# Demographic differences in tenure choice before and after the financial crisis in the Netherlands

## *A micro-level survey approach*

Teun Bakker
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| Version | **2** |
| Author | **Teun Bakker** |
| Student number | **S2786958** |
| E-mail | **t.bakker.9@student.rug.nl** |
| Supervisor | **dr. M. (Mark) van Duijn** |
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**Abstract**

Tenure choice is the choice between renting or buying a house, that almost everyone makes once or more in their life. Tenure choice has been in the Dutch news lately since in certain areas where renting is hard, people with average incomes cannot buy houses anymore. This affects people their lives and has large welfare implications because a lot of the wealth of households is represented by housing equity. The outcomes of tenure choice on aggregated level affect the economy, housing market and building patterns.

The association between demographic characteristics and tenure choice is often found in scientific research. In this research: age, couple status, migration background and income are central. Binary logistic regression models are used to test the expected associations between these demographic characteristics and tenure choice in the Dutch WoON dataset. Later, interaction variables are used to see if associations differ before, during and after the GFC, which is expected because of the increasing risk of house buying. With the interactions being significant our model suggests that associations of the demographic characteristics with tenure choice differs before, during and after the GFC. For age and income, the positive association with homeownership increased, for being a couple and native Dutch, the positive association with homeownership decreased during and after the GFC. This means that not all demographic groups with high homeownership rates have become relatively more likely to own a home during and after the GFC.

Keywords: tenure choice, demographic characteristics, risk, GFC, logistic regression models.

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# 1. Introduction

## 1.1. Motivation

Buy or rent a house? Sooner or later almost everybody makes this decision that is referred to as tenure choice. The topic is important, since it has implications for the economy and welfare of a country because renters and buyers have different rights and (tax) obligations. Tenure choices also influence building patterns and the physical structure of residential areas (Clapham et al. 1987). In most European countries and the United States, buying a house is traditionally the more popular choice (Statista, 2019; Trading Economics, 2019). In 2017 almost 70% of all EU residents lived in a house they owned and, in all countries, more than half of the households are owner-occupier (European Commission, 2019). From the 1980s onwards, market-driven housing policy became leading in Western Europe after decades of government led rebuilding subsequent to the Second World War (Financieel.Infonu, 2019). In this period homeownership was stimulated and promoted by the governments. Most European governments still stimulate homeownership because they believe it makes their citizens more self-reliant and prosperous (Vastgoedactueel, 2017). The Netherlands, which is the central country in this research, also shows a long-lasting trend of homeownership stimulating policies. Apart from the institutional and economic context, which will be also discussed in this study, demographic characteristics are important determinants of tenure choice.

Demographic characteristics can explain part of the tenure choice, since certain characteristics are associated with higher likelihood of buying a home. The question which people are relatively likely to buy or rent, given the market and institutional circumstances, is important for housing market forecasts since it is connected to housing demand. The most obvious demographic characteristic associated with tenure choice is income. The likelihood to be owner-occupier increases with income (OECD, 2016). Other demographic factors that are often used to explain tenure choice are age, couple status and migration background (Citylab, 2019). The average age of home buyers shows a long-lasting upward trend in both the US and Netherlands (CBS, 2017). But during and short after the global financial crisis or shortly GFC, this upward trend was interrupted, and the average age of homebuyers declined. The interruption of a trend can also be observed in housing prices. Between 2008 and 2013 the house prices in the Netherlands decreased after years of rising (AD, 2017). The same pattern can be observed on the Global Real House Price Index (IMF, 2019). The decrease in house prices would, in theory, make it easier to buy a home for starters if disposable incomes remain stable. This would decrease the average age of homebuyers, as is also observed. The interruption in age and housing price trends is overlapping with the financial crisis or GFC that was most felt in 2008 and 2009 in the Netherlands (Rijksoverheid, 2017). It will be interesting to see if this pattern, where the financial crisis creates a shock or breakpoint in a trend, also goes for other demographic characteristics like income, couple and migration background that are also associated with tenure choice.

After the GFC, from 2014 onwards, the Dutch house prices grew to an all-time high in 2019 (Volkskrant, 2019). In the Randstad area, which is the most densely populated area in The Netherlands, people with average incomes could now only afford 5% of the houses. This has led to societal problems like the deficit of teachers and policemen in certain expensive areas (Financieel Dagblad, 2018). Renting is also hard for these groups due to long waiting lists and strict norms for social housing. A lot of people in the Netherlands are 'too rich to rent and too poor to buy' (Trouw, 2015). The shortage of housing for people with average incomes already caused a school to close due to a deficit of teachers in the area (Parool, 2019). These societal problems because of high housing prices and inequality between demographic groups on the housing market seem to have become larger after the GFC, which will be researched in this study. Even in 2020, a lot of the problems in the housing market seem to be a result of the GFC more than 10 years ago (NOS, 2020). This makes the effect of the GFC on the association between tenure choice and demographic characteristics still a current and important topic.

There is a lot of attention for characteristics of buyers and renters, both in international and Dutch media, however not much in combination with shocks due to crises. It is known from earlier crises that people tend to postpone the decision to buy a house because a lack of faith in the economy. The increasing risks of falling household income and house price declines are important reasons for the procrastination of house purchases (Volkskrant, 2020). The risk of buying a house can be divided in two parts: uncertainty about future income is related to payment risk while possible house price decline is related to capital risk. Both types of risk increased during the GFC (Elsinga et al. 2011). One reason why the association between tenure choice and demographic characteristics will change during and after the GFC could be the different way demographic groups deal with these increasing risks.

In exploring which type of housing is needed in the future and forecasting housing demand, demographic characteristics are crucial. PBL (2014) expects that the future housing market will be even stronger determined by demographic factors. Insight in demographic trends and how they are associated with the housing market in different periods could help steer the housing policy of the Dutch government and adjusting housing stock on changing demand. As Dutch minister of home affairs Ollongren states (Rijksoverheid, 2019a) the housing stock should give room to all housing wishes and requirements, instead of just enough houses, we need the right type of houses. For market forces, it is also interesting to know if there will be for example more demand for owner-occupied houses for elderly or for rental apartments for young families. The question how coefficients of demographic factors that are associated with tenure choice, change in times of crisis, is urgent and could help to explain and forecast Dutch housing demand in future times of crisis. Surprisingly, in scientific research, there has not much been done with this interesting theme in the Dutch context. Since the tenure choice has an impact on the economy, satisfaction and wealth of people, it should be researched further.

*1.2. Review of literature*

In the international context, there are heaps of literature that connect tenure choice with demographic characteristics of households (Clark et al. 1994; Drew, 2015; Lennartz et al. 2016). Some studies point out one demographic factor and studies that investigate different factors that could be linked with tenure choice. Age (Gabriel & Rosenthal, 2015; Lennartz et al. 2016; Schilder & Conijn, 2013), couple status (Hendershott et al. 2009; Thomas & Mulder, 2016), migration background (Borjas, 2002; Painter & Yu, 2008; Uunk, 2017) and income (Clark et al. 1994; Lennartz et al. 2016) are central in this research.

Drew (2015) finds that homeownership rates are lower than average for unmarried, female, non-natives and central city inhabitants. Homeownership rates are above average for parents, higher age, higher education, higher incomes and people that are (previously) married. The amount to which these independent variables contribute to the homeownership rates differs for instance between period during and outside the big housing boom. The research shows that the choice to buy or to rent can be explained and predicted for a large part by demographic factors of a household. Demographic factors are thereby one of the most important determinants for demand in the housing market (CPB, 2018). What is not often researched in academic literature, is the development of these demographic characteristics over time, for instance before and after a potential breakpoint like the GFC.

The GFC that started in 2008 showed the instability of the housing market and global economy. The clear connectivity of national and regional housing markets with the international economy brought uncertainty about housing prospects for people in a lot of countries in the western world (Kennett et al. 2013). Uncertainty about housing prices and the economy in general, relates to increased risk and has in the past proven to depress the proportion of homeowners (Rosen et al. 1983). In times of uncertainty, people that are risk-averse become relatively even more likely to rent instead of buy. The households with relatively low incomes are the ones that become even more likely to choose rental homes in uncertain times. Demographic groups with relative low homeownership rates are in general more risk-averse and become even more likely to choose rental homes in uncertain times. Higher age, being native, being married and higher income are all positive correlated with risk-taking (Cohn et al. 1975; Grable, 1997; Jianakoplos & Bernasek, 2006). The GFC made the risk of buying a house bigger, and therefore the differences in tenure choice between demographic groups are expected to rise as well.

In other research about tenure choice, the effect of uncertainty is often not included while Rosen et al. (1983) argue this could lead to overestimation of the association of other factors -for instance tax effects- with tenure choice. In this research, uncertainty and risk will not directly be included as variables, but the effect of uncertainty is explored by time variables. If certain

demographic groups are postponing or cancelling their decision to buy a home and choose rental homes instead, it could say something about the way different groups deal with uncertainty and risk.

Insight in the changing association of demographic characteristics with tenure choice in times of crisis could be helpful in checking the effect of policy measures. The Dutch government tried to stimulate homeownership for all demographic groups during the GFC, but it might not have worked out the way they wanted. After the GFC, from 2012 onwards the Dutch housing policy became less focused on homeownership stimulation. It will be interesting to see how the policies influenced the demographic characteristics associated with tenure choice. This study will contribute to the topic with research about the demographic characteristics that are associated with tenure choice in the Netherlands over the 2002-2019 period. We will look at the short term (until 2012) and longer term (until 2018) influence of the GFC on tenure choice.

