



How New Housing Supply Affects The Vacancy Chain Mechanisms in Fryslân

Student: Lina Al Najar
S3722848
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University of Groningen
Campus Fryslân
Bachelor Global Responsibility & Leadership
GRL supervisor: Ofer Engel / Valentina Gallo
Statistics Netherlands supervisor: J.R. Hitzert

Abstract

The Netherlands is facing a housing shortage, prompting the government to build almost 1 million houses in 10 years. This study examines the impact of new housing on vacancy chain patterns in Fryslân using register data from Statistics Netherlands. Housing vacancy chains are sequences of moves that begin when a house first enters the market, such as through new construction, and end when no more houses become available for further moves. The findings reveal that the ownership dynamics in the chains fluctuate, with initial chains seeing more households moving from renting to owning in the early chains and this trend being reversed in later chains. Single-person households dominate all chains, challenging assumptions about their prevalence in cheaper housing chains. The study also identifies a shift from larger, more expensive houses in early chains to smaller, more affordable ones later. Household composition in Fryslân reflects national trends of increasing single-person households, but contrary to income-based expectations, they do not consistently move into smaller homes as they become available. This suggests Fryslân's single-person households are mobile and flexible in their housing choices, not limited to renting over owning.

Keywords: *Housing vacancy chains, Netherlands*

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1. Introduction

Currently, the housing market is considered one of the major challenges in the Netherlands. There is a huge shortage of housing partly due to the growing population, long construction procedures and limited building land. This makes it difficult for many people to find a home that suits their needs and capabilities (e.g. budget) (Ministerie van A.Z., 2023). It is also indicated by De Nederlandse Bank that housing prices are caused to rise by the low interest rates, which are being maintained at high levels by the tax benefits and the ability to borrow large amounts of money (compared to other countries) (DNB, n.d.). The lack of flow of elderly from larger to smaller houses was identified as another major cause of the current housing problem by the majority of municipalities. If this flow were to improve, more households would be able to find their desired homes (Parre, 2021). Another major cause would be the increase in single-person households and the decrease in household size. Between 1947 and 2017, the percentage of single-person households grew from 5% to 22% (Statistics Netherlands, 2018), while the household size decreased from 3.49 persons in 1964 to 2.11 in 2024 (Statistics Netherlands, n.d.). Because the household composition is steadily changing in this pattern, there is an increased need for small and affordable housing for small families and single-person households. Especially in cities, there is a huge shortage of this kind of housing. The number of households is rising faster than the housing stock (Ministerie van A.Z., 2023).

In 2021, the housing shortage in the Netherlands rose to 279,000. This is expected to rise further to 317,000 homes in 2024 (Ministerie van A.Z., 2023). In the Netherlands, the municipalities are in charge of supervising housing construction and making agreements with housing corporations in this regard (Ministerie van B.Z.K., 2012b). The provinces in turn oversee the municipalities. The municipalities have their budgets and

financial statements approved each year by the provincial executive (Ministerie van B.Z.K., 2012a). Since the housing issue has an impact on different types of citizens in the Netherlands, from newcomers to senior citizens, it has become an important part of election manifestos and debates in the House of Representatives. In order to take more control of the public housing task and the organisation of the Netherlands, the government decided to take more responsibility in this matter by appointing a Minister, Hugo de Jonge (Rijksoverheid, 2022), for public housing and spatial planning. In addition, in the new coalition agreement "*Looking out for each other, looking ahead to the future*", the current Dutch governing parties assert their plans to accelerate the building of new homes to around 100,000 a year. Up until 2030, the government plans to build 981.000 new dwellings. Of these 981.000, two-thirds should be affordable for low- and middle-income earners (Ministerie van A.Z., 2023).

The housing market in the Netherlands is complicated, and the opinions on how to solve it are divided. A few of these aspects, like demand not matching supply, increase in housing prices, and the lack of flow of households (usually elderly), constitute significant issues in this context. Therefore, there is a clear need to investigate these aspects in terms of research and policy development in order to resolve this ongoing problem. Since the provinces have to approve the plans for building houses, it is a good idea to look at provinces as a whole to determine housing policy. Fryslân is an interesting province to look at since it has a higher percentage of owner-occupied housing units compared to the national average while at the same time being around 25% cheaper than the national average. Housing costs for rental houses are lower in Fryslân compared to the rest of the Netherlands as well (Moerman, 2023).

Moving homes allows for people to decrease the disparity between desire and reality and is therefore a means in order to achieve that goal (Van Kempen et al., 2005). Depending on the type of housing unit that becomes available for buyers/renters, it could cause a chain of moving households that are also looking for a suitable house. This flow of households can cause a vacancy chain mechanism. Resource distribution by means of vacancy chains can happen when these resources are capable of being used again, for example, for houses. This was studied in hermit crabs, which reallocate their shells that constitute “housing units”, by either synchronous or asynchronous vacancy chains (Chase & DeWitt, 1988).

When a household moves into a vacant housing unit, in most cases, they leave a vacant house behind, which in turn allows another household to move into that house. This concept is called a vacancy chain mechanism and is not only reserved for housing units. In fact, it was first studied using job vacancies (see Figure 1).

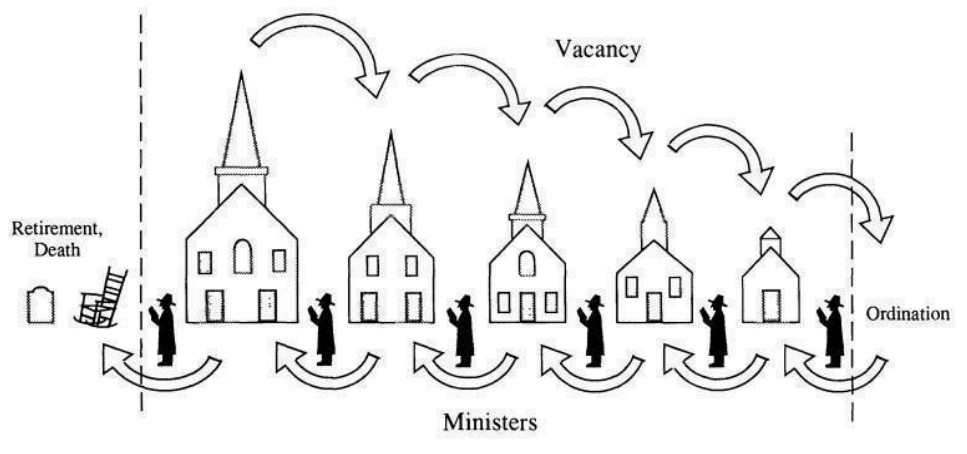


Figure 1: Sample vacancy chain from the Methodist Church (White, 1970)

There is currently insufficient insight into the effect of new construction on the flow in the regional housing market, therefore the Municipality of Groningen commissioned Statistics Netherlands (SN) to investigate this. The results of this research have been a

primary exploration which has brought up new focus points that could elevate the quality of the housing program by ensuring everyone gets the housing they need. One example is to focus on the types of homes people move into. The type of home can specify more about the flow of households and in turn help elevate the quality of the municipality's housing program (Statistics Netherlands, 2021). A "smooth" flow is of great importance for the proper functioning of the housing market. Households that move on to a new home have the opportunity to adapt their living situation to their housing needs and income, which in turn frees up (cheaper) houses that are suitable for first-time buyers (Renes & Jókövi, 2008).

Statistics Netherlands decided to continue this methodology to look into the province of Fryslân to gain more information on that region as well. Since 2016, Fryslân's population has increased again, after having declined between 2011 and 2016, by several hundred inhabitants every year due to positive foreign and domestic migration. The latter means that more people from the rest of the Netherlands settle in Fryslân than leave. Fryslân is facing a changing population composition: dejuvenation and ageing. Dejuvenation means a decrease in the share of children and young people in the total population. Ageing means an increase in the share of seniors in the population. Especially in the past decade, the number of births has fallen sharply. There are now almost 10,000 fewer children and young people (0-24 years old) living in Fryslân than ten years ago. At the same time, the number of citizens over 65 in Fryslân has increased significantly: from 16% of the population in 2004 to 23% in 2024 (Hutjes, 2024). In order to have a housing policy that fits with the changing population, it is important to look into new housing supply in the province of Fryslân and investigate the corresponding vacancy chains that arise.

The main focus of this study is to understand how the availability of new housing impacts vacancy chain patterns in the Fryslân province. Moreover, it aims to investigate how different types of newly supplied homes influence these vacancy chain dynamics. Through an analysis of the features of newly supplied housing, this research aims to provide insights into housing trends and suggest ways to improve the fairness and effectiveness of housing distribution. More specifically, the focus will be on vacancy chain mechanisms that start through new housing construction. Therefore, my main research question is: *How does the new housing supply affect the vacancy chain mechanisms in the province of Fryslân?* With the sub-questions being:

1. *SQ1: What are the ownership dynamics (owning vs. renting) in each chain?*
2. *SQ2: What are the household compositions in Fryslân in each chain?*
3. *SQ3: What are the housing unit characteristics of the left behind and newly inhabited houses?*

The income per different type of household differs and therefore different types of households have different means and needs in order to achieve their goal of moving to a desired house. Therefore, it is safe to assume that an average household consisting of at least three people (parents and children) has more means to buy or move into more expensive or bigger houses (Huisink, 2023; EMTG, 2021). On the other hand, single-person households have less income and therefore will not be able to move into e.g. a semi-detached house (*hypothesis 1*) (Renes & Jókövi, 2008).

