in accessible neighbourhood quality for starters and non-starters. If it is found that these disparities have increased over time, this may indicate increasing spatial inequality between starters and non-starters.

The local level findings of this study can inform policy design aimed at the real estate and planning aspects of a city, which could help reduce spatial inequality and socio-spatial segregation. As such, this study serves as a valuable contribution to the broader discussion on reducing inequality and lays some of the groundwork for achieving the goals outlined in the United Nations' agenda (UN DESA, 2022).

Importance of neighbourhood for opportunities and resources

Understanding neighbourhood quality carries societal value, as neighbourhood quality influences social and economic opportunities available to its residents (Rabe and Taylor, 2010). This can be explained through the geography of opportunity theory, the life course perspective, and the ecological systems theory. The geography of opportunity theory explores the ways in which individuals' geographic location, such as their neighbourhood, can shape their access to various resources and opportunities. The life course perspective advocates that each stage of life influences the one after it, and that social, economic, and physical circumstances each determine individuals' movements through time and space (Hareven, 1994; Elder Jr., Johnson and Crosnoe, 2003). The ecological systems theory examines, among other things, how individuals develop within the context of interconnected environmental systems. It emphasizes the impact of immediate environments (microsystem), broader social and cultural factors (macrosystem), and the interactions between these systems (mesosystem) on individuals' development (Bronfenbrenner, 1979). Together the theories shed light on the complex interplay between individuals' residential location, development and further environmental influences.

When homebuyers are only able to afford houses in low-quality neighbourhoods, this affects their access to resources and opportunities. For example, lower socioeconomic-neighbourhoods tend to have poor levels of educational facilities nearby and employment opportunities tend to be poorer (Murie and Musterd, 2004). Furthermore, the social network of the neighbourhood can affect individuals' life decisions (e.g., Galster and Killen, 1995). Environmental psychological theorising describes that behaviour is typically motivated by people's perception of what behaviour others perform and approve of (descriptive and injunctive norms, (Steg, 2019). Thus, neighbourhoods with high crime rates, low education, low school attendance and low employment aspiration can reinforce these behaviours among the residents.

The effect of neighbourhood does not only affect residents' current opportunities and resources, but also influences their future. Neighbourhood affects social mobility, defined as the change in someone's socio-economic position in society (Müller and Pollak, 2015). As individuals move through the social ladder, theoretical and empirical research has demonstrated that those in higher positions find it relatively easier to move further upward, because they tend to have comparatively greater opportunities for upward mobility, while those in lower positions are more likely to experience horizontal or downward mobility (Myers, 1983). Indeed, young homebuyers from disadvantaged areas may face exclusion from certain neighbourhoods by financial institutions and real estate professionals

(Coulter, 2017). Furthermore, the reduced employment stability and income in low quality neighbourhoods, hampers entry into the housing market, impeding upward mobility (Rosenbaum, 1995; Coulter, 2017). Additionally, when people with similar social position live together in homogeneous neighbourhoods, it perpetuates socio-economic segregation (Musterd *et al.*, 2017). Over time, individuals in low quality neighbourhoods are increasingly less likely to build connections with residents of high quality neighbourhoods, reducing future opportunities. Taken together, residing in low quality neighbourhoods limits housing career opportunities and social mobility.

Neighbourhood influence is not limited to the residents' own opportunities and resources, but can also influence transmission of poverty and wealth to future generations. Low education and employment opportunities decrease the likelihood that future generations of the current residents' will be able to purchase a home (Andrews and Sánchez, 2011). This is demonstrated in studies such as the Moving to Opportunity experiment, showing that residing in a better neighbourhood significantly improves adult and child outcomes, perpetuating intergenerational transmissions of poverty and wealth through housing across neighbourhoods (Ludwig *et al.*, 2013; Chetty *et al.*, 2020). Taken together, geography of opportunity theory, life course perspective and ecological systems theory offers valuable insight into the effect of neighbourhood on residents' current, future, and intergenerational transmission of opportunities and resources.

1.2 Academic relevance

Research has shown that there exists a gap in the literature concerning the movement of starters through different neighbourhoods within the regulated Dutch housing market (Tu, de Haan and Boelhouwer, 2018a; Hochstenbach and Arundel, 2020a). In order to comprehensively understand spatial inequality, local-level studies on housing and spatial dynamics are crucial, as emphasized by Glaeser et al. (2009). Therefore, this study focuses on examining the quality of the neighbourhood where starters and young homebuyers buy a home, in comparison to non-starters and older homebuyers. Then, it tries to investigate how the placement of starters and non-starters across the different neighbourhoods in terms of quality changes over time (e.g. increasing or decreasing disparities between the quality gap of these two groups).

This study contributes to the neighbourhood attainment literature in several ways. Firstly, this study uses multilevel data (Fischer and Lowe, 2015), incorporating household factors, such as buyers age and property type, and neighbourhood factors. This data allows to combine two levels of research, one that focuses on aggregate level data about quality level of the neighbourhoods (according to this study), and another focussing on the effect of individual level factors on neighbourhood attainment. Secondly, the 10-year time span of this research shows whether and how any changes in neighbourhood attainment between starters and non-starters are associated with changes over time. Furthermore, this study tries to explain potential mechanisms describing the pattern (i.e. changes over time), which can

contribute to ongoing discussions on the evolving nature of urban society, addressing a key issue of spatial inequality and socio-segregation (Wetzstein, 2017; Hamnett, 2019; Boelhouwer, 2020; Nijman and Wei, 2020). This can inform future studies and be of use in giving comparative insights into the operation of neighbourhood selection between national contexts or that of other cities in the Netherlands. These comparisons could give better insight in different dynamics across countries or cities offering valuable knowledge for researchers into the housing market for starters.

To achieve its objectives, the study will focus on investigating the attained neighbourhood quality of both starters and young homebuyers and non-starters and older homebuyers, and investigating potential changing disparities in attained neighbourhood quality between starters and non-starters, aiming to determine whether a growing disparity exists. The study will use data from the Kadaster, which encompasses all housing transactions in the province of Groningen over a 10-year period from 2009 to 2018.

1.3 Research problem statement

Despite the widely recognized challenges faced by young individuals in attaining homeownership, there exists a dearth of empirical evidence examining the relationship of neighbourhood quality attainment by starters and young homebuyers. Consequently, the primary objective of this study is to provide robust empirical evidence, and gain a well-grounded understanding of the association between attained neighbourhood quality and starters and young homebuyers. Specifically, the study aims to investigate whether there is an intensification in the difference between the attained neighbourhood quality among starters and young homebuyers and non-starters and older homebuyers. By doing so, this research aims to contribute to the existing literature on the dynamics of the housing market for starters and young homebuyers, and to discover if the age-related neighbourhood quality difference is widening. To achieve this aim, the study addresses the following central research question:

RQ: What is the relationship between buyer type and neighbourhood quality?

To effectively address the main research question, three sub-questions have been formulated, delineating the theoretical and empirical aspects of the study:

Sub-RQ1: *What insights does the existing scientific literature provide regarding home purchases and its corresponding neighbourhood quality amongst starters and young homebuyers, and what empirical evidence is there?*

The first sub-question aims to synthesize and critically analyse the existing body of scientific literature to shed light on the challenges in home purchases faced by starters and young homebuyers, with a particular focus on the influence of neighbourhood characteristics on their life trajectories.

Sub-RQ2: *What is the empirical relationship between buyer type and neighbourhood quality?*

The second sub-question aims to provide empirical evidence and a nuanced understanding of the neighbourhood quality in which specific buyer types (e.g. starter or non-starter) and age (e.g. young homebuyer or older homebuyer) are able to buy a home. This analysis draws upon Kadaster data that encompasses the entire housing stock in the province of Groningen between 2009 and 2018, incorporating transaction prices, geocoded information, and detailed attributes of the properties and buyers (De Kam and Mawhorter, 2022).

Sub-RQ3: How does the relationship between buyer type and their neighbourhood quality change over time?

The third sub-question seeks to determine how the attained neighbourhood quality per buyer type (e.g. starter vs. non-starter) changes over time. The investigation also relies on the utilization of the aforementioned Kadaster data in the ten year period from 2009-2018 (De Kam and Mawhorter, 2022).

1.4 Outline

The structure of the rest of this paper is as follows: Section 2 provides an overview of the theoretical framework, hypothesis, and conceptual model. Section 3 discusses the data and methodology employed in the study. Section 4 presents the results and provides a detailed discussion, limitation of the findings and presents future research ideas. Finally, Section 5 offers concluding remarks.

2. Theoretical framework

This chapter elaborates on the theoretical framework that underlies the study. It defines the main factors influencing homeownership for starters and describes how neighbourhood quality is influenced. Furthermore, this chapter provides the conceptual model for this study and its hypothesis.

2.1 Theoretical framework

Homeownership for starters and young homebuyers over time

One of the external factors affecting homeownership for young individuals is the state of the housing market. Housing market dynamics encompass various conditions, such as supply, demand and interest rates (Tu, de Haan and Boelhouwer, 2018b; Zuk *et al.*, 2018). In recent years, house prices have experienced a substantial increase in many cities, posing challenges for starters and young individuals seeking affordable properties (Jordà, Schularick and Taylor, 2016). Particularly, the focus in recent literature has been on millennials, born after 1980, who are often considered the "unlucky" cohort in comparison to the "lucky" baby boomers, who entered the housing market during a period of relatively lower house prices (Coulter and Kuleszo, 2022). Thus, due to increasing house prices, scholars suggest that millennials are facing prolonged delays in achieving homeownership compared to the previous generation.

Credit accessibility (or constraints) is a critical factor influencing the ability of young individuals to purchase a home or compel households to purchase a home different from their preference (Ortalo-Magné and Rady, 2006; Xu *et al.*, 2015). For example, young adults have encountered specific challenges in the aftermath of the Global Financial Crisis in 2008. Prior to the crisis, obtaining a mortgage with favourable interest rates was relatively straightforward. However, the collapse of the credit-driven market resulted in the Global Financial Crisis, prompting banks to adopt stricter credit standards and making it more difficult to secure a mortgage with favourable terms (Acharya and Richardson, n.d.). For instance, Goodman and Mayer (2018) observed a significant decline in homeownership rates following the Global Financial Crisis, with homeownership rates among individuals aged 25 to 34 dropping from 49% before the crisis to 34.5% in 2015. Furthermore, the increasing burden of student loan debt further hampers young adults' qualification for a mortgage. For instance, Choi et al. (2018) found that 51% of millennials who have not purchased a home cited student debt as a key factor. Mezze et al. (2018) demonstrated that among millennials who attended university, every $1,000 increase in student debt leads to a 1-2 percentage decrease in the probability of homeownership as a young adult. Thus, credit accessibility for starters has created disruptions in the housing market, leading to delayed moves and diminishing housing opportunities (Myers, Park and Cho, 2021; Coulter and Kuleszo, 2022).

Furthermore, the rising prominence of the private rental sector with high rental costs, presents a challenge for young adults in saving credit which can be used for a down payment on a house. A

comparative study across developed countries reveals a trend of declining homeownership in nearly all nations, with only a few exceptions where homeownership has continued to grow over the past decade, such as Germany, the Netherlands, and Sweden. The authors emphasize that the overall decline in homeownership is primarily driven by issues of affordability and the expansion of the private rental sector, where homeownership is treated as investment asset to generate high returns (Burke et al., 2020, Lennartz et al., 2016). Hence, such a financialised housing market is an important contributor to the housing affordability crisis, where homeownership is mostly accessible to high socio-economic groups, which increases the wealth of that group, and further increases the affordability gap (Lennartz et al., 2016) .