### 1.3. Problem definition and aim

The demographic factors of focus in this research are age, couple status, migration background and income. All these demographic characteristics are proven to be associated with tenure choice in previous research. But a comparison of the demographic characteristics that are associated with tenure choice in the Netherlands over time, is still lacking in academic literature. The period around the GFC is very suitable because tenure choice is likely to be influenced by the crisis. Since demographic characteristics are such an important determinant of tenure choice, insight in the way these react to a financial crisis could be helpful for both government and market parties in adjusting the housing stock to changes in demand. The central focus is on the association of demographic characteristics with tenure choice and whether the GFC has changed this. It is already known that demographics are associated with tenure choice and therefore the demand side of the housing market. Here will be explored if there are differences between change in association with tenure choice of groups that have had traditional lower homeownership rates, and other groups in the Netherlands during the GFC.

There is also some research about how the demographic factors of renters and buyers changed during the global financial crisis in different countries (Cszimady et al. 2017). But detailed research about change in homeownership rates of demographic groups in the Netherlands during and after the GFC is lacking. There could be a possible interaction effect between the timing of the GFC and the demographic characteristics that are associated with tenure choice. The conclusions from this research should give insight in the association between demographic characteristics and tenure choice, and how this association has changed over time. The research could possibly be helpful in the process of designing a policy to influence homeownership of certain demographic groups.

### 1.4. Main and sub questions

The main question for this study is: *how did the association between tenure choice and demographic characteristics change after the GFC in the Netherlands?*

Explaining variables that will be used in this research are:

1. Age (homeownership rates increase with age)
2. Couple status (Couples have higher rates of homeownership)
3. Migration background (Migrants have lower rates of homeownership)
4. Income (higher homeownership rates among higher income groups)

The extent to which these demographic characteristics are associated with tenure choice before and after the crisis will be compared. Two sub questions are central in the research. *Sub question 1: To what extent is scientific literature able to determine demographic factors that are associated with tenure choice?* The first sub question is about theory that underpins the rest of the research. In the theory part, demographic factors that are associated with tenure choice are explored and described. The presence of the associations that are derived from theory, is checked in the dataset with the first regressions. Are the demographic factors that are mentioned in the theory indeed associated with the rent/buy decision with the suggested sign? This will be checked with logistic regressions on the WoON dataset in Stata.

*Sub question 2: How did the GFC impact the coefficients for demographic variables that are associated with tenure choice in the Netherlands on short term and long term?* This sub question will be explored with the WoON dataset and Stata software, the results of the first sub question are also used for this sub question. The changing association between the independent variables (demographic characteristics) and the dependent variable (tenure choice) is explored by logistic regressions models with interaction variables. Control variables are added to increase the explanatory power of the model and control for the effects of other variables. With the results of the quantitative analysis, it can be stated if there are significant differences in the demographic factors that are associated with tenure choice before and after the GFC. If these significant differences are present, explanations must be researched. It is known that in the previous financial crisis much patterns that showed up in earlier crises tend to repeat. When there are significant differences between how the demographic characteristics that are associated with the buy/rent decisions in the Netherlands react on a crisis, it is very likely that in future crises these reactions are somehow similar. This could have implications for the demand side of the housing market in which type and how much houses are needed, especially if these changes in associations persist. In this part of the research, the implications of these patterns are explored and eventually, there will also be some investigation about how policy measures could be taken to counter these associations. The conceptual model of this research questions is:
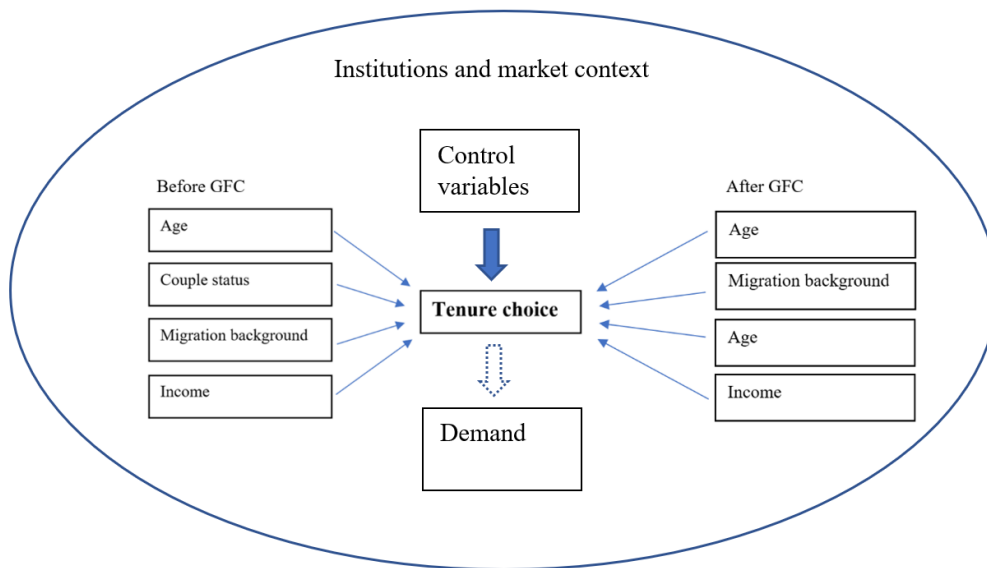
*Figure 1: Conceptual model*

### 1.5. Data and methodology

The dataset used for this research is the WoON dataset (DANS, 2019) from the Dutch ministry of home affairs. For the research, the variable HuKo (renamed *rentbuy*) in the WoON dataset is a suitable dependent variable. This is a binary variable that says if a household is tenant or owner-occupier of the house where they live. A new WoON dataset is created every three years from a large-scale survey. The versions of 2002, 2006, 2009, 2012, 2015, 2018 which are after a request all available, are used for this research. Since the datasets are collected on different points in time, it will be a longitudinal approach. As Mulder (1996) states, with longitudinal data the study could pay more attention to things that change over time. The dataset is suitable since it describes a lot of demographic characteristics and has the buy/rent variable in it.

### 1.6. Outline

The remainder of this paper is organized as follows. Section 2 describes our theory and the hypotheses that are based on the literature. Section 3 describes the contextual framework. Section 4 describes data and section 5 the methodology. In section 6 of the thesis, the results will be presented, and section 7 concludes.

## 2. Theory and literature review

Different forms of tenure are linked to different property rights in the western world. When someone rents a house, it gives them the right to use the house. When someone buys a house, it gives them the rights to transfer the house and make profit or loss on the housing investment which is why homeownership also brings more financial risks than renting. In other parts of the world, property rights are often less well defined. About one out of three people in the world lives in slums without

clear property rights (Cszimady et al. 2017). Therefore, only research in western countries with well-defined property rights linked to tenure choice will be covered in this literature review.

The choice between buying or renting looks rather straightforward on first sight. However, there are a lot of different ways to look at this tenure choice from a behavioural point of view. Mulder (1996) distinguishes four different approaches to look at tenure choice. The continuous choice approach, the risk approach, the two-stage choice approach and the three stage-stage search and choice approach. Since the continuous choice approach is best suited for micro-economic research on utility maximisation, it is the approach that will be used to look at tenure choice in this research. ''In the continuous choice approach, people are assumed to continuously choose between types of housing or levels of housing consumption'' (Mulder, 1996, p.212). The approach assumes that households are evaluating their housing situation continuous and use the outcomes of this evaluation to decide if they want to move. The choice to buy or rent is a part of this continuous choice housing approach and is seen as a rational choice. This means that people balance all benefits and costs of certain choices before they decide what is best to do (Scott, 2000). For tenure choice this means that people move to another house if they can improve their place utility (Wolpert, 1965). It is not very likely that the continuous choice approach is the way most people make their real tenure choice. It would cost a lot of energy and time to think about moving to another house every single day. But for research purposes, this approach is very suitable because researchers can assume that the current tenure is the expression of the utility maximizing housing choice of a household. In this research, it is assumed that people that live in a rental home, also want to live in a rental home and people that are owner-occupier prefer buying a house. This assumption makes it easier to interpret the outcomes about the association of demographic characteristics with tenure choice.

Utility maximisation is something that is often mentioned in relation to tenure choice. Utility maximization means that an individual or household picks the option with maximum utility (given their preferences and budget constraint) out of a couple of options. Utility stands for the rational degree of desire. Utility maximization is closely linked to rationality and rational choices, but it is not the same. In ideal cases, utility maximization is necessary for rationality. But in cases that are not ideal and where utility maximization is not possible, rationality is still possible. So rational choices are always possible, but utility maximization is not (Weirich, 2008). We will therefore assume that the tenure choice of a household is always a rational choice that tries to maximize the utility of the household. Utility maximisation is influenced by external factors like supply of houses and the effort needed to move, therefore the household will not always pick the option with maximum utility since the housing market does not always make ideal choice possible.

Buying is -in most Western countries- in general, more popular than renting. Being owner-occupier seems in most cases to be the rational choice, mainly on financial grounds. However, many researches prove renting for a lot of households to be more financially feasible than buying a house. Voicu & Seiler (2013) for example prove that the annual gain of renting in different cities in the

United States is between 4,49% and 8,04%. Beracha & Johnson (2012) show that renting is financially preferable over buying in somewhere between 72% to 91% of the cases. So, the financial argument for buying as the most popular tenure choice is doubtful, at least in the US. Assumed rationality of the tenure choice is therefore likely to be influenced by cultural and social values.