People move more in accordance to changes in life stages such as finishing school, marriage, divorce, new job, retirement, children leaving home, the loss of a spouse, or disability (Hansen & Gottschalk, 2006). This might be less common among retired

individuals who are in good health (Kallan, 1993; Robison & Moen, 2000; Chevan, 1995). Another big reason people move is space shortage. Families want larger homes in order to tend to a growing family, while older families can feel that they have too much space (Morris, Crull, & Winter, 1976; Pickvance, 1973). Being in a big house might be less of a concern for people in later life stages (Abu-Lughod and Foley, 1960). This can result in a variety of household composition across the vacancy chains (*hypothesis 2*).

A previous study indicated that there are a lot of merits to increasing the supply of market-rate housing. This is because when new, costly residences get occupied by high-income households, they also help middle- and low-income households through a vacancy chain mechanism by leaving cheaper housing units behind (see section 2.2 *Previous research*) (Bratu et al., 2021). As mentioned earlier, this “smooth” flow could help free up (cheaper) houses that are suitable for first-time buyers (Renes & Jókövi, 2008). Therefore, I expect there to be more expensive housing units at the beginning of the vacancy chains while more affordable housing units become available further down the chain (*hypothesis 3*).

The present study comprises five chapters designed to methodically explore different aspects of vacancy chain mechanisms in Fryslân. Through rigorous analysis and interpretation of empirical data, the study aims to uncover trends in housing mobility, identify factors shaping vacancy chain dynamics, and contribute valuable insights to the existing body of knowledge on the housing situation in Fryslân.

2. Literature Review

The following literature review will focus on previous research done on vacancy chains, vacancy chain mechanisms, discuss two possible methods used to analyse them and finally discuss implications for policy.

2.1 Vacancy Chain Mechanisms

First, it is necessary to gain a comprehensive understanding of vacancy chain mechanisms, which is paramount in unravelling the dynamics of housing mobility and assessing the impact of new housing supply on local housing markets. Vacancy chains represent a sequential process wherein the movement of households from one dwelling to another creates a cascade of housing transitions within the market. The concept of vacancy chains extends beyond housing units and can encompass various resources, such as jobs or even natural habitats (Rotjan et al., 2010). At its core, a vacancy chain begins with the creation of a vacancy, triggered by events such as relocation, retirement, or natural turnover, and progresses through a series of successive moves until equilibrium is reached (White, 1971).

To explain this process further, let's take a look at the following example. Let's say that a family (household 1) moves into a newly built house with 4 bedrooms and leaves their old house that only had 3 bedrooms due to a family expansion. This household therefore moves from housing unit B to housing unit A, which is the start of this vacancy chain (see Figure 2).



Figure 2: Household 1 moving into house A (source: Author).

Due to household 1 moving into house A, their previous unit, house B, is left vacant. A new household, household 2, then moves into that housing unit because it matches their needs more because it's slightly bigger and has a garden for instance. Household 2 in turn also leaves a housing unit vacant, which is housing unit C (see Figure 3).

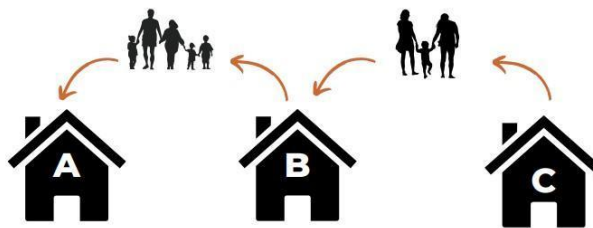


Figure 3: Household 2 moving into house B (source: Author).

A recently married couple, household 3, then in turn move into house C because they want to prepare for having children and therefore both move out of their respective family homes, housing unit D. In this example there would be two houses marked as D. Since those housing units are family units, meaning the couple's parents still live in their respective houses, the vacancy chain ends (see Figure 4).

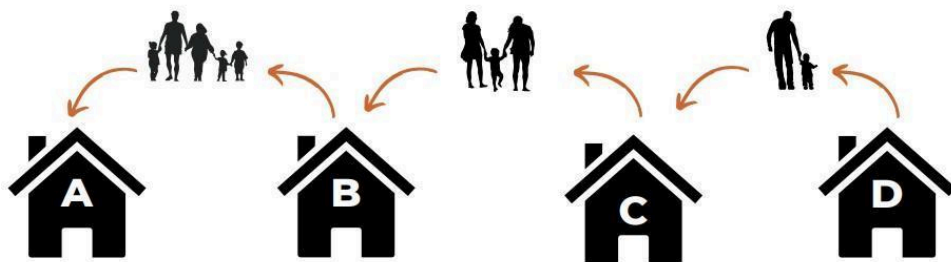


Figure 4: Household 3 moving into house C (source: Author).

This example illustrates that 3 chains are involved in this specific context. Households that move into a home and in turn leave a home vacant form the chains in the vacancy chain as illustrated in Figure 5.

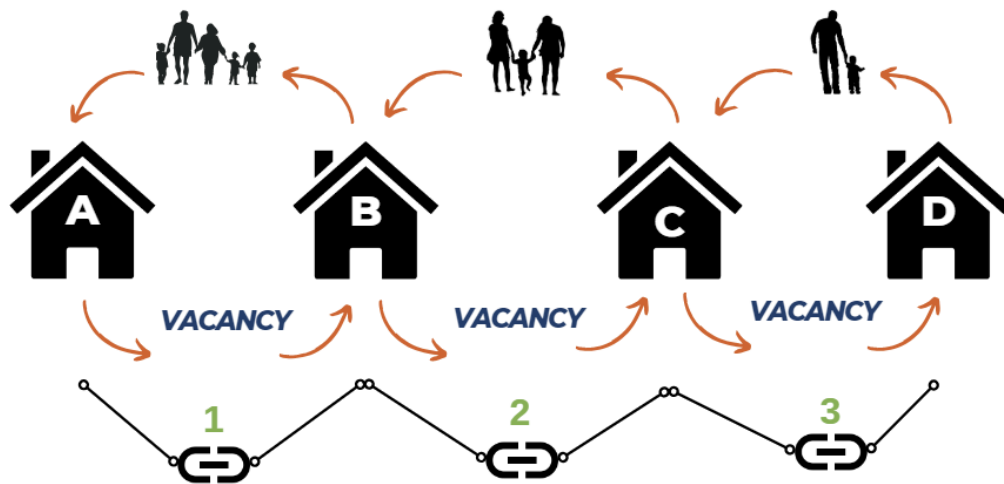


Figure 5: Example vacancy chain (source: Author).

The concept of vacancy chains is not reserved solely for housing units but could also apply to other resources like jobs or shells for hermit crabs (which are essentially housing units for crabs) (White, 1971; Rotjan et al., 2010). White (1970) first started researching vacancy chain mechanisms for occupational mobility, namely for methodist church ministers (see Figure 6) (White, 1970).

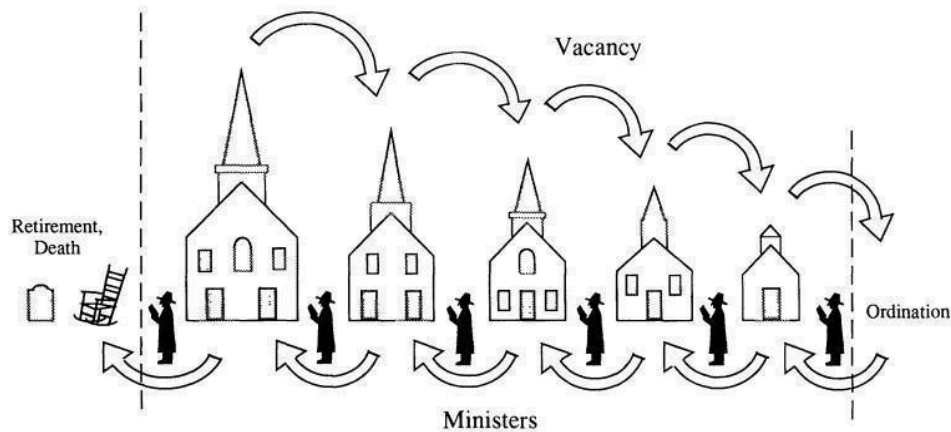


Figure 6: Sample vacancy chain from the Methodist Church (White, 1970)

In this case, the chain starts with the retirement or death and ends with a newly ordained minister. Once a minister retires or passes away, a position for church minister becomes vacant and allows for the other ministers to climb higher in rank or simply switch positions. At the end of the chain, a newcomer, a new minister, is then able to fill the last vacancy by applying for the position (White, 1970). Vacancy chains start when an initial vacancy enters the system or population, this could be a new job, a new house or an existing one that is vacated by someone who is leaving the system. That could be an employee retiring, a homeowner moving to a nursing home or a hermit crab dying and leaving its shell (White, 1971: Rotjan et al., 2010).

The described vacancy chain mechanisms were subject to research to specify and understand the underlying concepts and causal chains. According to White (1971), vacancy chain mechanisms are the interaction between two flows, one of housing units and the other of households. The two flows move in opposite directions and the size of the resulting flow of vacancies “determines the amount as well as net changes in stock of houses and households” (Marullo, 1985). These two flows can be seen in Figure 5 for housing and in Figure 1 for the methodist church vacancies. The vacancy chain starts with a vacant house, house A on the left, and once the house becomes occupied

by the first household, household 1, the vacancy flows to the previous house, house B, of household 1. The flow of households is then ongoing in the opposite direction. The households that move into a housing unit and leave a vacant one behind form the links of the vacancy chain. The length of the vacancy chain is defined as the number of links in this process.