Neighbourhood quality

This paragraph describes the characteristics associated with "better" or "worse" neighbourhoods (Rabe and Taylor, 2010). Firstly, as defined by Galster (2001), neighbourhoods encompass a collection of spatial attributes associated with clusters of residences and other land uses. Neighbourhoods can be different in terms of their characteristics. Choosing a neighbourhood is an important part of how people are sorted in society (Sampson and Sharkey, 2008). The aforementioned factors, such as credit accessibility, shed light on the challenges faced by young individuals in accessing homeownership, and when they do have access, they are often not able to buy the "better" houses which lie in "better" neighbourhoods (Rabe and Taylor, 2010). Li and Brown (1980) also argue that neighbourhood characteristics have an impact on house prices. Additionally, Rosen (1974) found that property prices play a decisive role in buyers' location choices, and that when property prices are too high they will buy in less preferred locations. These insights into the quality placed on "better" neighbourhoods, underscores the housing choices and opportunities available to young homebuyers (Hochstenbach and Musterd, 2018).

There are many price determining models and approaches in real estate. For example, the "3L" approach, proposed by Kiel and Zabel (2008), asserts that house prices are determined by the Metropolitan Statistical Area (MSA), town, and street where the house is located. In addition, Glaeser and Gyourko (2018) finds that house prices are closely related to neighbourhood characteristics such as amenities, crime rates, and school quality. However, one of the most common models is the hedonic price analysis, which aligns with traditional real estate and location theory, influencing residential land values (Cervero and Duncan, 2004). The theory assumes that goods consist of various attributes, and the total transaction price can be disaggregated into the individual prices associated with each attribute (Rosen, 1974). Such attributes are for example property type, size, age, and neighbourhood features (Tse, 2002). Such price analysis clearly shows that location is an important part of the price of a house.

Homebuyers are willing to pay more per square meter for homes with certain characteristics, such as the type of property, think of apartments or detached homes, but also the construction year (Goodman and Thibodeau, 1995). Though, the location is one of the largest determinants of the price

per square meter (Kiel and Zabel, 2008; Fernández-Durán *et al.*, 2011; Heyman and Sommervoll, 2019). Desired neighbourhoods are characterized with better amenities (Glaeser, Kolko and Saiz, 2001; Jim and Chen, 2010b). Examples of these amenities are: schools, transportation, walkability, parks, playgrounds, restaurants, grocery stores, community engagement, and healthcare services. Moreover, commuting costs play a fundamental role in determining the value of urban land (Alonso, 1983), underscoring the importance of employment opportunities, public transportation and well-connected highways close to homeowners residence (Howley, Scott and Redmond, 2009). Hence, the presence of better neighbourhood amenities, along with convenient proximity to work locations, contributes to residents' well-being and stimulates their overall willingness to pay more for homes with such characteristics. Therefore, as these factors of better neighbourhoods are reflected in higher prices, this study uses the price per square meter to determine neighbourhood quality.

2.2 Conceptual framework and hypotheses

Drawing upon the comprehensive literature review outlined in this section, the conceptual model in figure 1 illustrates the relationship analysed in this study. The primary hypothesis of this study posits that there is *a (inverse) relationship between buyer type and the neighbourhood quality* (H1). Moreover, it is anticipated that this inverse pattern will become more pronounced over time, leading to a progressively widening disparity between the neighbourhood quality of starters and those of non-starters (H2).

The conceptual model below shows the relationships that are studied. This study's approach has a multilevel nature, where the variables taken into account are either household factors (micro-level) which are specific per homebuyer(s), and neighbourhood factors (macro-level) which are related to the characteristics of the neighbourhood the buyer resides. The main relationship is that of starters (household factor) and their neighbourhood quality (neighbourhood factor). Firstly, the young homebuyers are added to this relationship to see if the age of the starter has an effect (household factor). Secondly, the transaction year is added to the main relationship to see what happens over a ten year time span (household factor). Lastly, control factors are added, namely whether the starter buys a home in a rural or urban area (neighbourhood factor), property type (household factor), construction year (household factor) and homebuyer count (household factor).

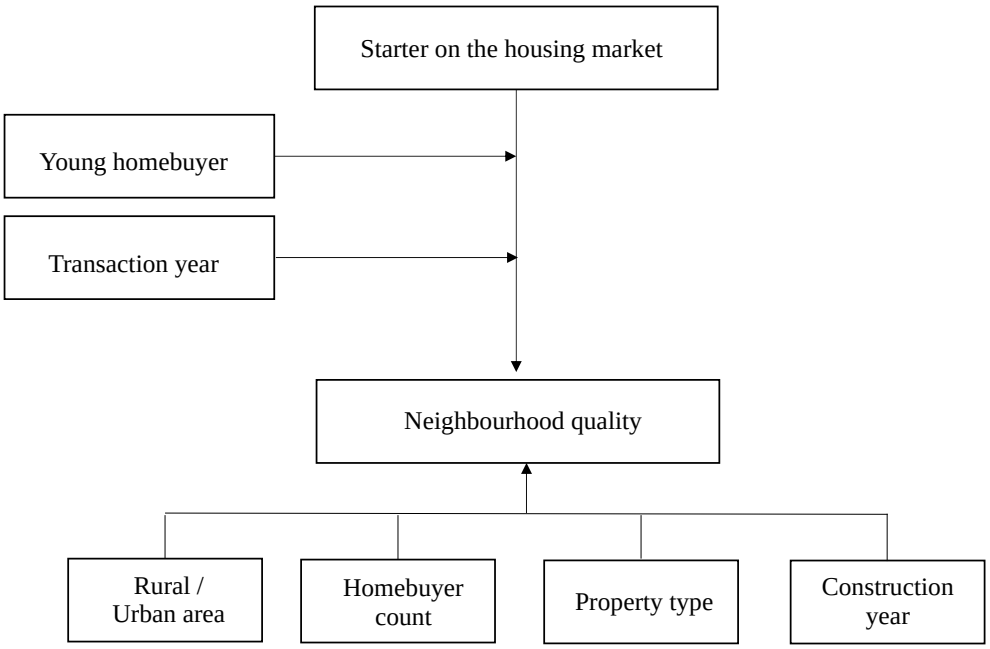

Figure 1. Conceptual model of the links between starter (household factor), neighbourhood quality (neighbourhood factor), young homebuyer (household factor) and transaction year (household factor), controlling for homebuyer count (household factor), property type (household factor), construction year (household factor) and rural/urban area (neighbourhood factor).

3. Data and methodology

This chapter serves as the methodological research framework for this study. Firstly, the spatial context of the research is presented. Secondly, the dataset utilized in the study is described. Thirdly, the operationalization of the variables is elaborated. Fourthly, the statistical methods employed for the data analysis are expounded upon and lastly, ethical considerations are elaborated.

3.1 Context

This study focuses on the province of Groningen, the Netherlands, between 2009 and 2018, to measure the attained neighbourhood quality of starters and non-starters, and young homebuyers and older homebuyers. By analysing the changes of neighbourhood quality that occur per group during this period, this study seeks to understand how the difference between the neighbourhood quality of starters and non-starters changes in the specific geographic of Groningen.

Firstly, the Netherlands is an interesting case, as a study on homeownership within 18 countries found that only the Netherlands, France and Germany experienced increasing homeownership in the last decade (Burke, Nygaard and Ralston, 2020). At the same time, the Netherlands has witnessed a sustained surge in house prices since the early 2000s, with the most substantial increase occurring after the Global Financial Crisis in 2013 and continuing to the present (CBS, 2022a). This increase has been particularly pronounced in densely populated areas, such as the Randstad region, encompassing major cities like Amsterdam, Rotterdam, Utrecht, and The Hague. Also, there is a decline in homeownership among young adults in the Netherlands, with significant decreases observed in Amsterdam, Rotterdam, and several university cities, including Wageningen, Maastricht, Groningen, Delft, Leiden, and Nijmegen (Hochstenbach and Arundel, 2020b). Hochstenbach and Arundel also highlights that young adults from lower socioeconomic backgrounds have been disproportionately affected by the decline in homeownership for this group, further underscoring the unequal geography of homeownership in the country. Medium-sized university cities exhibited particularly strong spatial polarization (Hochstenbach and Arundel, 2020b).

Secondly, the province of Groningen is a useful case for testing the ability of starters and young adults attaining “better” or “worse” neighbourhood qualities. On a practical level, Groningen boasts one of the fastest-growing housing markets in the Netherlands (CBS, 2023), with house prices experiencing a significant increase. Between 2015 and 2022, the average house price in the municipality of Groningen rose by approximately 50%, making that starters are more likely to be further pushed out of the housing market. More generally, Groningen is a promising study case as it is part of the Dutch housing market, which is highly regulated relative to other countries (Tu, de Haan and Boelhouwer, 2018a; Hochstenbach and Arundel, 2020a). Although previous studies have focused on the housing market for young homebuyers at the national or Randstad level (Tu, de Haan and Boelhouwer, 2018b; Hochstenbach and Arundel, 2019), local-level studies are equally important, and have not received

sufficient empirical attention (Glaeser, Resseger and Tobio, 2009). The housing market exhibits heterogeneity across different cities, and there appears to be limited support for starters and young homebuyers housing market opportunities in the province of Groningen. Moreover, the municipality of Groningen has a predominantly young population (with 33.3% young people between 18 and 25 years) and it has the largest percentage of students in the Netherlands (25% of the population is students; CBS, 2018b, 2022b). Therefore, a proportion of the graduates is likely to start their career in the region and tries to find a house to buy, which presents an intriguing case for research.

In terms of practical reasons for selecting Groningen, the city's rapidly growing housing market provides an opportunity to investigate the dynamics of the housing market in a unique setting. On the other hand, inherent reasons for studying Groningen include the importance of understanding the highly regulated Dutch housing market and the significance of studying local-level inequality in the housing market. As a university town, Groningen's young adult population makes it a particularly compelling case for investigating young adults' attained neighbourhood quality.

To establish the empirical context of the changing house prices in the province of Groningen, this study conducted an analysis utilizing a combined dataset comprising the average WOZ values per municipality for the period from 2009 to 2018, sourced from the Central Bureau of Statistics (CBS) (CBS, no date). This percentage WOZ change[1] ranges from -33.60 to +113.94 across municipalities, see table 1 for the exact numbers[2]. Rural municipalities such as Bedum, Marum, and De Marne experienced the highest decreases in WOZ values, with declines of 33.60%, 31.05%, and 23.08%, respectively. While more urban municipalities experienced increases in WOZ values, such as Leek (113.94%), Groningen (19.18%) and Appingedam (5.96%). Interestingly, the average WOZ change in the province of Groningen between 2009 and 2018 shows a decrease of 5.22%, while, as stated above, the average house price increase in the municipality of Groningen is 50% between 2015 and 2022, showing that the urban municipality of Groningen has increasing house prices while rural municipalities have decreasing house prices.

Table 1. Percentage change in WOZ value per municipality in the province of Groningen between 2008-2019

Municipality name	**Mean WOZ change**	**Municipality name**	**Mean WOZ change**
Leek	113.9378%	Stadskanaal	-17.07689%
Groningen	19.17583%	Delfzijl	-17.52458%
Appingedam	5.956572%	Winsum	-19.89093%
Zuidhorn	1.406226%	Veendam	-19.96424%

[1] The percentage WOZ change per municipality in the province of Groningen is calculated by subtracting the average WOZ value for 2018 from the average WOZ value for 2009 and dividing this by the WOZ value for 2009, multiplied by 100 (for every municipality).

[2] Note that municipalities redeploy, therefore, some municipality names are not the same as the present municipalities.