Tenure choice will always be a matter of choice for most households that are financially capable enough for both buying and renting. A part of the tenure choice is determined by individual preferences. But there are a lot of demographic characteristics that can help to explain another part of the tenure choice. With these characteristics, we can foresee if a household is more likely to buy or to rent a house. These insights could help to forecast the demand in the housing market and adjust the housing stock to the future demand. This research analyses if a household is renting or owning at some point in time. It has no implications for this research if the household has recently moved or not, their current tenure choice is seen as their preferred tenure choice. This can be seen as a limitation, but it is the best option given the dataset.

In this analysis, the demographic factors of focus are age, couple status, migration background and income. These are among the most important demographic variables that are associated with tenure choice. All demographic characteristics and control variables are discussed more in-depth in the following sections considering more (international) literature. Risk, uncertainty and policy are also discussed since they are expected to influence tenure choice. Next to that, exogenous factors also associated with tenure choice like institutions and economic context, are reviewed in the context chapter of the research.

*2.1. Age*

Gabriel & Rosenthal (2015) research on homeownership rates in the United States, shows that between 1970 and 1995 homeownership rates remain stable between 64% and 65%. In 2006 the homeownership rate has increased to 69%. After the crisis, the homeownership rate declined again towards 65% in 2013. For the variable age, the possibility of homeownership rises slowly with every extra year of age under 50, stabilizes between the 50s and mid-70s and declines after the mid-70s. Interesting is that homeownership rates for people below 60 years are lower in 2009 than in 2000, while individuals older than 60 years have higher rates of homeownership in 2009 compared to 2000. This shows that demographic characteristics that are associated with homeownership, change over time and during the financial crisis. It is discovered that around 40% of this change in homeownership can be attributed to change in attitudes and market conditions and around 60% to changes in population characteristics. The researchers forecast that homeownership rates are not likely to increase till the peak levels of 2005-2006 again but will also not fall much below 65%. The shock created during the GFC in association between age and tenure choice is expected to continue to influence homeownership rates in the United States. We will research whether this is also the case for the Netherlands

In Australia, positive but declining association of age and homeownership is also found. Increase in age from 20 to 35 years make the chance of owning a home increase from 26% to 69%. An increase in age from 35 to 60 years only increases homeownership rate from 69% to 78% (Hendershot et al. 2009). Lennartz et al. (2016) researches homeownership rates among 18-34 years old in different countries in Europe before and after the GFC. Earlier research already shows that in the US and UK, homeownership rates among the young generations decreased more than average during the GFC. The average decrease in homeownership between 2007 and 2012 was 5% for the researched European countries. However, for the Netherlands, the decrease was 10,2%. One of the conclusions of the article is that the financial crisis and economic crises, in general, may undermine existing residential patterns and reinforce living arrangements.

Schilder & Conijn (2013) show that the decrease in the number of house transactions during the GFC in the Netherlands was the greatest among people between 25 and 45 years old. For a large part, these are people that already have a house and postpone their decision to move because of the crisis. The number of starters on the housing market remains kind of stable during the researched period, while total number of transactions decreased between 2007 and 2011 with around 40%. In the rental market, there is not much change observed, the biggest change is that renting has become more popular because of the circumstances to buy a house. A lot of people postpone their decision to buy a house because of the crisis, but their wishes remained the same. The postponing group made the supply of housing increase fast after 2007. Because of the earlier findings discussed in this paragraph, it is expected that younger people have become relatively less likely to buy a house during and after the GFC.

### 2.2. Couple status

Hendershott et al. (2009) shows the same positive associations between age and homeownership rates as researches described above. But the main concern in their research is the effect of marital history on tenure choice. The variable current marital status is found to significantly influence tenure choice in Australia. Being single compared to married lowers the probability of being a homeowner by 36% for people below the age of 35. For people older than 35 years, the chances of owning a home are lowered by 13% when they are single as compared to married people. Single person households in general have lower probabilities of homeownership in Australia (Bourassa, 1995). Couples and two-parent families are more likely to own a home than singles and single-parent households in the United States. Single-parent and single households are quite unlikely to ever move from rental to owner-occupied housing (Clark et al. 1994).

The same kind of association between marital status and homeownership exists in Germany, the Netherlands and the United Kingdom (Thomas & Mulder, 2016). Being married increases the probability of being a homeowner in all three countries. The effect is the strongest in Germany since the tradition of marriage is most present in that country. The association of marriage with

homeownership is weaker than a few decades ago, however large part of this decrease is compensated for in the difference in tenure choice between cohabiters and singles. Cohabiting couples have higher homeownership rates than singles. It is assumed that this change has to do with people postponing their marriage and the less central role of marriage in society. Therefore, couple status is a good indicator to replace the former variable marital status in association with tenure choice. With couple status in this study we do no longer only refer to the fact if someone is married yes or no, we define it as living together with someone with whom you have a romantic relationship. People who are married and live together are always considered as a couple in this study, but couples do not have to be married to be part of the group of couples for the variable couple status. Based on literature above, a positive relationship between being a couple and homeownership is expected, but the influence of the GFC is still to be determined.

### 2.3. Migration background

In earlier studies, being non-native is found to be negatively associated with the chance of being a homeowner (Painter & Yu, 2008). Homeownership rates of people with a migration background in the United States are significantly lower compared to natives. Between 1980 and 2000 the differences in homeownership between migrants and non-migrants increased significantly. In 1980 the homeownership rate among migrants was 51,2% and decreased towards in 47,4% 2000. For native Americans, the homeownership rate was 63,2% in 1980 and increased to 67,2% in 2000 (Borjas, 2002).

In the Netherlands, native Dutch also have higher homeownership rates than groups with a migration background (Uunk, 2017). Big differences exist between the probability of owning a house for Moroccans (0,21) Turks (0,55) and native Dutch households (0,84). The odds of being a homeowner are around four times higher for Dutch people as compared to Moroccans and differ significantly. The effect of income on homeownership is also significant but the income effect is larger for migrants than for native Dutch people. Part of the differences in homeownership rates between ethnicities can be explained by variation in incomes. Another part of the difference in homeownership can be explained by the variable urbanization. When people live in a city, chances of homeownership are lower, and the ethnic minorities appear to live in the city more often. Since the association between living in a city and tenure choice is proved in more researches (Drew, 2015) it is included in our study as a control variable. The other independent variables in the model of Uunk (2017) could not fully explain the ethnic differences in homeownership rate, so having a migration background is proved to be negatively associated with homeownership.

*2.4. Income*

Income is in heaps of studies on tenure choice one of the most important explaining variables. When income increases, a household is more likely to buy a home instead of renting (Drew, 2015). It also works the other way around: lower incomes are more likely to rent instead of owning their homes. Change in income also plays a role in association with tenure choice, as decreasing homeownership rates among young adults are closely linked to decreasing incomes (Lennartz et al. 2016). The positive association between income and homeownership is proved by earlier research. But as Clark et al. (1994) indicate, the shift from renting to owning varies from period to period in the United States. Their research investigates how tenure choice is affected by changes in household characteristics on the one side and economic context on the other side. But the association of demographic factors, especially income, with tenure changes cannot be seen apart from economic context. The variables used for the economic context are prices, level of new construction, region, mortgage rates and inflation. The economic factors have a larger effect on families than on couples. Increasing income is in the final model significantly and positively associated with the chance to move to owner-occupied housing. Clark et al. (1994) show how economic context can be included in a demographic model on tenure choice. The economic context will be exogenous in our analysis because it is not a demographic characteristic. Nonetheless, it is important to note that the economic context cannot be seen apart from the association between tenure choice and demographic characteristics. This is one of the reasons why the GFC is expected to have an impact on the way these associations change.

*2.5. Control variables*

Apart from the four independent variables that are central in this research, a few control variables are considered. These are all variables from which the association with tenure choice is proved in earlier research. Adding these variables to our analysis will probably increase the explaining power. But most important the control variables prevent the model from giving spurious regression results, which means giving misleading statistical evidence. When control variables are integrated, the model will control for the effect of these variables and therefore the values of the independent variables are more reliant. The effect on the dependent variable that is caused by the control variables is filtered out of the values of the independent variables. A selection of control variables is made, also based on the availability of good measures for a variable in the WoON dataset. One of the researches that is used to identify control variables is from Raya & Garcia (2012). They describe different models that can explain tenure choice, for example a duration model and a transition model. Their model, called Classical model, describes the probability that an individual is a homeowner at a given point in time. This model is closely related to the way this research will explain tenure choice. We use three control variables in this analysis: household size, urban resident or not and education level.

Household size is positively associated with homeownership and will be included as a control variable. The larger the household, the more likely the household is to buy instead of rent a house

(Raya & Garcia, 2012). Goodman (1988) found the same effect of household size on tenure choice. The average household size in the study of Goodman (1988) for renters is 2,4 persons while for homeowners the average household size is 3,36 persons.

Another variable that is positively associated with homeownership in the Classical model from Raya & Garcia (2012), is education level. Although education is closely related to income, it is found to influence tenure choice also when corrected for income (Drew, 2015).

Drew (2015) also shows that homeownership rates are lower among people that live in the city. This is probably also true for the Netherlands since the share of rental housing is higher in cities (CBS, 2008). It is therefore hard to say if the fact of living in an urban or rural place affects the tenure choice or that the housing stock makes the percentage of renters higher in cities. However, the size of the place in which households live, is associated with their tenure status and therefore the urban/rural resident variable is included as control variable.