For vacancy chain mobility to happen, certain conditions need to be met. Firstly, the resources being redistributed, such as houses or jobs, need to have certain qualities. They should be reusable, discrete, identifiable, and used by one person or social group at a time. In vacancy chain mobility systems, a resource must be vacant prior to it being occupied by a new person. Usually, individuals outgrow their current job or housing unit and therefore want to change to something new, most of the time something “bigger” or “better”. These vacant units must be scarce, meaning that the amount of units is smaller than the amount of individuals who desire them. Additionally, most individuals must already have units they could leave behind when they move to a new one, meaning that the amount of newcomers is rather small in comparison with the number of individuals which are already in the system (White, 1971; Chase, 1991).

The two most important parts of the vacancy chain mechanism are the start and the end. These mechanisms can start through multiple ways (see Figure 7): (1) a house becomes vacant when the resident(s) has/have moved to a different region (local level) or country (national level); (2) a house of which the last resident has passed away; (3) newly build housing units; (4) conversions, i.e. former office buildings which have been converted into new apartments; (5) and through household formation.

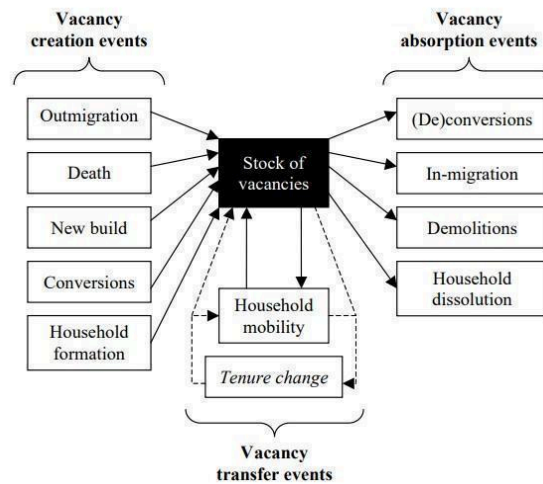


Figure 7: Vacancy stock-flow accounting framework (Ferrari, 2011)

The chain stops when there is no vacant house left. This could be: (1) (de)conversion of units; (2) a household from outside of the region (regional level) or country (national level) moving into the vacant house; (3) demolition of housing units; (4) and household dissolution (e.g. divorce or death at which one or more people stay in the house) (Ferrari, 2011).

2.2 Previous Research

Research on vacancy chains has evolved significantly over time, beginning with Firestone's introduction of theory in 1951. Kristof's work in the early 1960s was groundbreaking, effectively monitoring vacancy chains in metropolitan areas and setting the groundwork for subsequent studies (Lévy et al., 2017). The research process was labour-intensive and time-consuming because researchers needed to manually recreate each vacancy housing chain. This entailed travelling to households and identifying their prior addresses through interviews to complete the chain (White, 1970).

The notion of housing market filtering was also introduced by Kristof's work. This refers to the process by which housing units decrease in value over time, making them available to lower-income households. The primary method for evaluating housing unit filtering as a housing policy instrument has been vacancy chain analysis. In the early 1960s, this strategy was used by Kristof following the vacancies in New York City, which were generated by the construction of 64 dwellings. Through his research, he discovered that for every newly built unit, about 2.5 households migrated within the local housing market (Kristof, 1965).

There have been a few different studies (Brueggeman, 1970; Racster et al., 1971; Sands & Bower, 1974) utilising comparable vacancy chain analyses that have revealed similar results: building a new dwelling permits one household to relocate into the new dwelling while creating approximately 1.5 new vacancies in the housing market. According to Sands and Bower (1974:202-209), limiting this analysis to the influence on the local housing market may be insufficient for evaluating housing policy. This is because many vacancies, especially those in the higher cost range, do not stay available in the local market. Rather, these vacancies often appear in dwellings bought by individuals relocating to or from other locations, creating housing vacancies in these locations. Lansing et al. (1969), who tracked vacancies across the country, discovered that chains are longer when not limited to specific property markets, with an average chain length of approximately 3.5. Therefore, every dwelling generated an approximate of 3.5 vacancies. These results showcase the aggregate effect of vacancies across the bigger picture instead of only focusing on local housing markets.

Nevertheless, determining the efficiency of using filtering as a policy measure requires more than calculating chain length. The focal point should be put on the households

that get to benefit from these vacancies, most importantly for policy measures that aim to improve prospects for low-income households. As per Emma and Magnusson (1988), it is vital to take into account the direct and indirect advantages that come along. Examples would be the newly constructed dwellings (direct) and the dwellings left vacant (indirect).

Subsequently, White (1971) introduced a new paradigm in the realm of vacancy chain research by reconstructing vacancy chains using Markov projections (see 4. *Methodology* for an explanation of Markov models). Due to this new framework, it was possible to reconstruct vacancy chains using statistical methods (Turner, 2008; Turner & Wessel, 2019) based on one known move (Willekens, 1999), which then allowed other researchers to refine and apply these projections such as Hua (1972, 1977, 1985, 1986, 1989), Sands (1976, 1977, 1979), and Emmi (1984a, 1984b, 1986a, 1986b, 1990a, 1990b, 1991). White's methodology made it possible to gain a more methodical and quantitative understanding of housing dynamics by utilising mathematical simulations to study residential mobility and vacancy-absorbing occurrences. This was a notable shift from previous qualitative methodologies, paving the way for more data-based, quantitative research on vacancy chains. Since their introduction by White in 1971 (Lévy et al., 2017), Markov models were used in a great number of housing vacancy chain research (Turner, 2008; Turner & Wessel, 2019).

Although Markov models have been used extensively and are efficient, they appear to be inadequate in capturing diverse demographics, most importantly overlooking stable households and social shifts in dwelling occupancy caused by residential mobility sequences. As a result, the impact of housing vacancy chains is not adequately considered when developing local housing policies. Therefore, a different method was

proposed that tackles these restrictions and takes into consideration both mobile and immobile households, housing stock characteristics, sociodemographic parameters of mobile and stable households, and chain effects. Mobile households are households that move frequently, examples would be military families or young professionals. In contrast, immobile households are households that (almost) never move, such as elderly homeowners who have lived in their current homes for decades. Stable households are comparable to immobile households, but they focus on individuals that have a long-term housing position, independent of their previous movement (Lévy et al. 2017). Despite the suggested model tackling some of the flaws of the Markov projections, it simulates the chains instead of reconstructing them.

A different method used to reconstruct vacancy chains is by using register data rather than interviews. However, this method is only achievable in regions that have a database of their citizens and their mobility. The Netherlands, amongst other countries, has such a database which is regarded highly due to its quality. In this country, citizens are commanded to register key life events varying from birth and death to moving houses (Prins, 2017), making it a reliable database to be used to reconstruct vacancy chains. To give an example, research conducted in the Netherlands (van Dam et al., 2010) and Finland (Bratu et al., 2021) using such register data has uncovered surprising trends concerning the distribution of new dwellings and the effect on local population turnover. Although newly constructed housing units generally tend to accommodate high-income households, studies indicate that low-income households also benefit from these units, as mentioned in the introduction. When high-income households move into newly constructed, expensive housing, more affordable units become available, eventually reaching middle- and lower-income households within two years (Bratu et al., 2021). Similar to the findings of van Dam et al. (2010), they found

that new residences in higher-priced neighbourhoods predominantly attract wealthy households. This occurs because when high-income households move into these new, expensive units, more affordable housing becomes available, thereby benefiting middle- and low-income households through a vacancy chain mechanism.

Generally, there is a noteworthy lack of methods to understand the impact of housing vacancy chains despite it having an impact on determining local demographics. Even though previous research on vacancy chains has shed light on regional housing markets, more thorough methods are required to provide guidance on housing policy on a local and nationwide level (Lévy et al., 2017). Despite having similar themes, the previous research uses a variety of approaches, from registration data (Bratu et al., 2021; van Dam et al., 2010) to statistical methods (White, 1971; Lévy et al., 2017; Turner, 2008; Turner & Wessel, 2019). Regardless of the variances, the shared goal is to decipher what happens when housing becomes available on the market, highlighting the intricacy of housing dynamics and the necessity of using a variety of research methodologies in order to successfully address them.

2.3 Methods

There are several methods for analysing vacancy chain mechanisms. The two methods which are the most well-known and commonly utilised in the literature regarding vacancy chains are the reconstruction method and the Markov chain method. The working of both methods will be outlined in terms of the vacancy chains as well as their advantages and disadvantages. For the purpose of this research, the reconstruction method was chosen for the operationalisation, however, both methods will be explained in order to paint the whole picture.

2.3.1 Reconstruction Method

The oldest method to analyse vacancy chain mechanisms was done by reconstructing the vacancy chain mechanisms by interviewing residents at the start of each chain and asking them about their previous residences. The interviewers would then go to those mentioned previous addresses to that household's previous address and so forth. In the past, there was no system in place for jotting down relocations and household compositions. Therefore, it was a very time-consuming and labour-intensive method (Scholten, 1986; White, 1971). Currently, most countries use register data or a combination of register and survey data, which allows this method to become easier to use (Bakker et al., 2014).