Eemsmond	-5.450042%	Loppersum	-20.56391%
Grootegast	-6.094916%	De Marne	-23.08331%
Ten Boer	-9.258691%	Marum	-31.00576%
Haren[3]	-9.777216%	Bedum	-33.60133%
Oldambt	-15.95746%	Average WOZ change	-5.2219%

3.2 Data

Data selection

The dataset used in this study is sourced from The Netherlands' Cadastre, Land Registry and Mapping Agency (Kadaster), which is responsible for maintaining records of property transactions in the Netherlands. The dataset includes every property transaction in the province of Groningen covering the period from 2009 to 2018, also referred to as the transaction sample (n = 51,193). It provides information on property transaction prices, geocoded data as well as characteristics of the houses and buyers. Such that each neighbourhood has a neighbourhood code, and this study uses the 309 neighbourhoods which have matching codes over the ten-year study period. The dataset is originally prepared by George de Kam in December 2021 and updated by Sarah Mawhorter in April 2022 (De Kam and Mawhorter, 2022). All the variables are used as defined in the Kadaster dataset, only the dependent variable defined by this study.

The population dataset excludes the observations which have missing information about whether the buyer is a starter or non-starter (defined by the Kadaster dataset), as this is the key independent variable (n = 305), and excludes observations which have missing information about the age of the buyer, as this also is a key independent variable (n = 2,042). Further, it excludes observations who bought a property with more than 3 buyers, as these are expected to be investors (n = 100).[4] Lastly, the study excludes observations that do not have neighbourhood quality, as this is the dependent variable (n = 7,361). These could be observations where the neighbourhoods did not have enough observations to create a accurately reflection of the neighbourhood quality (more than 10 observations), or the neighbourhoods lied in excluded municipalities due to too many changed neighbourhood codes. The final analytic sample consists of 41,385 observations (i.e. individual transactions). This is a sufficient research population, thereby ensuring that the results are representative, according to the power analysis conducted in G*Power. The power analysis showed that 20 observations is the minimum, and thus this

[3] Until 2019, Haren existed as an independent municipality. In 2019, Haren merged with the municipality of Groningen and is now part of the combined municipality known as Groningen (Gemeente Groningen, no date).
[4] 100 seems as a small number of investors in a 10 year period. This study acknowledges this, however, the investors might already been filtered out by starter status and age category, and in the scope of the study there is not another option of finding whether the buyers are investors.

study exceeds the minimum number of observations (with: effect size $f^2 = 0.89$, $\alpha = 0.05$, power = 0.95, nr of predictors = 11).

The Kadaster dataset ensures validity because it is a comprehensive and accurate record of all property transactions in the given area, as opposed to a sample of transactions. This means that the data is representative of the entire population of property transactions in the research area, and therefore has high external validity. Additionally, the dataset is an external reliable source of data because the Kadaster is a government agency that is responsible for maintaining accurate records of property transactions. Kadaster data has been shown to have high levels of validity and reliability, which is widely used in research on the Dutch property market (e.g. De Vries et al., 2009).

Dependent variable operationalization

The dependent variable in this study is referred to as *neighbourhood quality* and is a neighbourhood factor on macro level. According to relevant literature, reviewed in chapter 2, it is recognized that the transacted price per square meter of a property reflects the property and neighbourhood characteristics. If the transacted price per square meter for a property is higher than for other properties, it is the added value that homebuyers attribute to those properties within the specific neighbourhood. Therefore, it is their willingness to pay above and beyond normal prices for a particular house. As this study controls for property characteristics, neighbourhood quality encompasses a composite of many different home purchases and the buyers willingness to pay extra.

Neighbourhood quality is estimated through the following 2 steps. In the first step a percentage rank of the *property* quality for each observation is estimated, based on the price per square meter of a property. The percentage rank represents the relative position of the observation in the dataset, expressed as a percentage[5]. The equation is as follows:

$$Percentage\ rank\ property\ quality = \left(\frac{\left(\left(rank\ \left(\frac{€}{m^2}\right)\right) - 0.5\right)}{N}\right) * 100$$

Eq. 1

The rank property quality is thus measured by dividing the purchase price by the surface area for each observation. Then, the rank for each property price per square meter (€/m^2) within the dataset is computed. The ranks are assigned based on the ascending order of the price per square meter values, where the property with the lowest price per square meter receives a rank of 1, the next lowest receives a rank of 2, and so on. Subtracting 0.5 from the rank per square meter serves as a continuity correction. It ensures that the mean percentile is 50 and symmetrically handles the tails of the distributions

[5] Using a percentage rank instead of price per square meter is advantageous as it provides a more comprehensive and nuanced representation of the ranking between properties, and eventually in step 2 between neighbourhoods. Unlike using price per square meter, which can vary greatly, a percentage rank offers a standardized measure that allows for a clearer understanding of the relative positions of neighbourhoods. In addition, the use of ranks avoids the assumption of normality (Friedman, 1937).

(Bornmann, Leydesdorff and Wang, 2013). The N represents the total number of properties in the dataset. Dividing the property rank per square meter by N and then multiplying it by 100 converts the rank into a percentage (Hazen, 1914).

In the second step a percentage rank of the *neighbourhood* quality is estimated, which is the average of the percentage rank of the property quality (step 1) in a neighbourhood. This is estimated in QGIS, where the neighbourhoods are defined through neighbourhood codes. The equation is as follows:

$$Percentage\ rank\ neighbourhood\ quality = \frac{\sum_i Percentage\ rank\ property\ quality_i}{N_n} + \varepsilon$$

Eq. 2

The percentage rank neighbourhood quality (which is the dependent variable) is computed by adding all the percentage rank property qualities (step 1) in a certain neighbourhood and dividing that by that number of observations in that neighbourhood. For instance, if a neighbourhood has 50 observations, the average of the percentage rank of these 50 observations is calculated, resulting in an average percentage rank per neighbourhood. As the average is taken, this variable ranges from 5.24 to 74.07 percentage rank, instead of a normal percentage rank from 0 to 100. Then, each observation (property transaction) in the dataset is assigned an average percentage rank of its corresponding neighbourhood, which this study considers as the dependent variable: neighbourhood quality. As there are 309 neighbourhoods in the dataset, and there is one neighbourhood quality per neighbourhood, the dataset has 309 values for neighbourhood quality. Furthermore, as the neighbourhood quality is a ranking, the dataset comprises ordinal data, thus the interpretations of the analysis should be tailored accordingly.

This study acknowledges the potential violation of the assumption of independence among properties within the same neighbourhood, which could lead to incorrect standard errors (ε) and biased results. To address the assumption of uncorrelated error terms which might not be tenable in this case, this study employs VCE (Variance-Covariance Estimation) clustering, which allows for within-cluster correlation among properties within each neighbourhood. Using the output of the VCE clustering procedure provides a more robust and accurate assessment of the statistical validity of the model parameters in the regression analysis.

Dependent variable descriptive statistics

The average neighbourhood quality in the province of Groningen is 40.30 (see table 2). The map[6] (see figure 2) gives a visualisation of the neighbourhood qualities. To make a clear visualisation, a natural groupings tool in QGIS is used, where the qualities were divided into 5 groups (5-19%; 19-30%; 30-42%; 42-57%; 57-74%). This is only for visualisation purposes, as this study uses the total

[6] Only neighbourhoods with more than ten transactions were included, to ensure that the analysis is not unduly influenced by unusual cases. In addition, neighbourhoods in the municipalities Midden-Groningen and Westerwolde are not included, as the boundaries of these municipalities changed drastically during this study period, and consequently, did not have matching neighbourhood codes. Therefore, certain areas on the map are not coloured and left out of the analysis.

range of neighbourhood qualities in the analysis (from 5-74%). The map shows the neighbourhoods with the highest qualities (1-10) in dark purple, and the neighbourhoods with the lowest quality (300-309) in light purple. The top ten neighbourhoods with the highest qualities, mostly situated in the municipality of Groningen, are: 1. Sterrebosbuurt (Groningen), 2. Harenermolen (Haren), 3. Kop van Oost (Groningen), 4. Voorveld (Haren), 5. Klein Martijn (Groningen), 6. Paterswolde (partially Haren)[7], 7. Stationsgebied (Groningen), 8. Hemmen (Haren), 9. Scattered houses on the Hondsrug (Haren), 10. De Meeuwen (Groningen). On the other hand, the neighbourhoods with the lowest qualities are: 300. Kloosterburen (De Marne), 301. Losdorp (Delfzijl), 302. Beerta-Centrum (Oldambt), 303. Finsterwolde Ganzedijk (Oldambt), 304. Termunterzijl (Delfzijl), 305. Finsterwolde-Centrum (Oldambt), 306. Nieuweschans-Centrum (Oldambt), 307. Nieuweschans Nieuwbouw (Oldambt), 308. Godlinze (Delfzijl), 309. Drieborg-Centrum (Oldambt).

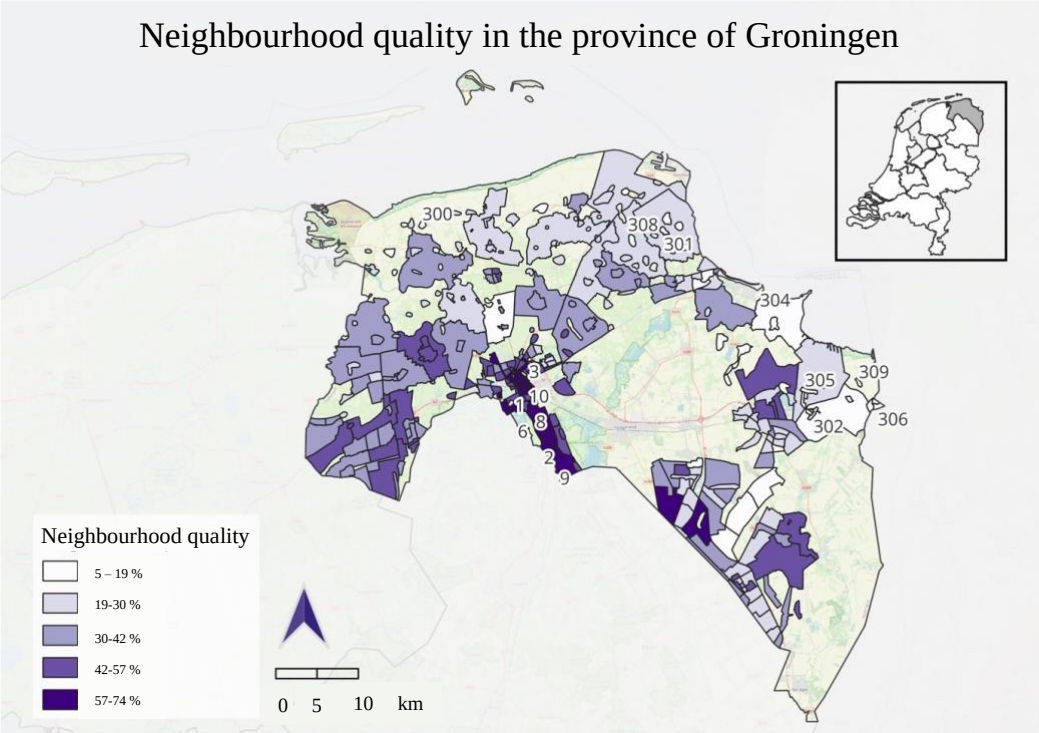

Figure 2. Neighbourhood quality in the province of Groningen

Note: 1-10 are neighbourhoods with the highest quality and 300-309 are neighbourhoods with the lowest quality, respectively; Quality ranges from 5-74% due to the average of the neighbourhood; areas that are not included did not have enough transactions or included changed neighbourhood codes which could not be used.

Household variables (micro-level data) and descriptive statistics

Table 2 presents the descriptive statistics for the variables used in the analysis, separately for household factors (micro-level) and neighbourhood factors (meso-level). This first sub-header describes the

[7] Note that municipalities redeploy, therefore, some municipality names are not the same as the present municipalities.

household factor variables. The key independent variable *starter* represents whether it is the first time someone buys a house. It is obtained from the Kadaster dataset and is presented as a dummy variable (*1 = buyer(s) is a starter; 0 = buyer(s) is a non-starter)*. Starters represent 38.57% of the buyers in the dataset and non-starters represent 61.43% of the buyers in the dataset.