### 2.6. Risk and uncertainty

With the variables discussed above, we can test if the expected associations are indeed present in the WoON datasets from 2002 till 2018. But the question why the association of these demographic characteristics with tenure choice differs before and after GFC, is also important for this study. Risk and uncertainty are key in understanding these expected differences in association. Homeownership is assumed to be riskier than renting, especially when we focus only on possible negative consequences of it. Part of the risk called capital risk is in the possibility of declining house prices, which makes the timing of the housing transactions extremely important (PBL, 2011). When house prices decline, households with high LTV can even have negative equity on their mortgages. If owner-occupiers in this case have to sell their house, for example because of the other important risk related with house buying: payment risk, they remain with a residual debt. The possible threat of residual debt could be one of the reasons to postpone the purchase of a house or not buy a house at all. Residual debt has not only negative consequences for the household, but it also negatively influences the housing market and economy when a lot of households have residual debt (Schilder & Conijn, 2016). In times of uncertainty and declining house prices, such as the GFC, the rising risk of homeownership is likely to influence the characteristics of homeowners because there are differences in the way demographic groups deal with risk.

Just like the association with tenure choice, the association of demographic characteristics with risk-taking behaviour is often researched. As mentioned before, in times of crisis the risk of housing investments increases. During the GFC, both payment risk and capital risk increased for Dutch owner-occupiers (Elsinga et al. 2011). After the crisis, the housing market recovers slower than the rest of the economy because people lack trust to buy a house as the director of the Dutch Economic Institute for Building states (Volkskrant, 2020). So, the perceived risk of buying a house has most probably increased after the GFC which can explain part of the expected change in the association

between demographic characteristics and tenure choice. We will shortly investigate the existing literature on correlation between demographic characteristics and investment related risk behaviour from economic studies before hypotheses are formulated. The mentioned studies are not about homeownership but about investing in general. However, we expect the demographic groups to react similar to risky investments and rising risk of buying in a house in times of crisis.

The literature about correlation between risk in investments and demographic factors is numerous and diverse. For this research it is important that in the housing market, the costs to enter (buy your first home) and the concerns (it is also your place of living) are higher than in most other asset markets therefore preventing extreme risk-taking behaviour from people that cannot afford it. The findings in the literature discussed below are kind of comparable to the investment choices people make in the housing market and therefore used.

Cohn et al. (1975) find a positive and significant correlation between investment in risky assets and age. This means people of higher age are more likely to invest in risky assets. Riley & Chow (1992) find the same effect, risk aversion decreases significantly with age until 65 years.

For couple status in older scientific research we use marital status. Married people are often assumed to take more risks because they expect to cope better with undesirable outcomes. Married people are significant more likely to take high or average investment risk as compared to single people (Grable, 1997). Jianakoplos & Bernasek (2006) find the same correlation, being a couple is correlated to taking more investment risks.

The relationship between migration background and investment risk generally shows negative correlations. Grable (1997) shows this correlation by dividing the different cultural backgrounds in the United States and finds White Americans have significant higher investment risk tolerance than Hispanics and Afro-Americans. Jianakoplos & Bernasek (2006) find the same kind of correlation: controlled for other demographic factors, white Americans take relative more investment risk.

The correlation between income and risk-taking behaviour is positive and significant in most researches. Grable (1997) finds that the mean income for people tolerant for high investment risk is $165,798, for average risk $120,548 and for low risk $61,038. The positive correlation between income and investment in risky assets is also found by Cohn et al. (1975). It is important to note that the percentage of income spent on housing is an important indicator of risk. Elsinga et al. (2008) explain in more detail how risk is related with house buying. On average the low-income and younger households are the ones that spent most of their income on their house, so in a normal situation, the risk of low-income households is already higher, which makes them even less likely to buy a house when the risk becomes higher in uncertain times like the GFC.

So higher age, being a couple, having no migration background and higher income are all correlated to higher investment risk-taking behaviour. Since the risks of buying a house increased during the GFC, these demographic groups are expected to relatively answer the tenure choice more often with owner-occupier during and after the GFC.

*2.7 Policy*

In addition to the increasing risk of buying a house, government policies also influenced the tenure choice in the GFC period. Just like in other Western countries as the United States, United Kingdom and Australia, the Netherlands has a long tradition of homeownership stimulating policies. The Dutch government traditionally tries to stimulate homeownership and affordability of houses among all demographic groups, with income-based subsidies and tax measures. In 2008/2009 which is seen as the start of the GFC in the Netherlands, the Dutch government tried to extend homeownership stimulation. As an example of these homeownership stimulating policies, the border for the National Mortgage Guarantee (Nationale Hypotheek Garantie NHG), a security for people who could not pay their mortgage anymore was raised in June 2009 from €265.000 to €350.000 (RSA Nederland, 2010). The building sector was also stimulated in 2009 with an extra budget of €395 million (VROM-raad, 2010). During the GFC, some policy measures also tried to diminish the differences in homeownership between income groups. For example, the tax treatment of houses worth more than 1 million became less favourable in 2009 while for other houses the tax stays equal (CPB, 2010). The (possible) owners of these expensive house are probably not the ones that are likely to move to rental housing, but it shows the levelling intentions of the Dutch government in this period. Most important is that the Dutch government stimulated homeownership among most groups and with their policy not fostered increasing differences among demographic groups during the GFC. The effects of homeownership stimulation among all income groups are doubtful. Stimulating low-income households to buy houses with risky finance has more or less failed in Australia and the United States (Beer et al. 2011). It could be even seen as one of the causes for the GFC.

After the GFC, from 2012 onwards, Dutch policies changed towards less homeownership stimulation. The tax benefits for homeowners were reduced and new mortgages must be fully repaid (Schilder & Conijn, 2013). In 2012 a legal maximum loan to value was also introduced. This maximum loan to value decreased stepwise from 105% in 2013 to 100% in 2018 (DNB, 2015). These rules made it harder to buy a home, especially for low-income households (Boelhouwer & Schiffer, 2016). When we look at housing policy in relation to the GFC, we see on the short-term policy that tries to stimulate homeownership and limit differences, with cutbacks especially targeting high-income groups. On a longer term, we see less homeownership stimulation and rules that make it harder to borrow and will most likely increase differences in homeownership among demographic groups. The effects of these policies in combination with the changing risk of homeownership on the demographics associated with tenure choice will be researched.

*2.8. Hypothesis development*

The main hypothesis is that the GFC has affected homeownership among groups with lower homeownership rates relatively more than other groups. The groups with relative low homeownership rates are more risk-averse. When risk of home buying goes up, in uncertain times like the GFC, the

tenure choice of these groups will be relative even less likely owner-occupied housing. Uncertainty about the prices of housing leads to lower homeownership rates and lower income households are relatively the most affected income group (Rosen et al. 1983). The uncertainty about debts on the housing market shifted during the GFC further to individuals and households (Kennet et al. 2013). Debts and differences between income groups thereby became bigger and will most likely grow further in the future. As Drew (2015) shows, the association between demographic characteristics and homeownership differs between periods before and during the housing boom, will this also be the case for the GFC? This study compares the association of demographic factors and tenure choice before the GFC (2002 and 2005) with the association during and short after the GFC (2009 and 2012) and after the GFC (2012, 2015, 2018) to see how these associations differ. Variables that are associated with homeownership rates according to earlier research and are used in the analysis are:

1. Age (homeownership rates increase with age)
2. Couple status (couples have higher rates of homeownership)
3. Migration background (migrants have lower rates of homeownership)
4. Income (higher chances of homeownership among higher income groups)

For all four variables, the following hypotheses are set and will be tested.

*Hypothesis 1: the positive association of age with homeownership has increased after the GFC.*

*Hypothesis 2: the positive association of being a couple with homeownership has increased after the GFC.*

*Hypothesis 3: the positive association of being native Dutch with homeownership has increased after the GFC.*

*Hypothesis 4: the positive association of income with homeownership has increased after the GFC.*

### 3. Context

The traditional housing wish of most people in the western world is to own a residential dwelling where they could live with their family, partner or by themselves (Beracha & Johnson, 2012; Reed & Greenhalgh, 2002). In almost all western countries most people live in an owner-occupied house. There are some exceptions like Switzerland, where only 34% of the households owns a house, but in countries like the United Kingdom, United States and the Netherlands the share of owner-occupiers is larger (Bourassa & Hoesli, 2008). This ideal type of housing has been dominant for generations. Homeownership is associated with benefits like more self-esteem, financial, educational and other benefits for the children, crime prevention and civic pride (Beracha & Johnson, 2012). Homeownership proved to have positive externalities on well-being of residents and their children (Painter & Yu, 2008). In countries like Switzerland where renting is more popular, the main reasons are relatively high house prices as compared to income and favourable tax treatment of renters (Bourassa & Hoesli, 2008).

*3.1. Comparison with other countries*

It is important to understand bit of the housing market context of the Netherlands to get a feeling for the way tenure choice works in this country. We will compare the Dutch context shortly with the situation in the United States and the United Kingdom because this research is in English and there is a lot of research on this topic in those two countries. Long term trends show that buying a house has become relatively more popular in the Netherlands since 1986 (Das Kapital, 2015). The homeownership rates have been around 60% over the last decade. For the United States and United Kingdom, the homeownership rates are traditionally higher. Both countries show homeownership rates above 65% since the 1990s while in the Netherlands the homeownership rate was only 55% in 1999 (OECD, 2016). From 2007 onwards, a strong decrease in homeownership rates can be observed for both United States and United Kingdom (Figure 2). This decrease in homeownership is likely to be associated with the global financial crisis or GFC
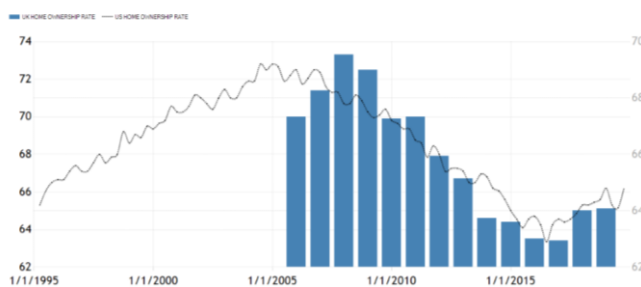


*Figure 2: Homeownership rates in UK and US (Tradingeconomics, 2020)*

For the Netherlands this same decrease in homeownership cannot be observed, the homeownership rates even increased from 53,7% in 2006, to 55,7% in 2009 and 57,6% in 2012 (CBS, 2019a). The average homeownership rate in the Netherlands might not have decreased after the GFC, the question in this research will be if the composition of the demographic groups comprises owner-occupiers might have changed. The expectation is that the demographic characteristics associated with tenure choice are different after the GFC. The percentage of starters on the housing market (people that occupy their first independent home) that bought a house has for instance decreased from above 50% in 2006 to around 30% in 2018 (RTLZ, 2018) which will most likely increase the average age of homeowners.