A popular means of collecting data on the dynamics of the housing situation of a country and specifically the fluctuations are Household Surveys, which were utilised in various parts of the world like the United States. Unfortunately, a lot of these surveys have a high non-response rate, which makes these surveys inefficient and raises serious issues regarding the quality of the survey outcomes. Therefore, the availability of data was scarce and not always reliable, which makes this method difficult to utilise in every region/country. In a country like the Netherlands, this data is more readily available thanks to the System of social statistical datasets (SSD). The SSD is a system of interlinked register-based data such as households and their current and previous addresses. Due to adjustments in existing legislation as well as the developments of new legislation, the use of this administrative data has been made possible by Statistics Netherlands (SN). The Statistics Netherlands Act, which is the legal basis of SN, specifies that the SN should utilise administrative data from

government institutions at every possible opportunity and grants them authorisation to do so. Also, it authorises SN to use the Citizen Service (CS) number. The SSD has made quite a crucial set of registers readily accessible to internal and external researchers. Since the data is mostly accurate and readily available to researchers, this method is the most efficient and accurate to use in the Netherlands (Bakker et al., 2014).

2.3.2 Markov Chain Model

The Markov chain model is a different way to analyse the vacancy chains compared to the reconstruction model. It is a mechanism for determining the probability associated with a sequence of events occurring based on the state of the previous event. The purpose is to determine the probability of transitioning from one state to another. One of the key advantages of this model is that the future state of a stochastic variable is only dependent on its present state. A stochastic variable is a variable whose values depend on the outcomes of random occurrences (Patel, 2022; Willekens, 1999).

In the case of vacancy chains, the models are usually embedded, first-order Markov chains that have absorbing states. “Embedded” pertains to the way that the model doesn't consider how long in terms of clock time it is necessary for a chain to move in, but it does consider the order of moves. In “first-order” Markov chains, the researcher assumes that the following position to which a vacancy moves is decided exclusively by the position that it is in the present. To give an example, an individual mobilising only evaluates the vacant housing unit, that person does not take into consideration the previous positions of the chain. The absorbing states are in the model because these chains don't continue endlessly but end at a certain point. A chain is absorbed when

the vacancy chain ends (see section 2.3). Markov chains are utilised because the Markov models expect that a cycle moves from one state to another, like how vacancy chains move from one housing unit to another, and that a definite probability can be assigned to each transition within reach (Willekens, 1999).

"The Markov chain model calculates the vacancy flow of different housing types that develops for a given supply of housing" (Teule, pp.182, 1996). In addition, the model provides insight into the length of the generated vacancy chains (Teule, pp.182, 1996).

2.4 Why people move: Theories on Residential Mobility

Virtually no one stays in the same home for their entire life. But exactly when and why does one move? In order to understand mobility patterns, it is important to understand the underlying thought behind moving behaviour.

Moving behaviour is a way for individuals and households to reduce the discrepancy between desire and reality (Van Kempen et al., 2005). Since residential mobility takes up time, energy and money, there is a whole decision process that precedes the move. There are different factors that determine residential mobility: household characteristics, housing values, and government policies, among others.

One of the pioneering theories in the study of residential mobility is the life-cycle model, which was introduced by Peter Rossi in 1955 (Rossi & Shlay, 1982). This model concludes that the life-stage transitions of families are closely intertwined with their housing requirements, leading to changes in residential mobility patterns. Meaning that how often people move increases in connection with changes in life stages such as finishing school, marriage, divorce, new job, retirement, children leaving home, loss of a spouse, or infirmity. Empirical evidence supports the notion that life-cycle changes,

such as graduation, marriage, new employment, or childbirth, significantly influence mobility decisions (Kallan, 1993; Robison & Moen, 2000; Chevan, 1995).

Rossi (1955) and other researchers (Chevan, 1971; Leslie & Richardson, 1961; Pickvance, 1973) mention that space shortages are one of the main housing issues caused by changes in people's life stages. Families tend to want larger homes during periods of growth and raising children, while older families may feel they have too much space (Morris, Crull, and Winter, 1976; Pickvance, 1973).

Later research by Morris (Morris and Winter, 1975) further exemplified Rossi's model, framing family residential mobility as a response to normative housing deficits. These deficits arise when families perceive a gap between their current housing situation and prevailing housing norms, driving them to seek housing options that align with these perceived needs.

The "stress threshold model" of housing movement, initially proposed by Wolpert (1965, 1966) and later expanded by Brown and Moore (1970), Speare (1974), and Fokkema, Gierveld, and Nijkamp (1996), suggests that relocation decisions are based on satisfaction or dissatisfaction with one's current residential location, encompassing both physical and social environments. This model emphasises place utility, where individuals assess the desirability of their location based on various factors. Brown and Moore introduced the concept of stress thresholds, proposing a two-phase decision-making process involving whether to move and where to move. Speare (1974) expanded on this concept by introducing "relative satisfaction with residential location". This includes individual and household traits, location features, and social connections. Higher satisfaction reduces the likelihood of relocation consideration, even when better alternatives exist. Speare's tests in 1969 and 1970 confirmed correlations between

dissatisfaction and both the inclination to move and actual mobility. However, only half of those contemplating relocation actually moved, with some eventually relocating due to external pressures. Speare's model, incorporating relative satisfaction, offers a comprehensive explanation of mobility patterns, with homeownership showing a significant direct impact on reducing mobility (Hansen & Gottschalk, 2006).

Another point to consider is that distinctions can be made between rental and owned housing. People in rented units move more frequently than owned units, with renters typically staying in a unit for about two years, while homeowners tend to stay for around seven years. According to research, 60% of homeowners stayed homeowners from 1976 to 1977, while 40% switched to renting. In contrast, 73% of tenants remained renters, while just 27% transitioned to homeownership (Marullo, 1985). Young adults generally prefer renting over buying, opting for less expensive housing (Rossi, 1955; Morris & Winter, 1975; Speare et al., 1974). In the Netherlands, one-person households prefer rental homes and multifamily complexes. However, middle-aged never-married, young divorcees, and never-married people in less urbanised areas have a balanced preference for renting and owning homes, with a higher preference for single-family dwellings. New households entering the housing market strongly favour rental housing and multifamily complexes. Except for older, never-married persons and new one-person households, most groups prefer to own their homes, especially in less urbanised areas (Faessen, 2002).

Based on these theories, it is safe to conclude that mobility is tied to a lot of different factors relating to an individual's life (choices). By using vacancy chain mechanisms it

is possible to research how to best help accommodate people's mobility choices and preferences.

2.5 Policymaking and Future Research

The insights gained from past and future studies about how vacancy chains work can significantly impact housing policies and guide future research. By researching specific areas and demographics, we can develop policies to determine which types of housing to build, thereby enhancing mobility and providing more people with housing opportunities.

A common misconception is that longer vacancy chains are always beneficial. However, this is not necessarily the case, as longer chains do not always result in a greater variety of housing becoming available, nor does it ensure that expensive housing will be utilised. In 2007, the VROM Council noted that the sale of expensive new-build homes in the early years of the 21st century was sluggish. As a result, building projects with many expensive dwellings were adjusted to include more affordable and mid-range homes. Thus, the success of a specific new-build strategy is highly dependent on the housing demand at a given time.

Building exclusively for the top or bottom of the housing market is not the most effective way to promote housing mobility. The VROM Council advocates a twin-track policy for new construction, which focuses on building both expensive, high-quality housing and maintaining a balanced housing stock. This balanced composition ensures the availability of sufficient housing across different price segments. Consequently, not only high-income households but also low- and middle-income households will have more opportunities for housing advancement. The precise balance between expensive and

affordable housing depends on the specific market conditions in a given housing market area (VROMraad, 2007).

3. Aims and objectives

Primary Goal - Comprehensive Vacancy Chain Descriptive Analysis:

Despite earlier studies, many components of housing vacancy chains are still unknown. This research intends to provide insight into the sorts and qualities of houses that become directly available as a result of new housing supply, as well as the implications for indirect availability further down the chain. The primary goal is to dissect the vacancy chains into 5 chains and analyse each chain individually.

This exploration is defined by the following primary key objectives:

Objective 1 - Ownership Dynamics:

The first objective is to analyse the shift in ownership dynamics within each chain, more specifically, conversions from rental to ownership and vice versa. The research of ownership dynamics across the different vacancy chains aims to identify noticeable trends and subtle variations that contribute to the overall narrative.

Objective 2 - Household Composition:

Aligned with the observed household compositions in each vacancy chain, this objective involves an in-depth examination of the distribution of one-person households, larger family units, and any noteworthy variations across different chains.

The intention is to uncover nuanced insights into the diverse household structures influencing housing transitions.

Objective 3 - Housing Unit Characteristics:

This objective aims to investigate patterns or shifts in housing unit characteristics, building on the findings outlining the features of housing units within each vacancy chain. The emphasis of this objective is to find out the type of units, such as terraced, detached, and multi-family homes, which contribute to a more nuanced understanding of Fryslân's changing housing market.

By pursuing these objectives, the aim is to make a significant contribution to the discussion of housing dynamics in Fryslân, providing useful insights into the intricate relationship between new housing supply and vacancy chain mechanisms.