The second key independent variable (and interaction variable) is *young homebuyer*, which is obtained from the Kadaster dataset. The original Kadaster dataset presents age as a categorical variable, with age category steps of 10 years each. The categories that are included in the Kadaster dataset are: < 21, 21-30, 31-40, 41-50, 51-60, 61-70, 71-80, and 81-90. This study groups age into a dummy variable as the study is interested in young homebuyers and older homebuyers, therefore the category 30 and below is labelled as young, and above 30 is labelled as older buyers (*1 = young homebuyer(s); 0= older homebuyer(s)).* Young buyers represent 30.30% of the buyers and older buyers represent 69.70% of the buyers (see table 2).

The third key independent variable (and moderator) is *transaction year*, which is obtained from the Kadaster dataset. Each case in the dataset includes a transaction year, which ranges from 2009 to 2018. As is apparent from the literature in chapter 2, the Global Financial Crisis had an impact on people's ability to purchase a property. For example, to encourage lending and buying a home, the Netherlands expanded their government guarantee schemes a few years after the crisis (Loomans and Kaika, 2023). The observation from the Kadaster data is consistent with literature, as the number of transactions nearly doubled after the recovery period of the crisis. For 2009 to 2018, the number of observations were: 3,358, 3,365, 3,193, 2,925, 2,907, 3,845, 4,456, 5,360, 6,056, 5,920, respectively.

The first control variable *homebuyer count* is included, which indicates how many people were included in the transaction of the home. This ranges from 1 to 3 buyers. This needs to be controlled for, as is in-line with the life course perspective (Mulder, 2006; Choi *et al.*, 2018; Clark, 2019), couples have more chance of buying a house. Whereas, the dataset shows that 46.91% of the buyers is a single buyer, 52.64% of the buyers are two buyers and 0.45% of the buyers are three buyers. The second control variable *construction year* ranges from the year 1580 until 2018, with a mean construction year of 1962. The third control variable is the *type of the property (1: apartment, 2: corner house in a row, 3: semi-detached, 4: house in the middle of a row, 5: detached and 6: unknown).* The descriptive statistics show that most homebuyers, namely 28.59%, buy an apartment.

Neighbourhood variable (meso-level data) and descriptive statistics

This sub-header describes the neighbourhood factor variable (next to the dependent variable which is already discussed in above). The last control variable is on neighbourhood level, namely whether the home is in a *rural* or *urban area.* In the province of Groningen, only the municipality of Groningen is an urban municipality and the other municipalities are rural municipalities (CBS, 2009). The dependent variable *neighbourhood quality* already includes location, and therefore only municipality fixed effects are included as binary variable, such that it reflects rural and urban properties (*1 = municipality of*

Groningen (urban); *0 = other municipalities in the province of Groningen (rural))*. According to the literature, this is an important aspect which needs to be controlled for, as people are willing to pay more for an urban area (Groot *et al.*, 2015). The municipality of Groningen holds 45.21% of all transactions, and the other rural municipalities hold the other 54.79% together (see table 2 for the descriptive statistics).

Table 2: Descriptive statistics

Variable	Categories (if applicable)	Frequency (%)	Mean	Std. dev.	Minimum	Maximum
Household factors						
Starter	Non-starter	61.43				
	Starter	38.57				
Young homebuyer	Older homebuyer	69.70				
	Young homebuyer	30.30				
Transaction year	2009	8.11				
	2010	8.13				
	2011	7.72				
	2012	7.07				
	2013	7.02				
	2014	9.29				
	2015	10.77				
	2016	12.95				
	2017	14.63				
	2018	14.30				
Homebuyer count			1.54	.51	1	3

Property type	Apartment	28.59				
	Corner house in a row	9.72				
	Semi-detached	14.26				
	House in the middle of a row	23.65				
	Detached	22.38				
	Unknown	1.40				
Construction year			1961.71	33.90	1580	2018
Neighbourhood factors						
Neighbourhood quality			40.30	14.98	5.24	74.07
Rural / Urban area	Rural	54.79				
	Urban	45.21				

Note: As there were no missing observations, the number of observations for each variable is the same (N=41,385)

Correlation Matrix

The table below displays the correlation table (table 3). According to Cohen et al. (2013) the correlation threshold for multicollinearity between independent variables is 0.8. The correlation shows that all the variables are below the threshold, which implies there will be no multicollinearity problem. In addition, the table shows that the independent variables are significantly correlated with the DV *neighbourhood quality* ($p < .0001$). A significant negative low correlation is found between *neighbourhood quality* and the dummy of *starter* ($r = -0.08$, $p < 0.001$), indicating a weak association between the two variables, whereby more neighbourhood quality is associated with less probability that the buyer is a starter. In addition, a significant negative low correlation is found between *neighbourhood quality* and the dummy of *young homebuyer* ($r = -0.09$, $p < 0.001$), indicating also that more neighbourhood quality is associated with less probability that the buyer is young. There is quite a high correlation between *neighbourhood quality* and the dummy of *Urban* ($r = 0.59$, $p < 0.001$), indicating that more neighbourhood quality is associated with an urban area compared to a rural area. As the 0.59 is below 0.8 it will stay in the analysis. It is important to note however that the interpreted variables above are dummy variables and thus do not have a linear relationship with the neighbourhood quality variable. Therefore, this might not accurately reflect the underlying relationship. It is necessary to examine other statistical measures, such as this study does through a regression analysis, to further understand the nature of these relationship.

Table 3. Correlation Matrix

	Neighbourhood quality	**Starter**	**Young homebuyer**	**Transaction year**	**Urban**	**Homebuyer count**	**Property type**	**Construction year**
Neighbourhood quality	1.00							
Starter	-0.08 ***	1.00						
Young homebuyer	-0.09***	0.61***	1.00					
Transaction year	-0.02 ***	-0.09***	-0.10***	1.00				
Urban	0.59***	0.05 ***	0.01	-0.05***	1.00			
Homebuyer count	0.02***	-0.20***	-0.16***	0.02***	-0.10***	1.00		
Property type	-0.34***	-0.05***	-0.05***	0.01*	-0.48***	0.19***	1.00	
Construction year	-0.03***	-0.049***	-0.05***	- 0.04***	-0.01***	0.10***	-0.07***	1.00

Note: Starter is a dummy variable with 1= starter compared to 0= non-starter; Young homebuyer is a dummy variable with 1= young homebuyer (<30) compared to 0= older homebuyer (>30); Urban is a dummy variable with 1= Urban and 0= Rural; Property type is categorical variable with 1: apartment, 2: corner house in a row, 3: two under a roof, 4: house in the middle of a row, 5: detached and 6: unknown;

***, **, and * correspond to significance level of <0.1%, <1% and <5% respectively.

3.3 Methodology

This study utilizes multiple linear regression analysis to investigate the relationship between buyer type and neighbourhood quality. The analysis includes six models, each with different specifications. Model 1 includes whether the homebuyer(s) is a starter or non-starter. Model 2 adds whether the homebuyer is young or an older homebuyer. Model 3 adds the transaction year to observe the influence of time on the parameters. Model 4 adds the interaction effect of starter and transaction year, and model 5 adds the interaction effect of starter and young homebuyer. Lastly, model 6 adds the control variables, specifically, homebuyer count, property type, construction year and whether the property is in a rural or urban area. The time fixed effects and property fixed effects are included, as these control for unobserved heterogeneity or individual-specific characteristics that may influence the dependent variable. Neighbourhood fixed effects are already included in the dependent variable, therefore including this in the model would be redundant and could lead to multicollinearity issues. The following equation reflect the models:

$$NQuality = \beta_0 + \beta_1 Starter_i + \beta_2 Youngbuyer_i + \beta_3 Transactionyr_t + \beta_4 Starter \times Youngbuyer_i + \beta_5 Starter \times Transactionyr_{it} + \beta_6 Acquirers_i + \beta_7 Ptype_i + \beta_8 Constructionyr_i + \beta_9 RuralUrban_i + \mu_i + \tau_t + \varepsilon_{it}$$

Eq. 3

Where:

$NQuality$	is the neighbourhood quality
β_0	is the constant
$Starter$	is whether buyer is a starter (1 = starter; 0 = non-starter)
$Youngbuyer$	is whether buyer is a young (1 = young; 0 = older)
$Transactionyr$	is the transaction year
$Starter \times Transactionyr$	is the interaction between starter and transaction year
$Starter \times Youngbuyer$	is the interaction between starter and young age
$Acquirers$	is the control variable homebuyer count of the property
$Ptype$	is the control variable for the property type
$Constructionyr$	is the control variable construction year
$RuralUrban$	is the control variable for the rural or urban location
μ_i	are the property fixed effects
τ_t	are the time fixed effects
ε_{it}	is the error term; the subscript i illustrates property effects and the subscript t illustrates time effect

As linear regression is used as estimation technique, therefore the assumptions of OLS are checked and satisfied in this paragraph before interpreting the results (Brooks and Tsolacos, 2010). a) The average value of the errors is zero (E(ut) = 0). This assumption is met when a constant is included in the regression, as this ensures the regression line is not forced through the origin. b) Constant error variance (Var(ut) = σ2 < ∞) , which refers to homoscedasticity. The scatterplot of the residuals and the dependent variable shows that there is a heteroskedasticity problem, and this is further confirmed by the results of the Breusch–Pagan/Cook–Weisberg test, which shows a non-constant variance. To address the issue of biased standard errors and incorrect statistical inference, the regression is run using robust standard errors. c) Covariance between error terms is zero (cov(ui, uj) = 0), which refers to autocorrelation. This assumption is violated, as homes are nested within neighbourhoods, therefore the clustering method is applied. d) Regressors are uncorrelated with the error term (cov(ut, xt) = 0), also known as the exogeneity assumption. A visual inspection is held, where none of the regressors show a pattern with the residuals, indicating that the assumption is met. e) Errors are normally distributed. A visual inspection of the errors show a very-close-to normal distribution. However, as the errors are very-close-to normally distributed, and the sample size is substantially large (n = 41,385), the central limit theorem is applicable, which ensures the assumption is met. f) Absence of multicollinearity. This assumption is violated when two or more independent variables are highly correlated, creating unreliable estimates of the regression coefficients. As shown in the correlation matrix in table 6, this assumption is met. Though, a VIF (Variance Inflation Factor) test is conducted post-regression to assess the severity of multicollinearity in the regression. The test showed there was indeed no concern for multicollinearity (VIF = 1.59 for starter). After running the VIF test for the regression results with the interacted variables, there is a higher VIF found, though this is common when there are interacted variables included and therefore this study does not see this as a problem (VIF = 13.52 for starter, Disatnik and Sivan, 2016).

In order to assess the robustness of the regression model, two approaches are applied. Firstly, the bootstrap method is applied, which gives insight into how variable the model parameters are. Secondly, a Chow-F test is performed, where the primary purpose is to examine whether there is a change in the studied relationship during the recovery period of a specific event, such as the Global Financial Crisis, and after the recovery period. As the literature revies chapter 2 suggests that there will be a difference between *neighbourhood quality* across different time periods. If there is a significant breakpoint found between time periods, this could help promote mechanisms that explain the results (Brooks and Tsolacos, 2010).

3.4 Ethical Considerations

To ensure the ethical use of the Kadaster data, this study has obtained permission to use the data for research purposes and has taken steps to safeguard the confidentiality of the data throughout the study.

Specifically, the dataset is stored in a protected environment, and all analyses are conducted using anonymous identifiers to ensure the privacy of individual property owners.