Compared to the United Kingdom and United States, the Dutch housing market is much more regulated. Especially the rental sector, that has a large share of social housing. In the Netherlands, about one third of the housing stock is social housing (CBS, 2019a) while in the United States (USHMC, n.d.) it is only around 1%. In the United Kingdom the share of social housing fell from over 30% in 1980 towards 17% in 2017 (Fullfact, 2018). In all three countries, the government has a long history of stimulating homeownership that has to do with supposed benefits like more reported wellbeing among owner-occupiers (Painter & Yu, 2008). Both the United Kingdom and the

Netherlands stimulated homeownership with tax deductibility of mortgage interest. In the United Kingdom, this system has already stopped before 2000 and in the Netherlands the policy is diminished after the GFC (OECD, 2016). Although some other policies to stimulate homeownership are still in play, the Netherlands and UK are slowly moving towards less homeownership stimulation. In the Netherlands, for instance, the maximum loan to value is decreased in 2018 to 100% (DNB, 2015). In general, we can observe that Dutch and UK governments are less focussing on homeownership stimulation and more on tenure diversity after the GFC. In the United States, the tradition of stimulating people to buy a house is the strongest as it relates to the 'American Dream'. The options for social housing are very limited and owning a home is still very strongly embedded in the American culture. There are no signs yet that homeownership stimulation by American Government will decrease. In 2019, for example, a new policy called the Affordable Refinance Program was released to let homeowners profit from low mortgage rates (The Mortgage Reports, 2019).

### 3.2. International context of independent variables

One of the demographic variables that are central in this research is age. The association between age and buying a home is assumed to be positive and increasing after the GFC. The observed effects in different countries are much alike. Over the last years, homeownership has become almost impossible for young people in the United Kingdom (Thomas & Mulder, 2016). In the United States, the average age of first-time homebuyers has risen from 32 in 1997 to 34 in 2017 (Citylab, 2019). In the Netherlands, the average age of people that buy a house also increased over the last years. In 1995 the average age of buyers was 34,6, in 2007 it has risen to 36,1 and 39,4 years in 2016. However, in between the average age showed a small decline, from 36,1 in 2007 to 34,7 in 2009 (CBS, 2017). This shock in the upwards trend coincides with the GFC. Ministerie van Binnenlandse Zaken en Koninkrijksrelaties (2016) shows that the percentage of people owning their home in the Netherlands increased from around 48% in 1994 to around 60% in 2015. In the same period, the percentage of people below 25 years that owned their home decreased. The young people below 25 years are the only age group in which no increase of homeownership was observed.

Ministerie van Binnenlandse Zaken en Koninkrijksrelaties (2016) shows large differences in tenure choice between couples and single households for the Netherlands. In both 1994 and 2015, all age groups show larger homeownership rates among households with couples compared to households with singles. This large difference is also observed for families with two parents versus one parent families. In the past, people being married were much more likely to own a home. In 1997 no less than 61% of the people that bought a home in the United States were married. But this percentage decreased to 46% in 2013 (Citylab, 2019). The traditional order of a household in the US was: get married and afterwards buy a home. Nowadays more couples first buy a home and get married later or do not get married with their partner at all (Point2Homes, 2019). Therefore, nowadays having a romantic relationship with one of the people you live with is a better indicator of tenure choice than

being married. In this research, we will refer to this as couple status. In the United Kingdom, higher homeownership rates are observed between married and cohabiters with romantic relationships as compared to households that do not consist of a couple. For married households in the UK, the predicted probability of homeownership is around 0,75 and for cohabiting with partners around 0,55. For households that do not consist of a couple, the probability of homeownership is only around 0,3. In the Netherlands, married and cohabiting couples have probabilities of homeownership above 0,75 while non-couple households have a probability below 0,5 (Thomas & Mulder, 2016).

Having a migration background decreases the chances of owning a home in the United States. However, the chances of owning a home for people with an Asian and Hispanic background have increased over the past few years (Citylab, 2019). For the United Kingdom, the same effect could be found. The homeownership rate among non-UK born migrants in 2018 was 44%, while the UK born population had a homeownership rate of 70% (Migration Observatory, 2019). For the Netherlands, we also see that people with a migration background still have lower homeownership rates, but differences are decreasing (SCP, 2019).

The Dutch ministry of home affairs (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2013) pays attention to the association of income with tenure choice. Between 1994, 2002 and 2012 the relative number of middle- to high-incomes living in rental homes has decreased stepwise. In owner-occupied homes, the number of elderly and single households has relatively increased. This is due to larger demographic trends like ageing and smaller household size. For income, the pattern is relatively stable. For low incomes, the share decreased and for middle incomes, the share living in owner-occupied homes increased slightly, however for the higher income groups, relative numbers remain stable. Ministerie van Binnenlandse Zaken en Koninkrijksrelaties (2016) found that in 2015 the average income of owner-occupiers (€45400) was almost double the average income of renters (€23400) in the Netherlands. These large differences demonstrate why income is an important indicator for tenure choice in all western countries. In the United States, the average income of owner-occupiers lies around $67.000 while for renters it is $34.000 (Brookings, 2017). This is comparable to the situation in the Netherlands where owner-occupiers earn also around twice as much as renters. In the United Kingdom, social renters have an average income of £18,000, renters in the private sector have £28,000 and households with a mortgage have £40,900 (National Housing Federation, 2016). So, in all three countries, income and tenure are strongly associated.

### 3.3. Institutions and market factors

In addition to demographic characteristics, institutional factors could be important determinants of tenure choice. But since these are no demographic factors, they are exogenous determinants that will not be included in the models of this research; however, it is interesting to know something about how they are associated with tenure choice since policies can have an impact on the research outcomes. Cszimady et al. (2017) show the importance of policy on tenure choice in Hungary. However, it was

expected that homeownership rates would fall during and after the financial crisis, they remained stable, even among lower income groups. This stability is probably due to the large subsidies on homeownership and the lack of affordable and good rental options. These institutional and market differences also function as main explanations for international differences in the impact of the GFC on households in the book of Forrest & Yip (2011). It may be the case that institutional (on the municipal or provincial level) differences and regional markets also are associated with the way homeownership rates of certain household groups in the Netherlands reacted on the financial crisis.

The institutional context in the Netherlands play undoubtedly a role in tenure choice. A study about drivers behind the tripled housing prices between 1995 and 2008 of Dutch parliamentarians found that the deregulation of the Dutch housing market and homeownership stimulation of the government are the main causes for the fast-rising house prices. Important regulations to stimulate homeownership are the national mortgage guarantee (NHG: nationale hypotheek garantie) and the law stimulation homeownership (BEW: wet Bevordering Eigen Woningbezit) (Tweede Kamer, 2013). The wider borrowing options and rules are designed to make it possible to buy a house for more households but make housing prices go up on aggregated level, because of the rising demand. The financial housing support from the Dutch government for owner-occupiers in 2016 was 13 billion euro's whereas for renters the support was 2,9 billion (Groene Amsterdammer, 2017).

Homeownership stimulating policies were dominant in the Netherlands around the GFC. In other European countries, similar policies are observed. France and Sweden, for example, gave guarantees for buyers of newly built homes to stimulate the building sector. On a regional level in the Netherlands we see the same, in Amsterdam, the share of owner-occupied homes increased during the GFC while the low budget rental sector decreased, partly because of policy measures (Nul20, 2010). The crisis made the imbalances and problems in the housing market bigger. But the crisis was no reason to postpone reforming, instead it can be a good start to reform the market step by step (RLI, 2010). From 2012 onwards, the Dutch government diminished the homeownership stimulating policies and tried to reduce mortgage debts. One of the measures was, for instance, a maximum loan to value of mortgages which were introduced by law in 2012. The maximum loan to value for houses has decreased from 105% in 2013 towards 100% in 2018 (DNB, 2015).

One effect of the GFC on the housing market was people postponing their decision to move because of uncertainty. The number of moving households on the Dutch housing market decreased by 12% between 2007 and 2011. For owner-occupied homes, this decrease was almost 40 per cent while for rental houses the number of moving households increased by 13% (CBS, 2012). Statistic Netherlands (CBS, 2012) shows also that the decrease in movements to a new house is the strongest among people that move from the one owner-occupied home to another owner-occupied home. Schilder & Conijn (2013) try to get insight into how large the pool of postponing house buyers during the crisis is and how likely these people are to move when the market recovers. It becomes clear that the residual debt on a house is an important determinant of flow on the housing market. The lack of

demand from people that already live in an owner-occupied home and want to move to another owner-occupied home is the main reason for the decline in transactions. The reason that those people do not want to move is the residual debt on their homes and this will not change unless house prices will rise strong. So, again market conditions seem to play a significant role in the tenure choice or at least the decision to buy.