4. Methodology

4.1 Data collection

Register data obtained from Statistics Netherlands will be used for this study in order to reconstruct the housing vacancy chains. The System of Social Statistical Datasets (SSD), developed by SN, standardises administrative register data and facilitates linkage through assigned linkage keys. The SSD encompasses comprehensive information about the Dutch population, including households, jobs, dwellings, taxes, and more (Bakker et al., 2014). For this study, data from the SSD will be utilised, focusing primarily on addresses recorded on January 1, 2018, and December 31, 2018. Additionally, the SSD provides multiple variables regarding (1) the dwellings themselves and (2) the households residing at those addresses.

To evaluate the impact of increased housing supply on vacancy chains in Fryslân, the SSD data will be processed using R, a programming language for statistical computing. This processing will compile vacancy chains that will serve as the basis for analysis. Specifically, the data collection will concentrate on households that first move into newly built housing units, designated as the "start population."

The data collection procedure involves obtaining address information linked to households at two distinct points each year—December 31st and January 1st (designated as "t"). Once the start population is identified, the subsequent steps involve tracing back to the housing units vacated by these households, collecting data on those units, and documenting the households that move into these vacated units. This process is repeated to create a comprehensive dataset that reflects the entire chain of housing vacancies and relocations.

By maintaining the dataset within the same year, we aim to capture vacancy chains where moves occur within a single year, enhancing the accuracy and relevance of our analysis. Further details of this methodology will be elaborated under the data analysis section.

4.2 Data analysis

Among the various methods available to analyse vacancy chain mechanisms, this research opts for the reconstruction method instead of the probability-based Markov chain model. For this study, Statistics Netherlands provided reliable register data, which enhances the accuracy of the vacancy chain analysis and reflects the real situation in

Fryslân. The following section outlines the application of the reconstruction method in the context of investigating the impact of newly built housing units on vacancy chains in Fryslân, clarifying the process details and using reference dates.

4.2.1 Reconstruction Model

The dataset used for this research is based on four main assumptions:

1. If a person lived at a specific address on January 1, 2018, but was not linked to that address on December 31, 2018, that person relocated in 2018.
2. If a person lived at a specific address on January 1, 2018, and is still tied to that address on December 31, 2018, they did not relocate in 2018.
3. If a person appears in the dataset on January 1, 2018, but not on December 31, 2018, they have either died or emigrated.
4. If a person was not in the dataset on January 1, 2018, but is on December 31, 2018, he or she was born or immigrated.

The data collection process begins with an emphasis on newly constructed or remodelled residences, known as "potential houses," which serve as the beginning for vacancy chains. These houses are identified and designated as the "start population." The dataset is then connected to check that these houses were vacant on December 31, 2018, or to determine whether additional household members still lived there. If the house is completely vacant, it becomes a prospective new home for other families.

The prior addresses of households that have moved into these possible residences are then identified. This procedure entails examining the dataset for previous addresses on January 1, 2018, and determining whether or not they were vacated. If an address is left blank, it becomes the new starting point for the following cycle of data collecting,

and the procedure is repeated. This iterative approach is repeated up to ten times, with all moves occurring within the same year to accurately represent vacancy chain dynamics.

To reconstruct the vacancy chains, the acquired data from the SN database will be used. Given that the research focuses on the impact of newly built housing supply on vacancy chains in Fryslân, the reconstruction of the vacancy chains will begin with the introduction of new housing supply in Fryslân. Consequently, on the reference date of December 31, 2018, house A (the newly constructed housing unit) is the first house in the chain and is checked to identify the associated household residing there at that time (see Figure 8). This is household number 1, also referred to as the starting population. On January 1, 2018, the dataset will be examined for household 1's previous housing unit, house B. First, dwelling B will be inspected to see whether it was left vacant (see 2.3 Vacancy chain mechanisms). The vacancy chain terminates if it is not left unoccupied, as in the case of household dissolution, but continues otherwise.

In certain circumstances, newly built residences are delivered in a specific month, e.g. June, but the first inhabitants move in several months later. If the newly built house does not have someone living in it as of December 31, 2018, the analysis will be extended to 2019 using the reference date of December 31, 2019. If a household lives in that housing unit, their former address will be reviewed on January 1, 2019, to receive house B, and so on.

Once housing unit A, household 1 and housing unit B are acquired, the data gathering moves on to the previous housing units (C, D, etc.) and corresponding households (2, 3, etc.). As a result, after receiving the data for housing unit B, we look at 01/01/2018 to acquire the data of the household that lived before household 1 in that housing unit,

could lead to situations in which a person moves to an institution, the house is taken into possession, and someone moves back in a later year.

Finally, based on our two benchmark dates, we assume that persons do not migrate more than once a year. However, a household may relocate several times in a single year. If such moves occur, it is presumed that any not accounted move is only short-term from the household's perspective, although this is not always the case.

5. Results

This section presents the acquired results from the reconstruction of vacancy chains in Fryslân. For clarity, the results will be split up per aim/objective.

5.1 Primary Goal- Comprehensive Vacancy Chain Analysis:

Overview of the newly built housing in Fryslân:

First, we begin by examining the initial state of the housing market, represented by the number of newly built housing units as of the reference date 31-12-2018. This initial population, denoted as the root or start population (A), serves as the foundation for our analysis. As households moved into these 4405 newly constructed housing units, they allowed for the inhabitation of 1765 houses (B) in the first chain, and so forth. This effect highlights the interconnectedness of housing occupancy levels within the vacancy chain. In Table 1, the number of houses per chain rounded off to 5 or 0 can be inspected. Figure 9 is a sunburst chart that visualises the decline of available housing units per chain after the root.

Level	Amount of housing units (rounded off)
Root (A)	4405
Chain 1 (B)	1765
Chain 2 (C)	970
Chain 3 (D)	485
Chain 4 (E)	245
Chain 5 (F)	110

Table 1: Number of houses per chain level.

Vacancy chains in FRL

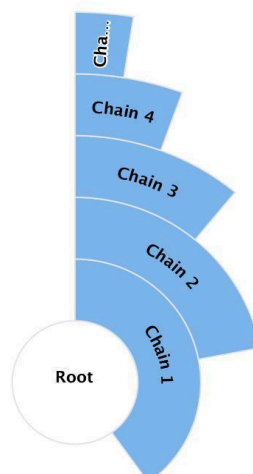


Figure 9: Sunburst chart of the vacancy chains in Fryslân

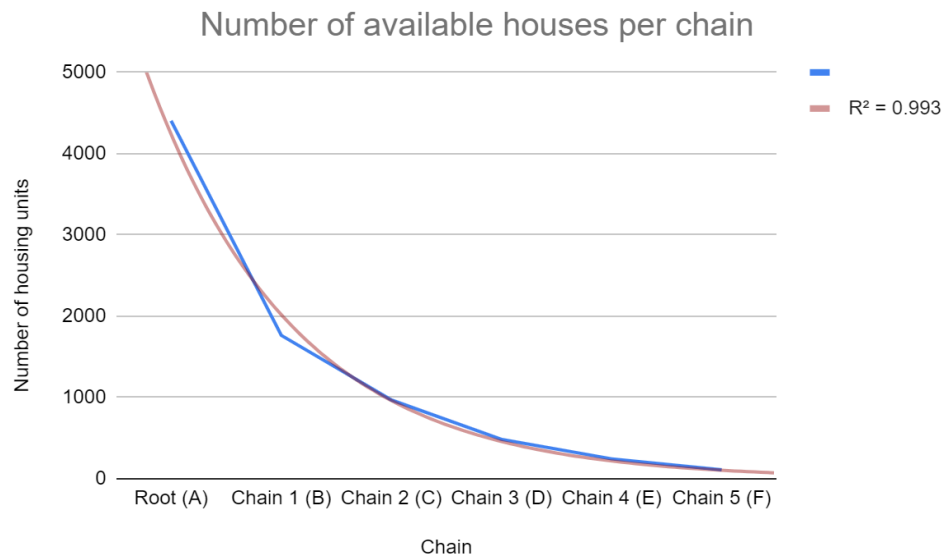


Figure 10: The number of available houses per chain (including root)

The graph above shows a pattern of exponential decay, as indicated by the R-squared value of 0.993. This stipulates that the exponential decay model can explain 99.3% of the variation in housing units across different chain levels. This decay is tied to the one year period in which the data is collected and sometimes 2 years in case of houses not being delivered (see 4.2.1 Reconstruction Model). This means that the pattern of the decay reflects the housing transitions happening within that one or two year period.

5.2 Objective 1 - Ownership Dynamics:

Chain 1:

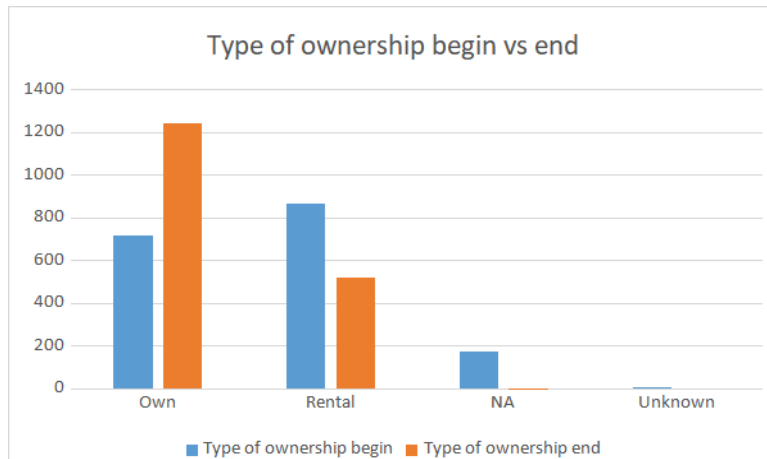


Figure 11: Type of ownership at the beginning versus end of chain 1

The initial chain comprises 1765 housing units (denoted as type B). In the provided graph, the preceding ownership status of these households (blue bars) before transitioning to their current housing (orange bars), as well as the current ownership status of these housing units can be seen. The majority of the previous ownerships were rental properties, more than 850, while the owned houses were at around 730. As for the current housing situation, there are more owned houses, around 1220, compared to the rental houses, which are around 570.