4. Results and discussion

This chapter presents the outcomes of the study and provides a detailed analysis and interpretation of these outcomes, followed by an indication of what the limitations are of this research are, and it proposes future research topics.

4.1 Results

Table 4 presents the results of the multiple linear regression analysis with clustering (for the regression without clustering see appendix A) by examining the relationship between neighbourhood quality (in percentage rank; neighbourhood factor) and the predictor variables, separately for household factors (micro-level) and neighbourhood factor (meso-level). The model included 41,385 observations and was statistically significant (Prob Y> F 0.0000), indicating that the predictors collectively explained a significant portion of the variance in neighbourhood quality. Model 6 will be further reviewed, as it has the highest adjusted R-squared and the variables included in this model are most in line with the theoretical framework of this study. The adjusted R-squared is 0.39, indicating that approximately 39% of the variability in the neighbourhood quality is explained by the independent variables included in the regression model. This value suggests a moderate level of explanatory power of the model (Ozili, 2022).

Firstly, whether the buyer is a starter (=1) or non-starter (=0), which is a household factor, emerged as a highly significant predictor of neighbourhood quality (β = -3.30, Robust S.E. = .71, p = <0.1%). The coefficient being significant implies that there is a meaningful association between being a starter and the quality of the neighbourhood they attain. The coefficient suggests that being a starter, compared to being a non-starter, is associated with a decrease in percentage rank in the attained neighbourhood quality. In other words, starters tend to buy homes in neighbourhoods with lower qualities compared to non-starters. When analysing young homebuyer (=1) and older homebuyer (=0), a similar effect on attained neighbourhood quality is found (β = -2.29, Robust S.E. = .84, p = <1%).

Table 4. Regression analysis with clustering (6 models).

	Model					
Neighbourhood quality	**1**	**2**	**3**	**4**	**5**	**6**
Intercept	41.22***	41.41***	40.97***	41.46***	41.56***	75.98*
	[1.38]	[1.40]	[1.42]	[1.42]	[1.42]	[36.95]
Household factor						
Starter	-2.37***	-1.04*	-1.21**	-2.31**	-2.73***	-3.30***
	[.60]	[.43]	[.44]	[.76]	[.84]	[.71]
Young buyer		-2.33***	-2.31***	-2.30***	-3.11***	-2.29**
		[.55]	[.54]	[.54]	[.74]	[.84]
Transaction year						
2010			.98*	.71	.69	.18
			[.41]	[.50]	[.50]	[.37]
2011			1.31**	1.17*	1.15*	.47
			[.43]	[.53]	[54]	[.44]
2012			.68	.75	.74	.41
			[.47]	[.58]	[.58]	[.49]
2013			1.25**	1.29*	1.25*	.57
			[.45]	[.57]	[.57]	[.57]
2014			2.04***	1.74**	1.70**	1.05
			[.49]	[.60]	[.61]	[.61]
2015			1.17***	.62	.57	.23
			[.36]	[.50]	[.50]	[.40]
2016			.58	-.30	-.35	-.11
			[.44]	[.63]	[.63]	[.43]
2017			-.17	-1.10*	-1.14*	-.36
			[.43]	[.54]	[.54]	[.38]
2018			-1.30***	-2.00***	-2.05***	-.68
			[.40]	[.51]	[.51]	[.39]
Starter x Young buyer					1.24	1.05*
					[.68]	[.48]
Starter x Transaction year						
1 2010				.60	.61	.56
				[.74]	[.74]	[.57]
1 2011				.23	.27	.23
				[.80]	[.80]	[.59]
1 2012				-.17	-.15	.53
				[.77]	[.78]	[.60]
1 2013				-.13	-.06	.60
				[.81]	[.81]	[.59]
1 2014				.64	.76	1.18*
				[.73]	[.73]	[.51]
1 2015				1.24	1.34	1.24*
				[.76]	[.76]	[.57]
1 2016				2.17**	2.27**	1.67**
				[.83]	[.83]	[.60]
1 2017				2.42**	2.51**	1.81**
				[.81]	[.81]	[.66]
1 2018				1.81**	1.89**	1.24*
				[.71]	[.71]	[.59]
Homebuyer count						
2						2.50***

						[.40]
3						-.40
						[1.20]
Property type						
2						-4.75**
						[1.69]
3						-1.01
						[1.40]
4						-3.78*
						[1.63]
5						-4.74*
						[2.28]
6						.32
						[1.71]
Construction year						-.02
						[.02]
Neighbourhood factor						
Rural / Urban						16.60***
						[2.90]
N	41,385	41,385	41,385	41,385	41,385	41,385
Prob > F	0.00	0.00	0.00	0.00	0.00	0.00
Adjusted R-squared	0.01	0.01	0.01	0.01	0.01	0.39

Note: Neighbourhood quality is the dependent variable. Starter, Young buyer and transaction year are the key independent variables.
***, **, and * correspond to significance level of <0.1%, <1% and <5% respectively.

Secondly, the interaction between starter and young homebuyer, which are household factors, also showed highly significant results (β = 1.05, Robust S.E. = .48, p = <5%). It is difficult to make an accurate conclusion from the coefficient of the interaction effect, therefore the results of the interaction are put into a margins plot[8] (see appendix B). Although a margins plot is not the most appropriate figure for dummy variables, it does shows what the neighbourhood qualities are for the interacted homebuyer types, and therefore it was used. The plot shows that the average neighbourhood quality percentage rank for starters and young homebuyer lies around 38.5, and for non-starters and young homebuyer this is around 39.1. For starters and older homebuyers this is around 39.5 and for non-starters and older homebuyer the average neighbourhood quality lies around 41.4. Thus, the interaction effect between starter and young homebuyer indicates they attain homes in neighbourhoods with the lowest qualities compared to the other three homebuyer types (e.g. non-starter and older homebuyer; non-starter and young homebuyer; starter and older homebuyer).

Thirdly, the results of the regression analysis reveal a significant result for the interaction effect between starter status and the year of the transaction. The years 2014, 2015, 2016, 2017 and 2018 are significant, meaning that the whole interaction effect can be analysed (2014: β = 1.18, Robust S.E. =

[8] To address the misinterpretation of overlapping confidence intervals in the margins of interacted variables, a 83% confidence interval is used to visually assess statistical significance of differences at the p <5% level (Austin and Hux, 2002; Knol, Pestman and Grobbee, 2011).

.51, p = <5%; 2015: β = 1.24, Robust S.E. = .57, p = <5%; 2016: β = 1.67, Robust S.E. = .60, p = <1%; 2017: β = 1.81, Robust S.E. = .66, p = <1%; 2018: β = 1.24, Robust S.E. = .59, p = <5%;). To gain a deeper understanding of this significant interaction, the margins plot[9] is further investigated, as depicted in figure 3. The plot reveals that in the first half of the dataset (2009-2014), both starters and non-starters experienced an increase in the neighbourhood quality. For example, in 2009, the average neighbourhood quality for starters was 37.9, while non-starters had an average of 41.1. Notably, in 2014, both groups reached a peak in neighbourhood quality. Starters had a higher increase, reaching 40.0 (+2.1 from beginning point in 2009), compared to non-starters reaching 42.1 (+1.0 from beginning point in 2009). However, in the following year (2015), both groups experienced a sharp decrease in neighbourhood quality (-1.0 in one year), followed by a continuing decline at a slower pace. Interestingly, starters ended up with a slightly higher neighbourhood quality compared with 2009 (+0.2 from 2009 to 2018), whereas non-starters experienced a decrease from their starting point (-0.8 from 2009 to 2018). These results imply that the difference in neighbourhood quality between starters and non-starters decreased as time progresses. Whereas, starters being slightly better off, while non-starters are worse off with regards to neighbourhood quality attainment over a 10-year time span.

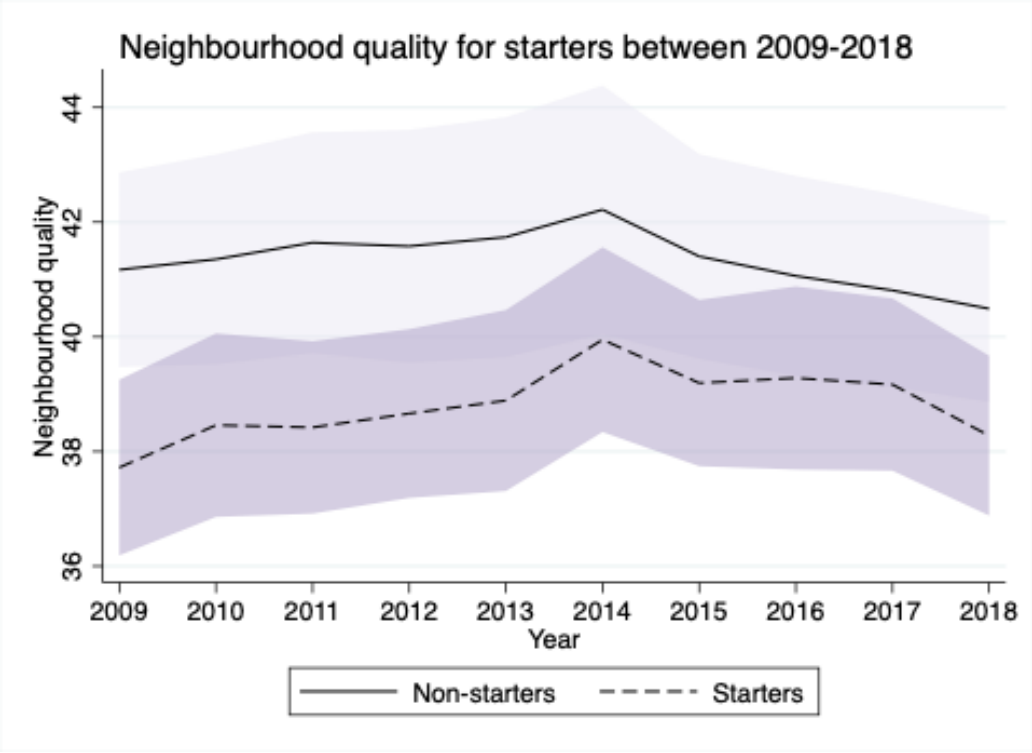

Figure 3. Margins plot: neighbourhood quality for starters and non-starters between 2009-2018

[9] To address the misinterpretation of overlapping confidence intervals in the margins of interacted variables, a 83% confidence interval is used to visually assess statistical significance of differences at the p <5% level (Austin and Hux, 2002; Knol, Pestman and Grobbee, 2011).

To ensure robustness of these findings, two approaches were applied. Firstly, similar results of the regression analysis were found when bootstrapping was performed on the model with 1000 replications (see appendix C). Secondly, a Chow-F test was employed which determines whether there parameters are stable over time. This test is useful in identifying changes occurring before and after a specific time period. Looking at figure 4 there seems to be a cut-off point at 2014, with an increase in neighbourhood quality up until 2014 and a decrease after 2014. Consequently, the Chow-F test looked at this cut-off point and found a test statistic of 23.4212, surpassing the critical F value of 2.321 ($df1 = 10$; $df2 = 41265$) at $\alpha = 0.01$. Therefore, the null hypothesis can be rejected, and it can be concluded, at a 99% confidence interval, that the parameters are not stable over time, meaning that the changes that have affected the model are strong enough to constitute a break, before 2014 and after 2014, according to the Chow-f test (Brooks and Tsolacos, 2010). Thus, the results indicate that during the second half of the dataset (after the post-economic crisis period), starters experienced not less and also not more difficulties in attaining neighbourhoods with quality, while non-starters experienced more difficulties in attaining neighbourhoods with quality.