The group of postponing movers started to catch up rapidly after 2014 thereby increasing the housing demand, number of transactions and housing prices (Wegwijs, 2020). Housing prices in the Netherlands even rose to an all-time high in July 2019 (Volkskrant, 2019). A problem of these high prices is that certain groups (young adults, lower incomes) cannot afford houses in certain expensive areas anymore. This spatial inequality has already led to societal problems. Financieel Dagblad (2018) states that the fear that policemen, nurses and teachers cannot afford houses in certain areas anymore is well-founded. Where these groups in theory could buy around 15% of the houses in the whole Netherlands based on their income, they could afford less than 5% of the houses in the Randstad area. This is the Western part of the Netherlands where the four biggest cities (Amsterdam, Rotterdam, Utrecht and Den Haag) are situated and house prices are the highest. Renting in this area is also hard because of long waiting lists for social housing and high prices in the free market rental sector. Measures like a company paying half of the rent have already been taken to persuade teachers to live in this area (Parool, 2018). Partly because of the high housing prices and long waiting lists for rental homes, there has already been a deficit of teachers in some cities in de Randstad. In September 2019 a primary school in Amsterdam had to close because of the deficit of teachers (Parool, 2019). In the province of Utrecht in the Randstad, only 1,6% of the houses cost below €150.000 in 2019 while in 2018 this was still 13%. It becomes harder and harder to find suitable owner-occupied housing for people with modal incomes in this area (NOS, 2019). So, market factors (high house prices) affect demographic characteristics that are associated with tenure choice. Therefore, market and institutional conditions are important external factors for this research that are controlled for by adding the year fixed effects to the regression models if possible.

### 4. Data

Most researches about tenure choice discussed in the theory chapter, use datasets based on large surveys in different countries. In this research, the dataset that is used is also a large survey, called WoON data, from the Dutch ministry of home affairs. This dataset is collected by the government to get insight into the residential status and preferences of the Dutch population. The survey to create the WoON Datasets is filled in every three or four years by about 60.000 randomly selected households (Rijksoverheid 2019b; Woononderzoek, 2019). The WoON datasets from 2018, 2015, 2012, 2009, 2006 and WBO (predecessor of WoON) 2002 are used for this study. Permission for the use of these datasets is granted by Data Archiving and Networked Services of the Royal Dutch Academy of Sciences (KNAW). Before the descriptive statistics and first regressions, a transformation needed is

the exclusion of all cases that did not fill in the rent or buy question. After this first transformation of the data, 374.589 cases remain. The number of cases for every year used in this research can be found in table 1. Although there are differences between the number of cases for the years, we can assume that these differences are not big enough to have large impact on the results. Therefore, there is no need to transform the data on forehand to make the number of cases for all years more equal.

Since the WoON dataset of different years will be used, it is possible to use a micro-level approach. The dataset contains individual cases (households) that all filled in the same survey (with small differences between the years) with hundreds of questions. Therefore, it is possible to conduct a 'survey' analysis that searches for associations between answers on different questions. This analysis will investigate the way the tenure choice (binary variable renamed *rentbuy*) is associated with other characteristics of a household. We use italics when we talk about the variables used in the analysis to avoid misunderstanding between for example the *rentbuy* variable and tenure choice in general.

### 4.1. Descriptive statistics of the dependent variable

The *rentbuy* variable that represents tenure choice is a binary variable with two options: a household either rents or has bought their house. When the *rentbuy* variable from WoON has value 1 the household is owner-occupier, when the *rentbuy* variable is 0 the household rents. Since it is a binary variable with values 0 and 1, the mean of the *rentbuy* variable can be interpreted as a proportion. The proportions of the variable *rentbuy* in the WoON dataset for different years are summarized in table 1. The percentages show how much of the respondents are owner-occupier and therefore reply with buyer on the question of tenure choice. To check the representativity of the sample, it is compared with the reported homeownership rates of the whole population of the Netherlands (CBS, 2019a).

*Table 1: Homeownership rates sample and population*

| Year | Cases with value for rentbuy variable in WoON | Percentage homeowners in WoON | Real percentage homeowners in the Netherlands |
|---|---|---|---|
| **2002** | 75.043 | 56,29% | No data |
| **2006** | 55.958 | 54,14% | 53,70% |
| **2009** | 69.149 | 56,84% | 55,70% |
| **2012** | 60.365 | 61,32% | 57,60% |
| **2015** | 55.225 | 61,61% | 57,12% |
| **2018** | 58.849 | 63,96% | 59,30% |
| **Total** | 374.589 | 58,87% | - |

*Note: numbers in the table are based on Rijksoverheid (2019b) and CBS (2019a).*

Table 1 makes clear that the real percentages of homeownership in the Netherlands, are in general a bit lower than the averages of the WoON data. The differences between homeownership in the sample compared to the population is, just like the unequal number of cases for the different years, one of the limitations of the data. However, the differences between the population and the sample are

assumed to be small enough to have no large impact on the research outcomes. One of the other things that appear in table 1 is the risen percentage of homeowners after the GFC. That observation is not in line with the theory of Rosen et al. (1983) who states homeownership percentages will decline in times of uncertainty about house prices.

### 4.2. Independent variables

The characteristics that are associated with tenure choice in discussed literature must be linked with variables or questions from the WoON dataset. In this paragraph, the transformations (For Stata commands see Appendix D) of independent variables age, couple status, migration background and income to make them suitable for the research are shortly discussed.

For the representation of age, there are two options in the WoON dataset. The first one is described as the absolute age in years of the head of the household and is renamed *age*. *Age* is a ratio variable since a meaningful mean can be calculated. This variable can be found in all WoON datasets except the one from 2018. In the dataset from 2018, the only variable for age is a categorial variable with 7 categories. To make this variable comparable to the *age* variable from other years, the mean of each group is token and the value for *age* of every case from the category is recoded into this mean. This transformation leads to measurement error and distortion of observed relationships with the independent variable age. Therefore, another way of including a variable for age is preferred. The ordinal variable with age categories from the 2018 dataset, is also present in the datasets for the other years. The categorical variable contains of 7 groups and is renamed *agegroups*. The groups are important for the interpretation of the regressions and can be found in (Appendix A) along with the definitions and categories of all other variables. We will refer in the following to the variable as *agegroups*, for the other variables we will also use their variable name which can be also found in Appendix A. When we mention age groups without italics, it is about age groups in general, not about the variable *agegroups*.

For the demographic characteristic couple status, two variables from the original WoON dataset are used. The *hhkern* variable tells if a household consists for example of a couple with children or a couple without children. It has seven categories that are reduced to two in our new variable *couple*. This variable will be a 1 if a household consists of a couple and 0 if there is no couple in the household. Only 262.098 of the 374.566 respondents filled in this question because people who live in a one-person household did not get the question about couple status. The problem is solved by taking all households with value 1 in the household size question and giving them value of 0 (no couple) in the *couple* variable. When they live on their own, it is impossible that they live with their partner so this way all cases have the right value for the couple variable.

The original variable for migrant status from the WoON dataset tells if the respondent is native Dutch, western migrant or a non-western migrant. The variable can be combined with the variable about the migration background of the partner to a new variable named *migrant*. This variable has a

value of 0 when both the respondent and their eventual partner are native Dutch. The variable has a value of 1 when the respondent and/or their eventual partner are non-Dutch. By reducing the number of categories for migrant status from 3 to 2, information is lost but for practical and interpretation reasons, this is considered the best way to deal with this variable.

The *income* variable is the household's spendable income for a year as based on the definition of Statistics Netherlands (CBS, 2019b). This definition means the income after deduction of taxes, which is spent on savings and consumption. Just like *age, income* is a ratio variable because a meaningful mean can be calculated. By looking into the skewness and histograms (which is done for every variable but only found problematic for *income*) of the *income* variable, it becomes clear that it is not normally distributed, while this is necessary to perform the regressions. The variable is therefore transformed in a logarithm to make it more normal distributed; this variable is called *logincome*. After the first regressions, it became clear that this natural logarithm of income is also not the variable that will be used for income in the final models.

Income has also a categorical variable in the WoON datasets which is preferred for practical and interpretation reasons. The *incomegroups* variable has 5 categories which are described in Appendix A. For age and income, the continuous and categorical variables are both included in the descriptive statistics to give a clear picture of the data. In the regressions, the categorical variables are used in this study since it became clear that these grouped variables are better suitable for the research after some test regressions with the continuous variables. Using the categorical variables also prevents measurement error since there are no missing values for these variables.

### 4.3. Control variables and descriptive statistics

A couple of control variables are shortly discussed in the theory chapter. These are the household size, the place of living (urban/rural) and education level. For the control variable household size, the variable *hhsize* is used. This variable shows the absolute number of people living on an address. *Hhsize* is a continuous variable with a minimum value of 1 and a maximum of 60. For households living in an urban or rural area, we use the *municipalsize* variable. This variable represents the number of inhabitants of the municipality where a household lives and has 8 categories (see Appendix A). The last control variable used is about the level of education. This variable represents the highest attained degree in the household, which could either be the respondent of the WOON survey or their partner. The variable is called *study* and has 5 levels, ranging from no education to a university degree. The year of observations is also included in regression models to control for effects of the business cycle and timing of an observation. Therefore, it is also included in table 2 with the descriptive statistics of the variables.