Chain 2:

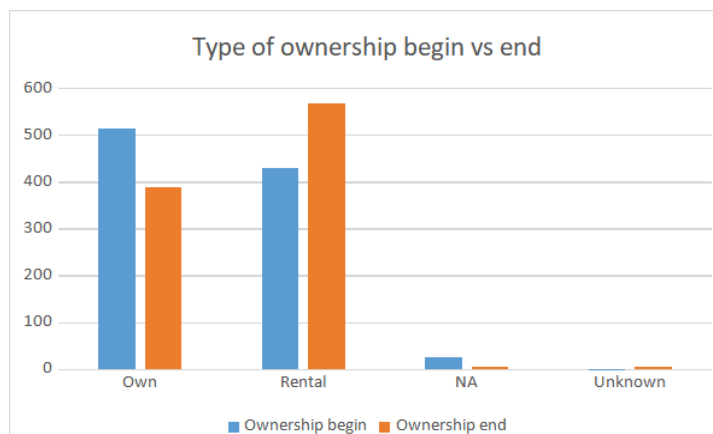


Figure 12: Type of ownership at the beginning versus end of chain 2

The second chain consists of a total of 970 housing units (denoted as C). Within this chain, 515 of the previous housing units were owned, whereas 430 were rental properties. Presently, there are 570 rental units and 390 owned units.

Chain 3:

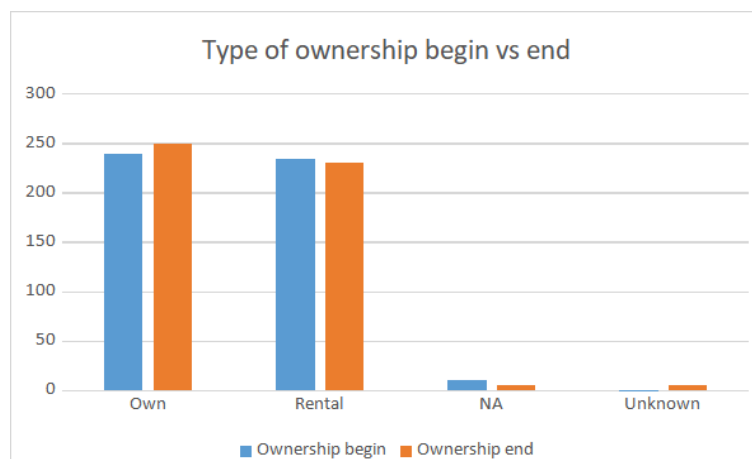


Figure 13: Type of ownership at the beginning versus end of chain 3

The third chain consists of 485 housing units (denoted as D). The preceding ownership status is more owned (around 245) than rented (around 230). The current housing unit status is 250 for owned houses and around 225 for rental houses.

Chain 4:

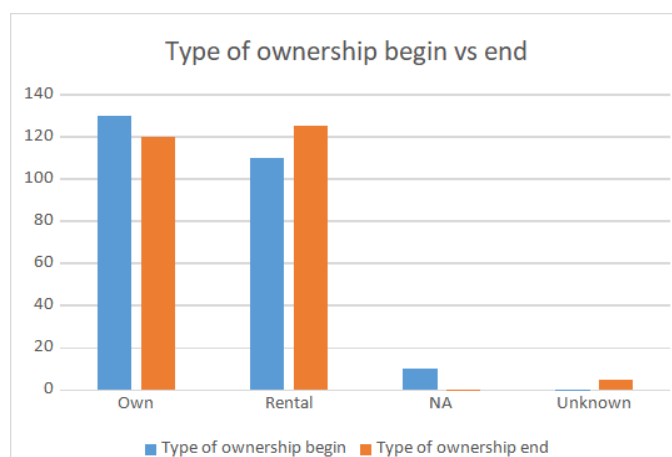


Figure 14: Type of ownership at the beginning versus end of chain 4

The fourth chain encompasses a total of 245 housing units (denoted as E). The beginning ownership type is around 130 owned and 110 rental housing units. After moving that becomes 120 owned and around 125 rental housing units.

Chain 5:

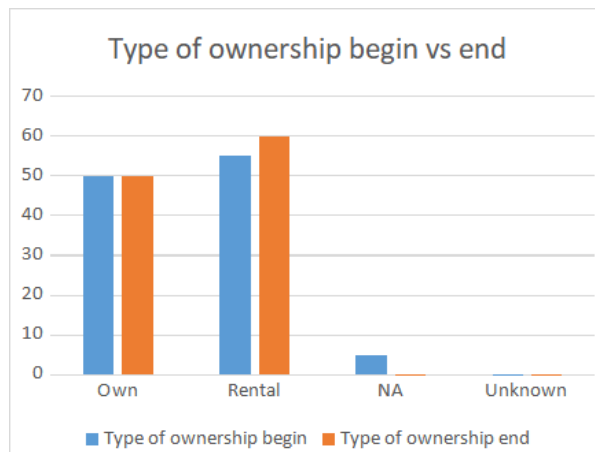


Figure 15: Type of ownership at the beginning versus end of chain 5

The fifth and final chain consists of a total of 110 housing units (denoted as F). The previous housing units consist of 50 owned housing units and around 55 rental units. The current ownership status is the same for owned housing units, also 50, and for rental units it is 60 housing units.

5.3 Objective 2 - Household Composition:

Chain 1:

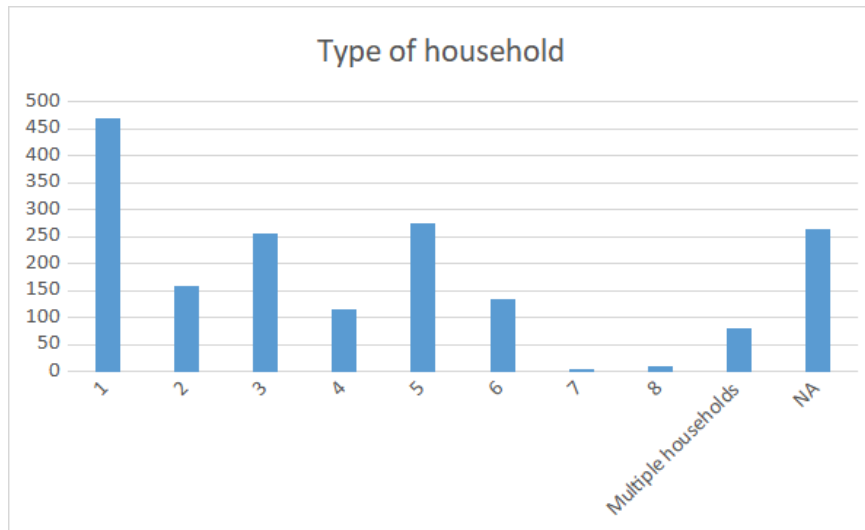


Figure 16: Household demographics in chain 1

Of the household compositions in the first chain, there are mostly single-person households, around 470, followed by five-person households, around 275. Furthermore, there are around 255 three-person households, 155 two-person households, 145 six-person households, 110 four-person households, 80 multiple households, 10 eight-person households and around 5 seven-person households.

Chain 2:

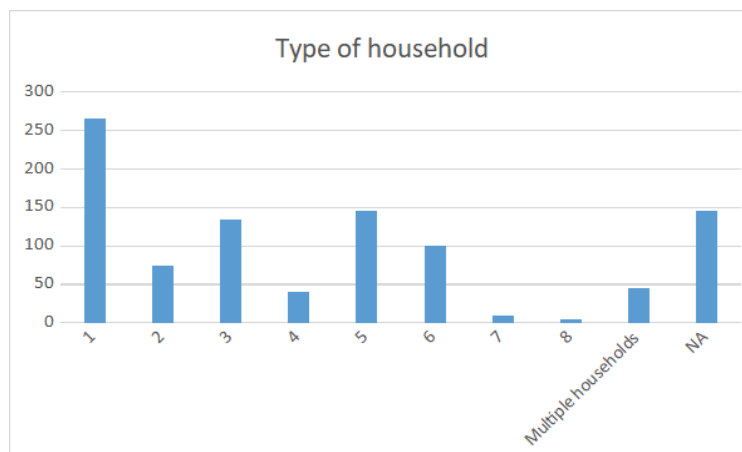


Figure 17: Household demographics in chain 2

In the second chain, there are approximately 260 single-person households, 149 five-person households, 135 three-person households, 100 six-person households, 75

two-person households, 49 multiple households, 45 four-person households, 10 seven-person households and around 2 eight-person households.