The primary hypothesis of this study posits that there is an (inverse) relationship between buyer type and the neighbourhood qualities they attain (H1). Moreover, it is anticipated that this inverse pattern will become more pronounced over time, leading to a progressively widening disparity between the neighbourhood quality of starters and those of non-starters (H2). The findings presented in this section find partial supporting evidence for these hypothesis. Firstly, the empirical analysis unequivocally confirms that starters and young homebuyers purchase homes in neighbourhoods characterized by lower qualities when compared to non-starters and older homebuyers. This is in line with literature, as starters and young homebuyers have less chances, through less capital, on the housing market, compared to non-starters and older homebuyers (Glaeser and Gyourko, 2018).

Secondly, contrary to initial expectations in literature (Jordà, Schularick and Taylor, 2016), the study reveals that starters go slightly up (from the beginning point) in neighbourhood quality over time, while non-starters are found to attain homes in neighbourhood with slightly lower qualities as compared to the initial years of this study. This could suggest that starters on the housing market are not having more difficulty on the housing market, while non-starters are having more difficulty. However taking into account that these results only represent people who buy a home, and not people who are trying to enter the housing market but cannot. Therefore, even though it could be that starters are less able to buy a house, -something this study does not capture, but when they do buy a house, this study shows they are not worse off in the last few years.

Thirdly, this study presents evidence for a slight decrease in the attained neighbourhood quality disparity between starters and non-starters. This finding suggests that starters are slightly better off in their neighbourhood quality attainment. As this study links neighbourhood quality to spatial inequality, this finding is unexpected as literature suggests an increasing spatial inequality trend between starters and non-starters was expected (Hamnett, 2019; Nijman and Wei, 2020).

4.2 Discussion

This study concerned the understanding of the societal relevance of the neighbourhood quality attained by starters and young homebuyers, and how this quality for starters and non-starters changes over time, in the context of the housing affordability crisis. This understanding contributes to the ongoing debate about reducing inequality, outlined in the United Nations' sustainable development agenda (UN DESA, 2022) and sheds light on the social significance of the crisis for young individuals, access to opportunities and spatial inequality and socio-segregation (Savage *et al.*, 2013; Piketty, 2014; Wetzstein, 2017; Nijman and Wei, 2020). By examining neighbourhood selection dynamics, this research provides insights into urban change and housing market dynamics.

The study's academic relevance lies in assessing differences in the level of neighbourhood quality attainment between starters and non-starters. Existing scientific literature explains that there is growing socio-spatial inequality and that the housing affordability crisis is a driver in this development (Savage *et al.*, 2013; Piketty, 2014; Wetzstein, 2017; Nijman and Wei, 2020). Recent studies highlight that increased house prices make it difficult for young adults to buy a house, let alone choose in which location they would prefer to live, and that the neighbourhood in which someone lives can impact their social mobility (Musterd, Ostendorf and De Vos, 2003; Chetty *et al.*, 2020). Although it is common knowledge that starters do not have equal chances on the housing market as compared to non-starters, who have accumulated wealth, there seems to be a gap in the literature regarding the neighbourhood attainment by starters compared to non-starters, in particular how this evolves over time (e.g. is there an increasing affordability gap which increases spatial inequality?; Hochstenbach and Arundel, 2020a). Additionally, literature stresses the importance of local-level research into inequality (Glaeser et al., 2009). Therefore, this study contributes empirical evidence and insights into the ongoing discussion surrounding housing market dynamics for starters in the province of Groningen, which could challenge existing theories.

The results of the current study diverge slightly from what was expected based on broader literature which suggests an increasing spatial inequality gap (Hamnett, 2019; Nijman and Wei, 2020). In this study, it was found that the disparity in attained neighbourhood quality decreased slightly between starters and non-starters between 2009 and 2018. This is different than expected, as this study links disparity in attained neighbourhood quality with spatial inequality (see introduction). Starters, despite the difficulties they faced buying a house after the Global Financial Crisis, such as stricter credit standards and increased competition of other buyers, exhibit a trend of increasing ability to move to neighbourhoods with quality up until 2015 (Xu *et al.*, 2015; Myers, Park and Cho, 2021; Coulter and Kuleszo, 2022). After 2015, this group sees a decreasing trend for the attainment of neighbourhoods with a quality, ending with no change across the span of 10 years. On the other hand, across the same 10 year period, non-starters exhibit a trend of decreasing ability to move to high-quality

neighbourhoods. When combining these results for the attained neighbourhood quality for starters versus non-starters, we observe a small reducing disparity (see figure 3).

To my knowledge, this study is the first to find a reduced disparity of attained neighbourhood quality between starters and non-starters at the local-level, which could indicate a first step towards the reduction of spatial inequality. It could provide valuable insight into the complex factors driving spatial inequality and inform policy discussions on affordable housing and social mobility. To give more insight into these factors, some potential deeper mechanisms that may explain the trend seen in this study are explained below (e.g. before and after 2015).

Firstly, after the Global Financial Crisis there were delays in moves and a general decline in homeownership (Myers, Park and Cho, 2021; Coulter and Kuleszo, 2022). The reduced competition could be a driving mechanism for the upward trend of starters that are able to buy homes in neighbourhoods with higher quality. However, around 2014, a clear turning point is observed with an increase in property transactions (CBS, 2018a; Tu, de Haan and Boelhouwer, 2018a). The government, through the housing agreement (Woonakkoord), introduced various measures aimed at revitalizing the housing market. This brought about a transformation in the housing market, leading to heightened buyer competition after 2014, whereby starters are only able to buy homes in neighbourhood with less quality again. This mechanism could explain (part) of the trend seen in this study.

Secondly, general economic conditions can impact the attained neighbourhood quality gap between starters and non-starters. In the years following the financial crisis, when particularly those with large investment portfolios were hit the hardest, the Dutch economy gradually started to recover. So, prior to 2015, starters may have experienced less competition for homebuying and they may have been able to compete in the higher-status neighbourhoods. By 2015, there were signs of improvement, with a return to positive economic growth and declining unemployment rates. After 2015, the Netherlands continued to experience modest economic growth (Rijksoverheid, no date). This may mean that from 2015, a wide range of potential buyers suddenly felt more positive about their economic future, and ventured onto the housing market once again. This effect could have led to increasing competition, where homebuyers, both starter and non-starter, were less able to pay a quality for the more sought-after neighbourhoods.

Thirdly, changing preferences could impact where people buy a house. For example, changing preferences may arise due to shifts in lifestyle choices, where younger generations may prioritize proximity to urban centres, access to public transportation, walkability, or sustainable features (all aspects of a neighbourhood with a quality). In addition, starters and young homebuyers might be more open minded than older homebuyers and think ahead to which neighbourhoods are upcoming. This

could be an explanation for the 10-year trend where starters and young homebuyers do not decrease in attained neighbourhood quality, while non-starters and older homebuyers do.[10]

Limitations and future research

The findings of this study have to be seen in light of some limitations. A first limitation concerns the link between spatial inequality and the current study's dependent variable, neighbourhood quality. While it was assumed that these constructs are closely related, there is no literature that confirms this link directly. Therefore, the conclusion regarding the findings related to spatial inequality in the current study should be interpreted with some level of caution. Future research could benefit from assessing this link, which if found, would open the door for research in other contexts or time-periods with data on neighbourhood quality.

A second limitation concerns this study's limited number of housing and neighbourhood control variables. While price per square meter can be used as a measure of property quality (which was used to calculate neighbourhood quality), there are other factors that can influence this as well. While the inclusion of other control variable could have given a more accurate representation of property quality, these data were not available. Future research could benefit from more detailed datasets that include various factors that influence property quality.

The observations in this dataset are not independent, as individuals are nested within neighbourhoods. A limitation is that this study does not use multilevel analysis to account for this dependence of observations. While this method is recommended for similar future studies as it accounts for more detailed insights into hierarchical and/or unbalanced data (Bryan and Jenkins, 2016; Oshchepkov and Shirokanova, 2022), performing a full multilevel modelling analysis goes beyond the scope of the current study.

[10] This study tried to see if there is a change in neighbourhood preference through a post-hoc analysis. The analysis shows which neighbourhoods went up in average price per square meter after 2015 compared to before 2015, and which neighbourhoods did not. These values range from -€1126.972 price per square meter to +€1010.371 price per square meter (see appendix D for a list of the average change). To investigate if starters and young homebuyers preferred upcoming neighbourhoods (where prices per square meter increased), a multiple linear regression was held (regression assumptions were checked and met; see appendix E and F for the regression table). The findings indicate that starters, compared to non-starters, were less likely to buy a house in upcoming neighbourhoods (β = -2.77, Robust S.E. = 1.44, p = 0.054). When adding age categories, instead of young versus old homebuyers, the effect was even more pronounced for starters (β = -4.39, Robust S.E. = 1.49, p = 0.003). However, the findings suggest that the young age category (<30) more often buy a house in upcoming neighbourhoods compared to buyers with the age of 41-60 (β = -3.41, Robust S.E. = 1.74, p = 0.049). Thus, this post-hoc analysis finds mixing evidence for this 'changing preference' mechanism, which indicates further research is needed to investigate this.

The timeframe of this study could be seen as a limitation. The 10-year time period this dataset holds might not be extensive enough for a comprehensive analysis on spatial inequality. Additionally, this study looked at the time period just after the Global Financial Crisis which most certainly has impacted the results. The post-Global Financial Crisis period is insightful as a form of natural experiment, but it is not generalizable to all other periods. Future research could consider longer study periods or compare different time periods, such as pre-financial crisis and post-pandemic periods. By expanding the temporal scope, researchers can gain a more comprehensive understanding of the dynamics of neighbourhood quality and their evolution over time.

Due to limited access to data, this study could not make an in-depth analysis of starters' social mobility and geography of opportunity. It would be interesting to further investigate these theories, by incorporating more buyer characteristics. For instance, exploring the buyer's previous neighbourhood quality could suggest if they went up or down in neighbourhood quality (promoting the Social Mobility theory). Additionally, investigating the instantaneous effect of point-in-time measures could be of essence, as studies of neighbourhood effects and poverty do not solely depend on the current neighbourhood but also on the neighbourhood history. Considering whether the homebuyers received financial assistance, such as the Dutch "Jubelton", from their parents, can shed light on intergenerational wealth dynamics (promoting the Geography of Opportunity theory).

While the current study employed a phenomenon-driven research approach, focusing on observing and understanding the existing dynamics of starters in the housing market, future research could adopt a normative approach. By identifying necessary steps to achieve greater affordability for starters, a normative approach can explore potential solutions and promote better social mobility through neighbourhood attainment across generations. Unaffordable housing can have long-term effects passed down through generations, emphasizing the need for research to address affordability concerns and explore potential solutions and promote better social mobility through neighbourhood attainment across generations.

It would be valuable to analyse psychological determinants of neighbourhood qualities, such as the desirability of neighbourhoods, which this study was not able to capture. It would be interesting to investigate if the use of "neighbourhood desirability", a psychological preference measure, (instead of neighbourhood quality) gives the same outcome and it can give further insights into the dynamics of neighbourhood attainment between starters and young homebuyers and non-starters and older homebuyers.

While this study focused on the changing landscape for starters in the province of Groningen, it would be intriguing to extend the analysis to other parts of the Netherlands. Comparing multiple cities can provide valuable insights and highlight differences between these locations. This in turn could give insight into the characteristics of different cities, and their relationships with equality and social mobility, which could lead to policy advice to promote equality across all cities. In addition, as the

province of Groningen is a small province with not much variation between neighbourhoods, this could limit the generalization of this study.