*Table 2: Descriptive statistics*

| | Full sample N= 374.566 | | | | Renters N= 153.656 | | | | Owner-occupiers N= 220.499 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Variable** | **Mean** | **S.D.** | **Min.** | **Max.** | **Mean** | **S.D.** | **Min.** | **Max.** | **Mean** | **S.D.** | **Min.** | **Max.** |
| *Rentbuy* | 0,589 | 0,4821 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |
| *Age* | 51,25 | 17,34 | 15 | 95 | 51,9 | 19,63 | 15 | 95 | 50,8 | 15,516 | 15 | 95 |
| *Age groups* | 4,077 | 1,7266 | 1 | 7 | 4,148 | 1,938 | 1 | 7 | 4,028 | 1,56 | 1 | 7 |
| *Couple* | 0,617 | 0,486 | 0 | 1 | 0,401 | 0,49 | 0 | 1 | 0,769 | 0,422 | 0 | 1 |
| *Migrant* | 0,127 | 0,333 | 0 | 1 | 0,179 | 0,383 | 0 | 1 | 0,09 | 0,286 | 0 | 1 |
| *Income* | 34.392 | 25.057 | -977.077 | 960.557 | 23.485 | 14.656 | -977.077 | 795.163 | 42.014 | 27.845 | -485.769 | 960.557 |
| *Log income* | 10,265 | 0,63 | 1,099 | 13,775 | 9,926 | 0,555 | 1,099 | 13,586 | 10,502 | 0,568 | 1,099 | 13,775 |
| *Income groups* | 2,348 | 1,347 | 1 | 5 | 1,6 | 0,961 | 1 | 5 | 2,87 | 1,332 | 1 | 5 |
| *Study* | 3,624 | 1,295 | 1 | 5 | 3,171 | 1,365 | 1 | 5 | 3,941 | 1,141 | 1 | 5 |
| *Hhsize* | 2,348 | 1,338 | 1 | 60 | 1,929 | 1,241 | 1 | 60 | 2,64 | 1,325 | 1 | 47 |
| *Municipal size* | 5,093 | 1,573 | 1 | 8 | 5,508 | 1,649 | 1 | 8 | 4,803 | 1,449 | 1 | 8 |
| *Year* | 2009,93 | 5,457 | 2002 | 2018 | 2009,53 | 5,396 | 2002 | 2018 | 2010,21 | 5,481 | 2002 | 2018 |

The descriptive statistics in table 2 give insight into the kind of variables used in this research. *Rentbuy, couple* and *migrant* are all binomial variables with values of 0 and 1. Age and income are both included as continuous and categorical variables, but in the analysis only as a categorical variable. Tenure choice is a binary variable with two outcomes: buy or rent. These two options make it possible to divide the whole sample into two groups: buyers and renters. A couple of statements from theory could be explored by looking at the differences between the groups. In table 2, the means of the independent variables are therefore also summarized separately for renters and owner-occupiers. The numbers in this table can support part of the findings from the theory chapter about characteristics that are associated with tenure choice.

The first important observation in table 2 is that there are 220.449 (58,85%) owner-occupiers and 154.067 (41,13%) renters in the sample. The average age of the owner-occupiers is 50,8 years while the average age of the renters is slightly higher with an average of 51,9 years. This is in contrast with the theory of for example Gabriel & Rosenthal (2015) that expects higher ages for owner-occupiers than for renters. When we look at the *agegroups* variable (figure 3), the pattern is more like we would expect based on theory. The percentage of homeowners increases from the first age group (18-24 years) until the third age group (35-44 years), from the fourth age group onwards the percentage of owner-occupiers decreases slowly. In the last age group of people above 75, only 38,35% of the households own their home. This is probably one of the reasons why the average age of renters for the continuous age variable is slightly higher.
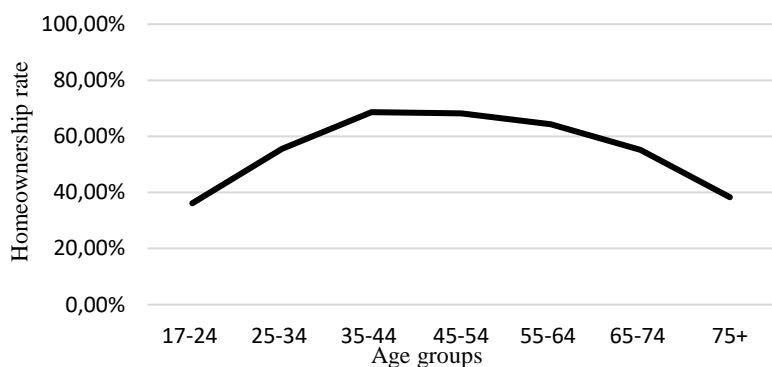
*Figure 3: Homeownership rates per age group*

For couple status, numbers in table 2 are in line with theory (Hendershott et al. 2009; Thomas & Mulder, 2016). Among renters, 40,1% of the household exists of a couple. Among owner-occupiers, about 77% of all household contains a couple. Being a couple is therefore indeed likely to be associated with rising chances of being a homeowner. Migration background also shows the same pattern as expected from theory of Borjas (2002), Painter & Yu (2008) and Uunk (2017). Their researches found lower homeownership rates among non-natives which is in line with the descriptive statistics in table 2. From the owner-occupiers, 9% of the households consist of at least one non-native persons while for the renters almost 18% of the households contain at least one non-native person.

The pattern for *income* is also in line with theory of Clark et al. (1994), Drew (2015) and Ministerie van Binnenlandse Zaken en Koninkrijksrelaties (2013). For owner-occupiers, the average income is €42.013 while for renters the average income is €23.485. Figure 4 also makes clear that the percentage of homeowners increases with income. All discussed associations from theory and descriptive statistics will also be statistically checked with regressions in Chapter 5 and 6.
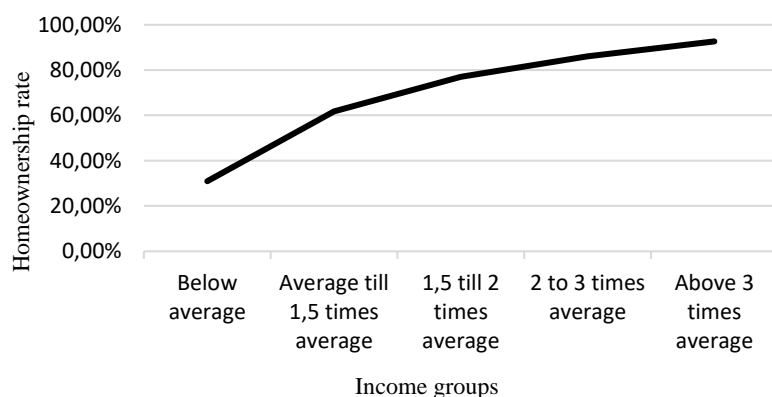


*Figure 4: Homeownership rates per income group*

The correlation between the variables needs to be checked before any regressions are made. The most common border for correlation is 0,7 (Researchgate, 2015). When the correlation is above this border of 0,7 it is assumed to be problematic. The correlation matrix (Table A2, Appendix B) did not indicate any problematic correlation. The only three variables that show strong correlation are the

variables *year* with the *crisis* and *aftercrisis* variables that show if an observation is made before, during or after the crisis. This strong correlation is expected as both variables indicate the exact timing of an observation. These two variables are therefore not used in the same regression models later. The *crisis* and *aftercrisis* variables are not included in the correlation table in Appendix B to prevent misunderstanding.

The multicollinearity between the variables is also monitored. To check for multicollinearity, the most common measure is the variance inflation factor (VIF) value. Even with the strict border value of 2,5 (Researchconsultant, 2019) there is no sign of problematic multicollinearity in the variables (Table A3, Appendix B). The mean VIF is 1,4 and the highest value is only 1,79. This is in line with the findings from the correlation table that suggests there is no problematic correlation between the variables.

## 5. Methods

The rent/buy decision, which is called tenure choice, is an example of a discrete choice as explained by Train (2009). A discrete choice has alternatives which are mutually exclusive, exhaustive and a finite number of alternatives. Tenure choice is a binary choice since there are two options: a household either lives in a rental or in an owner-occupied house. Of course, there are more differences between houses, for example, the distinction between social and market rent, but these differences will not be included in this analysis for practical reasons. An important assumption that goes with discrete choices is that households exhibit utility maximization behaviour as described in the literature review. So, the household will choose to buy or rent on behalf of rational thoughts about what is best for them, given their budget constraint.

Since tenure choice is a binary discrete choice, a logistic or logit model is the most common way of analysing this choice. Our methodology and approach are closely related to DeMaris (2015) and Thomas & Mulder (2016) who also work with logit models to predict a binary discrete choice. The logit model is popular because it could be directly interpreted and the choice probabilities take a closed form (Train, 2009). Key assumptions for using the logit model are that the error term ($\varepsilon$) has a logistic distribution and the error terms are independent. One of the first steps in building the model is to check if these assumptions hold. Exploration of the variables, scatterplots of the error term and postestimation tests did not indicate problems with the assumptions. The postestimation linktest that is conducted after the final logistic regression models, did not indicate any specification error for the chosen model (see Appendix C).

### 5.1. Logistic regression interpretation

The outcomes of a logit model could be interpreted as a probability since it has only two possible values. A number between 0 and 1 will be the outcome when certain demographic characteristics of a household are used as input. The outcome tells something about the probability of owning a house for

a household with the entered demographic characteristics. The estimation of the logit model works with the maximum likelihood technique (DeMaris,1995). For more information about this technique, the book from Hosmer & Lemeshow (1989) is recommended.