Chain 3:

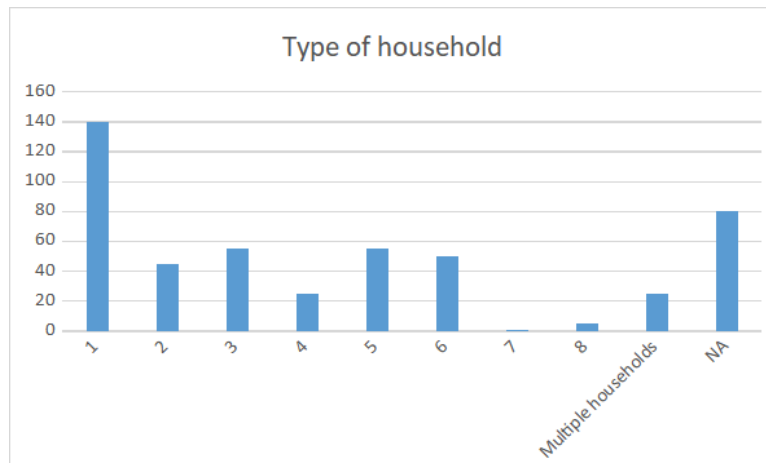


Figure 18: Household demographics in chain 3

In the 3rd chain, there are approximately 140 single-person households, three-person and five-person households with both standing at 55 housing units, 50 six-person households, 45 two-person households, 25 four-person and multiple households, 5 eight-person households and 1 seven-person household.

Chain 4:

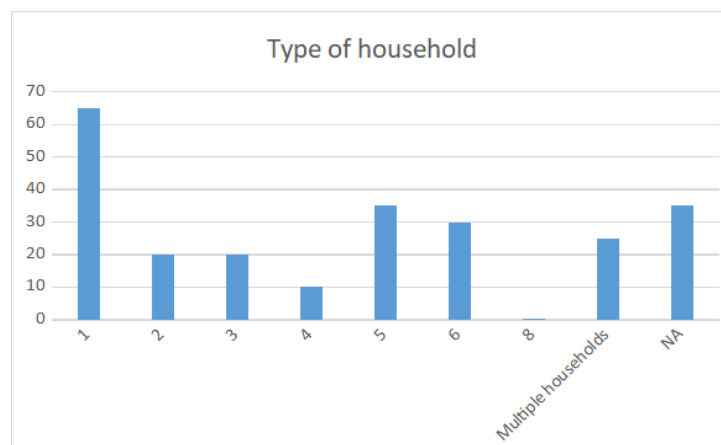


Figure 19: Household demographics in chain 4

In the 4th chain there are approximately 65 single-person households, 35 three-person households, 30 six-person households, 25 multi-family households, 20 two- and three-person households, 10 four-person households, 1 eight-person households and 0 seven-person households.

Chain 5:

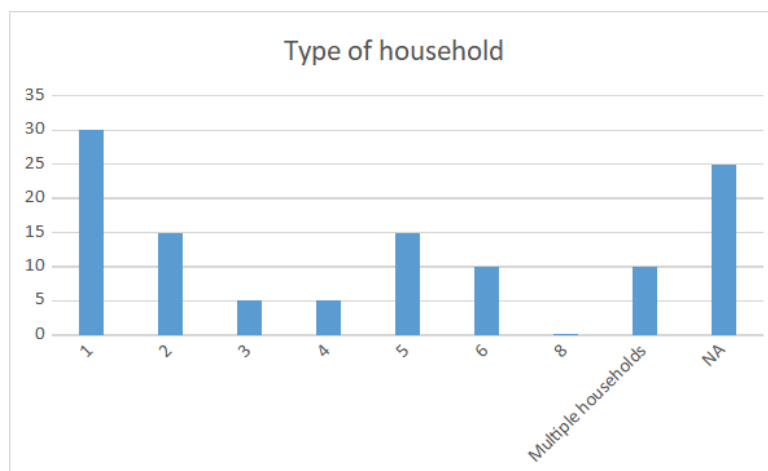


Figure 20: Household demographics in chain 5

In the 5th and last chain there are approximately 30 one-person households, 15 two- and five-person households, 10 six-person and multi-family households, 5 three- and four-person households, 1 eight-person household and 0 seven-person households.

5.4 Objective 3 - Housing Unit Characteristics:

Chain 1:

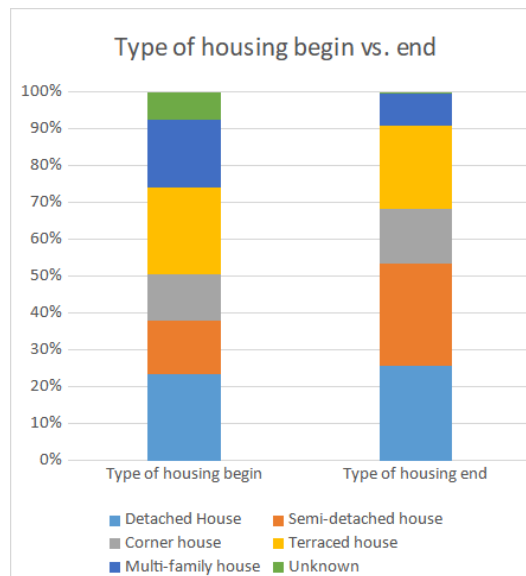


Figure 21: Types of housing unit at the beginning compared to the end of chain 1

In this graph, the preceding type of housing unit (type of housing begin), the households left in this chain and the type of housing they are currently living in (type of housing end) can be seen. The beginning types of housing units consist of approximately 23% terraced houses, 16% semi-detached houses, 22% detached houses, 13% corner houses, 18% multi-family houses and 8% unknown.

The end housing types consist of 26% detached houses, 27% semi-detached houses, 15% corner houses, 23% terraced houses, 9% multi-family houses.

Chain 2:

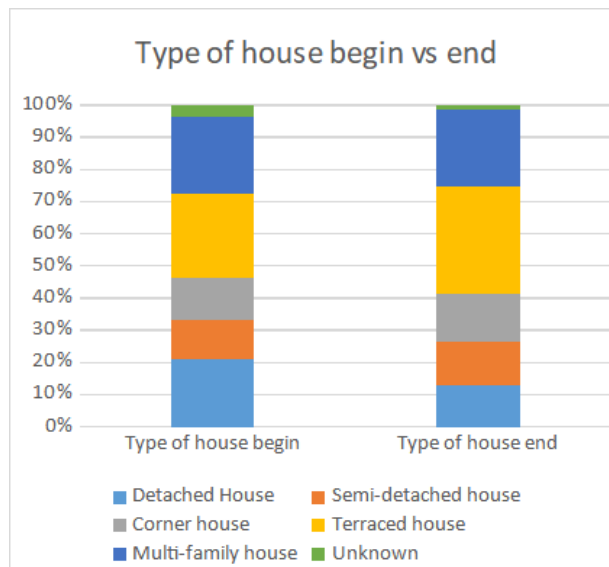


Figure 22: Types of housing unit at the beginning compared to the end of chain 2

The previous housing units consist of 21% of detached houses, 12% semi-detached houses, 15% corner houses, 25% terraced houses, 24% multi-family houses and 3% unknown.

The current housing units consist of approximately 13% detached houses, 13% semi-detached houses, 15% corner houses, 34% terraced houses, 24% multi-family houses and 1% unknown.

Chain 3:

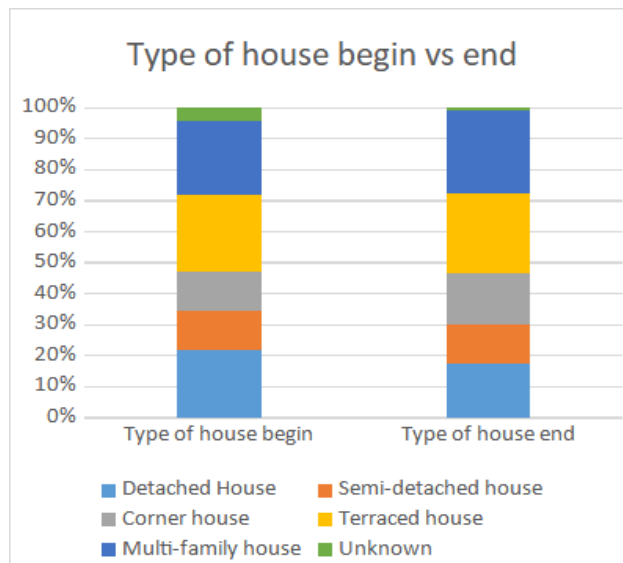


Figure 23: Types of housing unit at the beginning compared to the end of chain 3

The previous housing units consist of 21% of detached houses, 13% of semi detached houses, 13% of corner houses, 23% of terraced houses, 26% of multi-family houses and 4% unknown.

The current housing units consist of 18% detached houses, 12% semi-detached houses, 17% corner houses, 24% terraced houses, 28% multi-family houses and 1% unknown.