Lastly, as discussed in the previous section, mechanisms impacting the attained neighbourhood quality for starters, could be access to capital, general economic conditions and changing preferences. The first two factors are beyond the influence of real estate professionals and policy makers. While studying the role of changing preferences could provide a mechanism for policy intervention, it has received little empirical attention. Understanding and making use of preference dynamics could potentially be key in creating more equal neighbourhoods and reducing spatial inequality (e.g. by selectively improving neighbourhood amenities as a means to change perceptions of lower-status neighbourhoods). Given the post-hoc analysis in this study, further investigation into changing preferences would be valuable to make a statement about this. For example, future research could focus on exploring the reasons behind the substantial increase in qualities observed in specific neighbourhoods. Conducting in-depth case studies in neighbourhoods that have experienced the most significant changes in quality can shed light on the underlying causes. Through these case studies, researchers can identify the specific factors contributing to quality changes and explore potential strategies to promote greater equality among neighbourhoods, or to boost social mobility. Understanding the drivers of changes in neighbourhood quality can inform efforts to create more balanced and inclusive neighbourhoods.

5. Conclusion

The housing affordability crisis has emerged as a pressing issue, where housing-related expenses increase more rapidly than wages. Starters is one of the vulnerable groups that is most affected by unaffordable houses. Analysing the changing landscape of buyer type and attained neighbourhood quality may lead to valuable information about the placement of starters, and inform potential strategies for creating more mixed neighbourhoods, and wider abilities to move between neighbourhoods, through public policies. Therefore, this study aims to examine the relationship between buyer type and the attained neighbourhood quality, how this relationship is affected by age, and how it has changed over time. Understanding neighbourhood quality carries societal value, as neighbourhood quality influences social and economic opportunities available to its residents. Additionally, it holds academic relevance as there seems to be a gap in literature about neighbourhood attainment for starters.

To address this gap in the literature, the study focuses on analysing a local-level market; the province of Groningen. The empirical analysis confirms the expectations that starters and young homebuyers tend to purchase homes in neighbourhoods with lower qualities compared to non-starters and older homebuyers. Though, the attained neighbourhood quality of starters did not decrease over the ten-year study period, while it did decrease slightly for non-starters. As such, this study's investigation into the changes of the neighbourhood quality disparity between starters and non-starters presents a unexpected trend. It answers the main research question, where a decreasing disparity in attained neighbourhood quality between starters and non-starters is seen.

These findings contribute to the ongoing debate of starters chances on the housing market. By examining the dynamics of neighbourhood selection and disparities, this research provides insights into urban change and housing market dynamics. I suggest that mechanisms impacting the described trend could be access to capital, general economic conditions and changing preferences. While the first two factors lie (mostly) beyond the influence of real estate professionals and policymakers, they may be able to influence and make use of changing preferences in creating more equal neighbourhoods. This idea has received limited empirical attention, and more research on this topic is needed, in order to comprehend better the interplay between the mechanisms affecting neighbourhood quality attainment, which could help reduce inequality.

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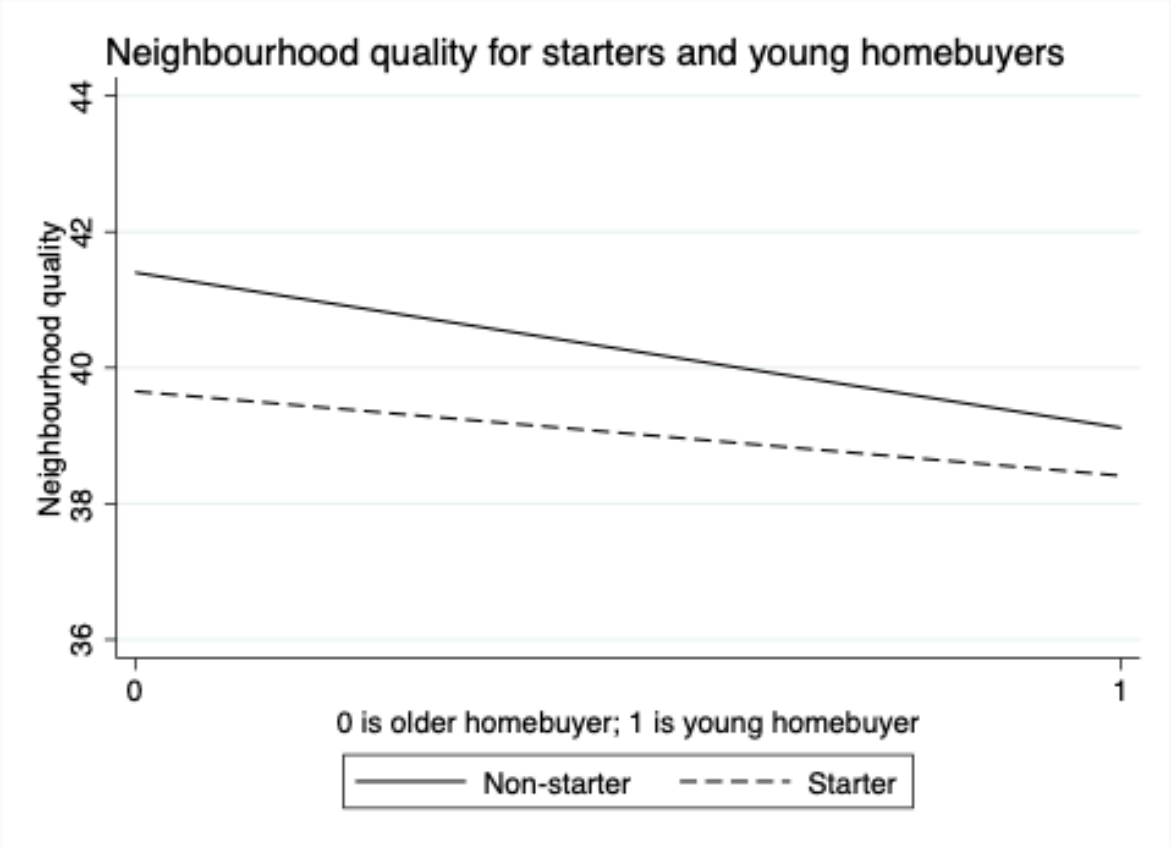
Appendix A: Multiple linear regression without clustering

	Model					
Neighbourhood quality	**1**	**2**	**3**	**4**	**5**	**6**
Intercept	41.22***	41.41***	40.97***	41.46***	41.56***	47.63***
	[.095]	[.097]	[.27]	[.36]	[.36]	[.45]
Household factor						
Starter	-2.37***	-1.04***	-1.21***	-2.31***	-2.73***	-2.32***
	[.15]	[.19]	[.19]	[.53]	[.55]	[.39]
Young buyer		-2.33***	-2.31***	-2.30***	-3.12***	-2.33***
		[.20]	[.20]	[.20]	[.33]	[.23]
Transaction year						
2010			.98***	.71	.69	.22
			[.37]	[.50]	[.50]	[.37]
2011			1.31***	1.17*	1.15*	.56
			[.37]	[.50]	[1.15]	[.37]
2012			.68	.75	.74	.65
			[.37]	[.52]	[.52]	[.39]
2013			1.25***	1.29*	1.25*	.50
			[.38]	[.52]	[.52]	[.39]
2014			2.04***	1.74***	1.70***	1.04*
			[.35]	[.48]	[.48]	[.370018]
2015			1.17***	.62	.57	-.047
			[.34]	[.46]	[.46]	[.35]
2016			.58	-.30	-.35	-.24
			[.33]	[.44]	[.44]	[.33]
2017			-.17	-1.10*	-1.14**	-.41
			[.32]	[.43]	[.43]	[.32]
2018			-1.30***	-2.00***	-2.05***	-.75*
			[.33]	[.43]	[.43]	[.32]
Starter x Young buyer					1.24**	1.28***
					[.41]	[.29]
Starter x Transaction year						
1 2010				.60	.61	.099
				[.74]	[.74]	[.52]
1 2011				.23	.27	-.19
				[.74]	[.74]	[.52]
1 2012				-.17	-.15	.097
				[.75]	[.75]	[.54]
1 2013				-.13	-.06	.42
				[.76]	[.76]	[.55]
1 2014				.64	.76	.58
				[.71]	[.71]	[.52]
1 2015				1.24	1.34	.80
				[.69]	[.69]	[.49]
1 2016				2.17***	2.27**	1.23*
				[.67]	[.67]	[.48]
1 2017				2.42***	2.51***	1.21*
				[.66]	[.66]	[.48]
1 2018				1.81***	1.89**	.77
				[.66]	[.66]	[.49]
Homebuyer count						1.89***
						[.11]

Property type						
2						-3.96***
						[.22]
3						-3.59***
						[.21]
4						-3.49***
						[.17]
5						-6.96***
						[.20]
6						-3.78***
						[.50]
Construction year						-.02***
						[.00]
Neighbourhood factor						
Rural / Urban						14.49***
						[.15]
N	41,385	41,385	41,385	41,385	41,385	41,385
Prob > F	0.00	0.00	0.00	0.00	0.00	0.00
Adjusted R-squared	0.01	0.01	0.01	0.01	0.01	0.47

Appendix B: Margins plot for neighbourhood quality of starters and young homebuyers



Appendix C: Multiple linear regression with bootstrapping (model 6)

Neighbourhood quality	
Intercept	75.98***
	[3.42]
Household factor	
Starter	-3.30***
	[.43]
Young buyer	-2.29***
	[.26]
Transaction year	
2010	.18
	[.39]
2011	.47
	[.38]
2012	.41
	[.42]
2013	.56
	[.42]
2014	1.05**
	[.40]
2015	.23
	[.36]
2016	-.11
	[.36]
2017	-.36
	[.35]
2018	-.68*
	[0.34]
Starter x Young buyer	1.05**
	[.33]
Starter x Transaction year	
1 2010	.55
	[.58]
1 2011	.23
	[.57]
1 2012	.53
	[.58]
1 2013	.60
	[.61]
1 2014	1.18*
	[.57]
1 2015	1.24*
	[.53]
1 2016	1.80*
	[.53]
1 2017	1.81**
	[.53]
1 2018	1.24*
	[.52]
Homebuyer count	
2	2.51**

	[.12]
3	-.40
	[.67]
Property type	
2	-4.75***
	[.23]
3	-1.01***
	[.23]
4	-3.78***
	[.17]
5	-4.74***
	[.22]
6	.32
	[.48]
Construction year	-.02***
	[.48]
Neighbourhood factor	
Rural / Urban	16.61***
	[16]
N	41,385
Replications	1000
Wald chi2(30)	36762.34
Prob > chi2	0.00
Adjusted R-squared	0.37

Appendix D: Change in house price per square meter between 2 time periods, for each neighbourhood in the province of Groningen (2015-2018 and 2009-2014)