Chain 4:

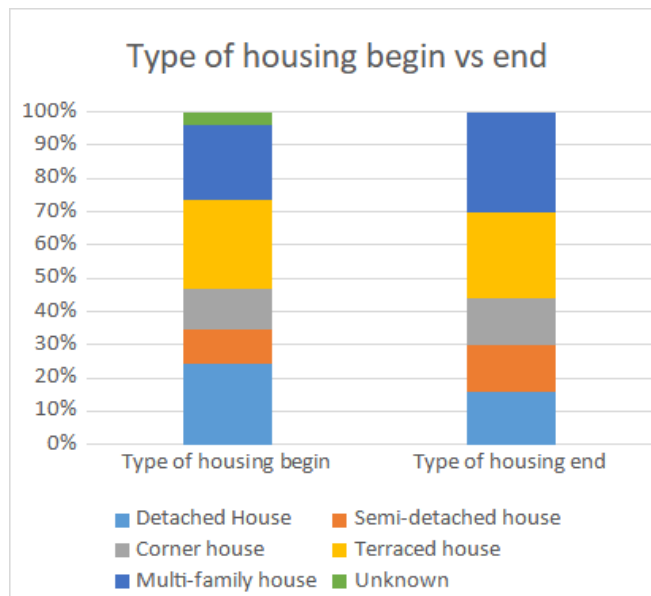


Figure 24: Types of housing unit at the beginning compared to the end of chain 4

The previous housing units consist of 24% detached houses, 12% semi-detached houses, 14% corner houses, 25% terraced houses, 21% multi-family houses and 4% unknown.

The current housing units consist of 16% detached houses, 14% semi-detached houses, 14% corner houses, 26% terraced houses and 30% multi-family houses.

Chain 5:

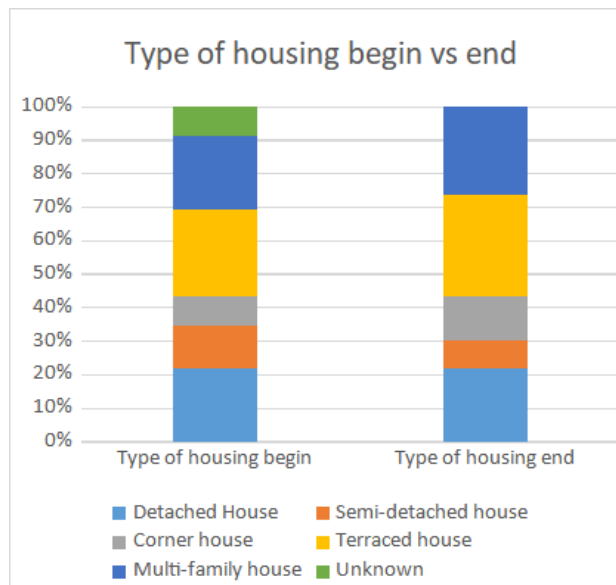


Figure 25: Types of housing unit at the beginning compared to the end of chain 5

The previous housing units consist of 22% detached houses, 13% semi-detached houses, 9% corner houses, 25% terraced houses, 22% multi-family houses and the rest unknown.

The current housing units consist of 22% detached houses, 8% semi-detached houses, 14% corner houses, 29% terraced houses and 27% multi-family houses.

5. Discussion & Conclusion

The main focus of this study was to understand how the availability of new housing impacts vacancy chain patterns in the Fryslân province by examining ownership dynamics, household compositions, and housing unit characteristics.

5.1 Ownership Dynamics

In the first chain, more people moved from rental units into homes they purchased. In the second chain, this trend reversed, with more people moving from owned units to

rentals. The third chain saw a return to more people living in and moving to owned housing units. In the fourth chain, the pattern flipped again, with more people moving from owned housing units to rentals. Finally, in the fifth chain, more people ended up in rental units, while the number of owned housing units remained constant.

Young adults typically lean towards renting rather than buying, often choosing more affordable housing options (Rossi, 1955; Morris & Winter, 1975; Speare et al., 1974). On the other hand, there are single-person household demographics that show a balanced preference between renting and owning homes, mostly in less urbanised regions (Faessen, 2002).

We can infer from the data that our initial hypothesis is generally incorrect. Different types of households demonstrate a clear preference for homeownership, with single-person households being the majority in each chain (see section 5.2). While three- and five-person households show significant interest in buying homes, especially at the start of these chains, the majority of the households are single-person households. This could be explained by the lower prices of owner-occupied housing units compared to the rest of the Netherlands (Moerman, 2023).

There is no observable trend indicating that mostly single-person households prefer renting over buying. Furthermore, the data does not include information on the preferences of single-person households or other household types when it comes to buying versus renting property.

5.2 Household Compositions

The majority of households in each chain are single-person households. This contradicts the hypothesis that single-person households, due to lower income, would appear more in the later chains where cheaper houses (EMTG, 2021) become available (Renes & Jókövi, 2008). This suggests that in Fryslân, single-person households have both the need and ability to move more frequently.

Following single-person households, households consisting of three and five people are also prevalent in each chain. This trend likely exists due to family-related considerations such as the need to move closer to schools or work (Morris, Crull, and Winter, 1976; Pickvance, 1973; Kallan, 1993; Robison & Moen, 2000; Chevan, 1995).

5.3 Housing Unit Characteristics

The data shows a clear trend across the five chains in terms of housing unit types at the beginning and end of each chain. In the initial chains (chain 1 and chain 2), there is a notable preference for larger and more expensive housing units such as detached, semi-detached, and corner houses (EMTG, 2021). For instance, chain 1 starts with 26% detached houses and 27% semi-detached houses, reflecting a higher proportion of these types of units compared to the end of the chain, where multi-family houses become more prevalent.

As the chains progress, particularly in chain 3 to chain 5, there is a shift towards smaller and more affordable housing options, predominantly terraced houses and multi-family units. This transition aligns with the hypothesis that as households move

through the chains, they vacate larger and potentially more expensive homes (EMTG, 2021), making them available for others who might be seeking their first home purchase, thereby increasing the availability of affordable housing units later in the chain (Renes & Jókövi, 2008).

5.4 Overall Correlation

The exponential decay graph shows a strong correlation between the houses in this vacancy chain, indicating a clear pattern. However, this analysis is time-dependent as it is based on data from only two points within one year (besides the exception mentioned in 4.2.1 Reconstruction Model). Putting those assumptions to the side, the correlation accompanied with a highly significant R-squared, indicates that the model explains a considerable portion of the data's variability.

Based on the results of the three sub-questions, we can see there are a few clear trends in the vacancy chains in Fryslân, but that the current demographic seems to be far from the norm. The data illustrates a consistent pattern where initial chains show a preference for larger and more expensive housing units such as detached and semi-detached houses. As households progress through subsequent chains, there is a noticeable shift towards smaller, more affordable housing options like terraced houses and multi-family units (EMTG, 2021). This progression supports the hypothesis that vacancy chains facilitate the turnover of larger homes to potentially more affordable options over time, thereby influencing housing affordability dynamics in Fryslân (Renes & Jókövi, 2008).

The household compositions seem to follow the national trend in the case of increasing single-person households (Statistics Netherlands, 2018) but does not follow the trend of

having less income and moving into generally smaller houses, which become more available near the end of the chain (Renes & Jókövi, 2008). This suggests that single-person households in Fryslân exhibit mobility and flexibility in housing choices, rather than solely gravitating towards renting over buying. It also suggests that single-person households are more diverse and have different wants and needs for housing (Faessen, 2002).

5.5 Limitations

Several assumptions and biases limit this study, such as assuming people move only once, excluding those who did not move within the year and that moves to institutions are irreversible. These limitations make the results of the study not provide a full picture of the vacancy chains in Fryslân but rather only a part of it.

This brings us to the next important point: the register data may have flaws and missing information. In our results, we have already encountered some instances of non-applicable data. Additionally, we do not filter for specific types of institutions, which limits our ability to distinguish between different scenarios, such as an elderly person moving into a long-term care facility with no intention of moving back versus other types of institutional moves. This lack of differentiation can affect the accuracy and depth of our analysis.

Furthermore, household compositions are discussed only in terms of the number of individuals per household, without considering other important factors such as whether the household consists of one or two parents, the ages of household members, and their incomes. The absence of this detailed information restricts our ability to fully understand the dynamics within these households.

Additionally, the findings of this study are specific to the province of Fryslân and the specific time frame considered. Different regions may have varied demographics, household compositions, and needs. Moreover, this study was conducted using data from before the COVID-19 pandemic. Post-pandemic, the rise of hybrid and fully remote work arrangements has allowed households to reassess their housing needs and satisfaction, potentially altering the dynamics observed in this study (Bouma, 2022).

5.4 Future research

For future studies, it is important to take into account income as it determines the means for mobility. Other variables would make the research more comprehensive, such as age, life stage etc. Expanding the research to multiple points, either in one year or in multiple years, to see whether the correlation stays like that would provide a better understanding of whether the observed correlation holds over time, making the results more accurate for the population of a province. Adding a qualitative part to this study would be valuable as well, as this could provide why people actually move and what kind of houses they are looking for.

Analysing vacancy chains in detail, so based on the initial type of house (so not only newly built houses but e.g. detached houses), would be interesting as well in order to see whether it actually frees up cheaper houses compared to terraced houses.

Future studies could also investigate the reasons for the increase of single-person households and the impact of demographic changes on housing affordability. Other things to be considered are longitudinal studies that track households' housing

journeys, which could provide important insights into the long-term consequences of ownership transfers and vacancy chain dynamics.

All things considered, using register data provided by SN to reconstruct housing vacancy chains appears to be a good way to answer the question of how new housing supply affects the vacancy chain mechanisms in the province of Fryslân. In order to provide policymakers with helpful insights in order to determine which houses are best suited to be built in an area to suit the needs of a demographic, more research needs to be done.

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