Neighbourhood	**Change**
Verspreide huizen in het noordwesten	-1126.972
Verspreide huizen Aduard	-855.9199
Rasquert	-786.5966
Onstwedde Buitengebied Noord	-624.7832
Lauwersoog	-562.6027
De Haspel	-532.6603
Losdorp	-522.1768
Verspreide huizen Stedum inclusief Startenhuizen	-477.6292
Verspreide huizen op de Hondsrug	-443.145
Den Andel	-389.8966
Verspreide huizen Lutjegast	-337.3867
Noorderhoogebrug	-329.7971
Verspreide huizen ten noorden van Jonkersvaart	-270.0342
Pieterburen	-264.3984
Delfzijl-Centrum	-257.0178
Eexta-Zuid	-256.9412
Zuidwending	-252.4254
Thesinge	-251.7594
Termunten	-230.6928
Veendam-Centrum	-219.1244
Noordwijk	-215.7517
Lauwerzijl	-205.7112
Hoornse Park	-173.8125
Garnwerd	-160.2284
Hemmen	-156.6428
Ezinge	-153.661
Den Horn	-140.0281
Holwierde	-138.2897
Nieuwolda	-136.1374
Kruisweg	-135.2958
Warffum	-132.1791
Godlinze	-126.9643
't Waar	-123.6429
Kopstukken	-110.8491
Verspreide huizen Beerta	-106.9258
Beerta-Centrum-West	-105.9529
Vledderveen	-102.995
Saaksum	-91.61963
Bierum	-88.76434
Nieuweweg	-86.8811
Adorp	-85.54163
Winschoten-industriegebied	-84.67151
Wehe-Den Hoorn-West	-77.67133
Farmsum	-76.66956
Ulrum	-76.09387
Spijk	-74.57507
Maarswold	-72.11279
Delfzijl-West	-70.97815
Maarsstee	-68.59949
Houwerzijl	-66.56519
Visvliet	-66.10309
Leens	-66.07227
Nienoordsrand	-65.2467
Verspreide huizen Bierum	-61.2287
Scheemda	-60.78503
Nieuweschans Nieuwbouw	-59.46332
Stedum	-55.62952
Nieuweschans De Bron	-52.91101
Tuikwerd	-51.18433
Verspreide huizen Termunten	-49.93311
Verspreide huizen ten noorden van het Damsterdiep	-49.4801
Eexta	-49.37732
Waterland	-46.0697
Villabuurt	-44.22705
Winschoten-Sint Vitusholt-Lanengebied	-43.03699
Noordhorn	-42.84521
Oostwold	-41.12073
Verspreide huizen 't Zandt	-37.49829
Woldendorp	-36.47626
Baflo	-36.31323
Uithuizen	-29.56152
Finsterwolde Ganzedijk	-28.48755
Kloosterburen	-27.14886
Finsterwolde-Centrum	-26.75305
Meedhuizen	-21.9126
Midwolda	-21.2688
De Hagen	-20.94739
Appingedam-West	-19.61316
Stadskanaal Noord Centrum	-18.2627
Voorveld	-14.74438
Stadskanaal Noord	-12.88855
Loppersum	-12.32056
Borgercompagnie (gedeeltelijk)	-11.68726
Hornhuizen	-11.05139
Delfzijl-Noord	-5.979248
Uithuizermeeden	-5.603027
Opende-West	-2.965088
Winsum	-1.880371
Jonkersvaart	-1.291748
Appingedam-Centrum	-1.214478
Alteveer Buitengebied	-.0814209
Verspreide huizen Baflo	.4023438
Stadskanaal Centrum	1.603149
Veendam-Sorghvliet	3.728882
Verspreide huizen ten noorden van de Wilp	5.314697
Fivelzigt	7.707397
Ripperda	10.9519
Grijpskerk	11.55798
Vinkhuizen-Noord	11.90186
Veendam-Oude Ae	12.71875
Drieborg-Centrum	15.62646
Nieuweschans-Centrum	19.60162
Niekerk	20.52222
Ten Boer	21.29785
Eenrum	22.54333
Appingedam-Oost	23.00256
Maarsveld	23.19727
Kornhorn	25.3186
Niezijl	25.67712
Winschoten-Bomenbuurt	26.78638
Westerlee	27.46021
Boven-Wildervank	28.36316
Oldehove	28.3844
Rodenburg en omgeving	29.18323

Niehove	33.79724
Usquert	33.84753
Potmaar	39.89185
Briltil	40.21936
Garrelsweer	40.4292
Nieuwe Pekela	43.51636
Diepswal	43.92664
Kantens	44.70044
Termunterzijl	45.29865
Sint Maheerdt	45.84631
Industriegebied Vleddermond	46.17297
Parkwijk	46.53064
De Brake	48.35779
Winschoten-Noord	48.99963
Buitenwoel	52.00305
Onstwedde	54.755
Winschoten-Zuid	55.02966
Scheemdermeer	56.01465
Garmerwolde	57.24072
Wildervank	57.80115
Oosteinde	61.94043
Kommerzijl	63.22693
Holte	64.30127
Beerta-Nieuwbouw	68.84491
Opende-Oost	69.10876
Vogelwijk en De Borgen	70.3324
De Linie	71.34814
Beerta-Centrum	75.00189
Damsterbuurt	75.10327
Middelstum	77.23718
Zeerijp	78.43872
Verspreide huizen ten noorden van het Eemskanaal	79.25598
Zoutkamp	81.87341
Wehe-Den Hoorn-Oost	82.22302
Onderdendam	83.46106
Doezum	83.62537
Wagenborgen	84.73035
Bedum	84.7749
Beijum-West	85.82397
Niesoord	85.86487
Oosterpoort	86.77563
Dideldom	87.09424
Grootegast	87.22205
Lewenborg-West	88.06738
Bebouwde kom Zevenhuizen	90.80554
Verspreide huizen Kantens	90.99646
Europapark	91.00964
Ten Post	91.65308
Musselkanaal Zuid	91.81616
Beijum-Oost	93.60059
Niebert	95.48792
De Wilp (gedeeltelijk)	95.49182
Stadskanaal Noord Landskant	98.11023
Veendam en omgeving station	98.68115
Noordwolde	98.93713
Verspreide huizen Zuidhorn	100.7888
Zeeheldenbuurt	103.4124
Lutjegast	105.7277
Musselkanaal Noord	105.745
Boven-Pekela	106.4304
Feerwerd	106.6617
Heiligerlee	106.7867
Musselkanaal Centrum	108.0587
Klein Martijn	109.2898
Veendam-Zuid	109.3282
De Hunze	112.7347
Alteveer	115.2615
Harenermolen	115.917
Oude Pekela	115.9879
Aduard	116.2365
Marum	116.7729
Warfhuizen	117.0104
Zuidhorn	117.562
Verspreide huizen	118.6016
Ommelanderwijk	118.6563
Verspreide huizen Oldekerk	121.6758
Hoogkerk-Zuid	124.0844
Verspreide huizen Eemskanaal (ten zuiden)	126.6232
Oosterhoogebrug	131.4254
Ulgersmaborg	131.6504
Buitengebied ten westen van Zevenhuizen	133.0712
De Held	136.6379
Selwerd	137.4708
Reitdiep	139.4475
Mussel	139.8215
Sauwerd	144.7941
Buitengebied ten zuiden van Leek	149.1735
Gravenburg	150.0104
Helpman	150.2795
Lewenborg-Noord	150.7437
Lewenborg-Zuid	151.2076
Obergum	151.2695
Winschoten-Grintweg	151.5226
Binnenstad-Noord	152.6455
Verspreide huizen Bedum	154.5643
Winschoten-Centrum	154.5817
Verspreide huizen Damsterdiep en Eemskanaal	156.6501
Centrum Leek en omgeving	159.1576
Florabuurt	160.5327
Ruischerbrug	162.4688
Van Starkenborgh	164.5615
Roodeschool	170.198
Haren	170.2576
Hoogkerk Dorp	171.3322
Veendam-Middenweg en omgeving	172.9952
Vierhuizen	174.5724
Paddepoel-Noord	174.577
Kostverloren	174.9691
Nuis	176.1427
Corpus den Hoorn	177.6487
Ruischerwaard	179.2446
Indische buurt	179.9091
Hoornse Meer	180.3328
De Wijert-Zuid	181.618
Oranjebuurt	184.4396
Laanhuizen	185.379
Wirdum	185.5638
't Zandt	187.059
Verspreide huizen Grijpskerk	187.7601
Sebaldeburen	190.4244
Piccardthof	192.3154
Verspreide huizen Leens	193.679
Oldekerk	195.0276
Oosterhaar	198.8109
Bebouwde kom Enumatil	201.8772

Finsterwolde nieuwbouw	202.2023
Finsterwolde Hardenberg	202.8139
Binnenstad-Zuid	206.2798
De Wijert	206.3396
Westeremden	211.3202
Gorechtbuurt	213.0543
Noordlaren	214.2263
Zilvermeer	220.8125
Garsthuizen (gedeeltelijk)	221.1422
Nieuw-Scheemda	223.0955
Schildersbuurt	227.6443
Ceresdorp	231.2362
Professorenbuurt	233.9354
Zandeweer	240.3823
Vinkhuizen-Zuid	242.7947
Keuningswijk	243.5288
Drielanden	243.5361
Nieuw-Beerta	245.8234
Oudeschip	248.9929
Zuidwolde	256.7833
Leermens	260.0891
Coendersborg	260.416
Bareveld	261.8013
Verspreide huizen Adorp	261.9535
De Buitenhof	263.0416
Woltersum	267.0229
Tuinwijk	275.3608
Bebouwde kom Tolbert	276.2311
Stationsgebied	282.3994
Noorderplantsoenbuurt	290.8464
Badstratenbuurt	295.7057
Engelbert	307.7491
Paddepoel-Zuid	312.5518
Hortusbuurt-Ebbingekwartier	318.7887
Sterrebosbuurt	321.1091
Sint-Annen	323.134
Verspreide huizen Uithuizermeeden	335.7286
Onstwedde Buitengebied Zuid	339.2069
Verspreide huizen ten zuiden van Opende	348.9979
Bloemenbuurt	349.6287
Herewegbuurt	353.5685

Verspreide huizen Ezinge	356.4736
Verspreide huizen ten zuiden van Sebaldeburen	361.3422
Buitengebied Tolbert	367.6699
Bangeweer	371.7209
Verspreide huizen Winschoten	381.3204
Grunobuurt	384.3741
Onnen	390.7571
Bebouwde kom Oostwold	405.1073
De Hoogte	413.7813
Glimmen	419.2233
De Meeuwen	430.3535
Verspreide huizen Finsterwolde	433.391
't Lage van de Weg	464.6024
Westernieland	486.8308
Verspreide huizen in het noordoosten	498.4532
Vierverlaten	505.1934
Rivierenbuurt	520.4586
Binnenstad-Oost	521.7874
Verspreide huizen Midwolda	530.3571
Pieterzijl	555.0695
Vogelbuurt	571.6106
Verspreide huizen Onner Esch	656.0645
Boerakker	672.2017
Kop van Oost	751.0913
Binnenstad-West	771.9271
Paterswolde (gedeeltelijk)	1010.371

Appendix E: Post-hoc analysis (multiple linear regression): Do starters move to neighbourhoods with house price increases?

House price increase	
Intercept	-823.99***
	[4.02]
Starter	-2.63*
	[1.52]
Young buyer	.25
	[1.59]
Urban / Rural	124.51 ***
	[1.57]
Homebuyer count	3.82***
	[1.21]
Property type	
2	-29.07***
	[2.12]
3	-34.20***
	[2.36]
4	-27.55***
	[1.77]
5	-39.90***
	[2.19]
6	-27.12***
	[5.40]
Construction year	-.22***
	[.02]
N	41,385
Prob > F	0.00
Adjusted R-squared	0.32

Note: Dependent variable is the house price increase in euro's after 2015 (2015-2018) compared to before 2015 (2009-2014). The key independent variables are starter (vs non-starter) and young homebuyer (vs older homebuyer).
***, **, and * correspond to significance level of <1%, 5% and 10% respectively.

Appendix F: Post-hoc analysis (multiple linear regression): Do young homebuyers move to neighbourhoods with house price increases?

House price increase	
Intercept	-823.99***
	[4.02]
Starter	-4.20***
	[1.49]
Age category	
31-40	.25
	[1.59]
41-60	-3.03*
	[1.73]
>60	-3.94
	[2.50]
Urban / Rural	123.99***
	[1.54]
Homebuyer count	3.70 ***
	[1.20]
Property type	
2	-30.38***
	[2.13]
3	-35.36***
	[2.37]
4	-28.64***
	[1.79]
5	-40.88***
	[2.54]
6	-28.09***
	[6.80]
Construction year	-.22
	[.02]
N	41,385
Prob > F	0.00
Adjusted R-squared	0.32

Note: Dependent variable is the house price increase in euro's after 2015 (2015-2018) compared to before 2015 (2009-2014). The key independent variables are starter (vs non-starter) and age category (reference category =<30).

***, **, and * correspond to significance level of <1%, 5% and 10% respectively.