The interpretation of logistic regression works as follows: if independent variable x changes by one unit, ln(odds) of choosing option 1 (living in an owner-occupied house as compared to option 2 living in a rental house) will increase with the value of β1. The odds can be calculated by taking the exponent of coefficient β1. These odds are easier to interpret than the ln(odds). Therefore, in the results of this analysis, the odds will be mentioned instead of the ln(odds). The interpretation of these values is about change in one independent variable at the time when all other variables are constant.

The logistic regression models in this analysis are used to measure association between demographic characteristics and tenure of a household. It is important to understand that finding association between two variables is not the same as claiming causation. Association means that there is a relationship, not that changes in the dependent variable are necessarily directly caused by the independent variables. Positive association means that as one independent variable goes up, the dependent variable also goes up. Negative association means that as one independent variable goes up, the dependent variable goes down or the other way around. To measure the performance of the associations that are found in the logit model, alternatives for R squared like Nagelkerke, Cox & Snell or McFadden could be used.

### 5.2. Logistic regression models

The logistic regression models in this research built up in complexity, the number of variables increases step by step. To explain association between tenure choice and demographic characteristics as good as possible, control variables are included from the second model and onwards. The theory and variables that are described earlier are combined into models to test the hypotheses.

$$Tenure\ choice\ (0\ or\ 1) = \ln(\frac{p}{1-p}) = \alpha + \beta_1 X + \beta_2 T + \varepsilon \quad \text{(Model 1)}$$

This model will function as a base model, control variables and interaction variables are added to this model later. In model 1 (and the following models) the X stands for the independent variables *agegroups, couple, migrant* and *incomegroups*. The T stands for the *year* of observation and is included to control for market trends and fixed effects in different years. It is included in all models where no other time variable is present. When the variable *aftercrisis*, that tells if an observation is made before or after the GFC is included, this T cannot be included due to correlation error. $\alpha$ is the constant while $\beta_1$ and $\beta_2$ are coefficients that have to be estimated. $\beta_1$ stands for all coefficients of the different age and income groups, couple status and migration background. The ε is the error term of the model.

$$\text{Tenure choice } (0 \text{ or } 1) = \ln(\frac{p}{1-p}) = \alpha + \beta_1 X + \beta_2 T + \beta_3 Z + + \varepsilon \quad \text{(Model 2)}$$

Model 2 is the base model with control variables. The Z in this model stands for the control variables *hhsize*, *study* and *municipalsize*. By adding these control variables, the values of the coefficients $\beta_1$ of the independent variables change. $\beta_3$ stands for the coefficient of the control variables while $\beta_2$ is still the coefficient of the year fixed effects. The purpose of the control variables is to make the values of the independent variable more reliable since their values are adjusted for by other variables that also influence the independent variable according to the research discussed in paragraph 2.5.

$$\text{Tenure choice } (0 \text{ or } 1) = \ln(\frac{p}{1-p}) = \alpha + \beta_1 X + \beta_3 Z + \beta_4 C + \beta_5 X * C + \varepsilon \quad \text{(Model 3)}$$

In model 3 the *crisis* variable is added, this binary variable has a value of 0 if the observation is done before 2008 and 1 if it is after. The dataset is limited between WoON 2002 and WoON 2012 to see the difference in associations of tenure choice with demographics between the situation before (2002 and 2006) and during/short after the GFC (2009 and 2012). The use of interaction variables is necessary to see how the demographic characteristics that influence tenure choice, differ over the years. $\beta_5$ is the coefficient for the association with tenure choice of all interactions of independent variables with the *crisis* variable and stands for 12 different coefficients (all different age and income groups except the reference categories, couple status and migration background interacted with *crisis)*.

$$\text{Tenure choice } (0 \text{ or } 1) = \ln(\frac{p}{1-p}) = \alpha + \beta_1 X + \beta_3 Z + \beta_6 A + \beta_7 X * A + \varepsilon \quad \text{(Model 4)}$$

In model 4 variable A is included. This A stands for the timing of an observation relative to the GFC and is represented by the binary variable *aftercrisis* that reflects if an observation is made before or after the crisis. The value of this binary variable is 1 if an observation is made after the crisis (>2010) and 0 if it is before (<2008). By interacting this *aftercrisis* variable with the independent variables X 4, the long-term change in associations of the independent variables with tenure choice over time, before and after the GFC, can be investigated. The period (from 2002 till 2018) is longer than for model 3 to see if potential changes in association between demographic characteristics and tenure choice persist in the long term.

$$\text{Tenure choice } (0 \text{ or } 1) = \ln(\frac{p}{1-p}) = \alpha + \beta_1 X + \beta_2 T + \beta_3 Z + + \beta_8 X * T + \varepsilon \quad \text{(Model 5)}$$

In model 5 the variable T that stands for the different years is used as an interaction variable. This variable T gives the exact year of the observation with 2002 as reference category and is interacted with the independent variables to see how these change over the years.

## 6. Results

The first four regression models as discussed in Chapter 5 give the results as shown in table 3. The numbers in the table are the odds of homeownership for a certain group as compared to the reference category.

*Table 3: Regression results*

| Variable/Model | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| **Agegroups** | | | | |
| 25-34 years | 1,112*** (0,02) | 1,176*** (0,022) | 0,747*** (0,02) | 0,747*** (0,02) |
| 35-44 years | 1,714*** (0,032) | 1,777*** (0,034) | 1,004 (0,027) | 0,988 (0,026) |
| 45-54 years | 1,504 *** (0,028) | 1,697*** (0,032) | 1,003 (0,027) | 0,977 (0,027) |
| 55-64 years | 1,47*** (0,027) | 1,878*** (0,037) | 1,137*** (0,032) | 1,101*** (0,03) |
| 65-74 years | 1,508*** (0,028) | 2,0261*** (0,04) | 1,088*** (0,318) | 1,047 (0,03) |
| 75 years and older | 1,132*** (0,022) | 1,613*** (0,034) | 0,85*** (0,027) | 0,809*** (0,025) |
| **Couple** | 2,373*** (0,021) | 1,871*** (0,02) | 1,994*** (0,034) | 1,968*** (0,033) |
| **Migrant** | 0,389*** (0,005) | 0,475*** (0,006) | 0,41*** (0,09) | 0,409*** (0,009) |
| **Incomegroups** | | | | |
| Average till 1,5 times average | 2,72*** (0,027) | 2,353*** (0,025) | 1,906*** (0,037) | 1,954*** (0,034) |
| 1,5 till 2 times average | 4,856*** (0,061) | 3,886*** (0,051) | 3,242*** (0,071) | 3,372*** (0,073) |
| 2 till 3 times average | 8.115*** (0,118) | 6,015*** (0,092) | 5,44*** (0,141) | 5,754*** (0,149) |
| Above 3 times average | 16,032*** (0,374) | 10.897*** (0,263) | 9,367*** (0,375) | 10,032*** (0,401) |
| **(After)crisis** | - | - | 0,34*** (0,014) | 0,27*** (0,011) |
| **Agegroups * (after) crisis** | | | *Interactions with crisis variable* | *Interactions with aftercrisis* |
| 25-34 years | - | - | 3,712*** (0,175) | 4,899*** (0,226) |
| 35-44 years | - | - | 3,885*** (0,184) | 4,853*** (0,223) |

| | | | | |
|---|---|---|---|---|
| 45-54 years | - | - | 3,291*** (0,156) | 4,647*** (0,212) |
| 55-64 years | - | - | 3,168*** (0,149) | 5,985*** (0,278) |
| 65-74 years | - | - | 3,451*** (0,167) | 6,282*** (0,304) |
| 75 years and older | - | - | 3.412*** (0,174) | 10,032*** (0,401) |
| **Couple\*(after)crisis** | - | - | 0,856*** (0,018) | 0,87*** (0,017) |
| **Migrant\*(after)crisis** | - | - | 1,2*** (0,036) | 1,207*** (0,035) |
| **Incomegroups\*(after) crisis** | - | - | | |
| Average till 1,5 times average | - | - | 1,218*** (0,03) | 1,498*** (0,035) |
| 1,5 till 2 times average | - | - | 1,102*** (0,033) | 1,471*** (0,043) |
| 2 till 3 times average | - | - | 0,989*** (0,035) | 1,303*** (0,044) |
| Above 3 times average | - | - | 1,131*** (0,063) | 1,384*** (0,075) |
| Control variables | - | Yes | Yes | Yes |
| Year fixed effects | Yes | Yes | - | - |
| After crisis variable | - | - | - | Yes |
| Crisis variable | - | - | Yes | - |
| Constant | 0,2653 (0,004) | 0,2538 (0,007) | 0,3828 (0,0128) | 0,4612 (0,015) |
| Pseudo R² | 0,2224 | 0,2574 | 0,2526 | 0,2618 |

*Note: dependent variable is tenure choice. Standard errors between parenthesis. Significance: \*p <0,10 \*\*p<0,05 \*\*\*p<0,01. Reference categories: Income groups: below average. Migration background: is native Dutch. Couple status: no couple. Age groups: 17-24 years old. Model 5 is not included because the postestimation linktest indicates specification error in this model.*


### 6.1 Interpretation of the results

All models are interpreted separately to provide the best explanation for all effects. For the interpretation next to DeMaris (2015) and Thomas & Mulder (2016), UCLA (n.d. 2) is used.

$$Tenure\ choice\ (0\ or\ 1) = \ln(\frac{p}{1-p}) = \alpha + \beta_1 X + \beta_2 T + \varepsilon \quad \text{(Model 1)}$$

After the first couple of test regressions it became clear that for interpretation and practical purposes, categorical measures are preferable above absolute measures for age and income. So, for age and income categorical (ordinal) variables with groups are used. This means that results in the table are relative numbers that tell something about the odds in comparison to a group that is set as a reference category. For *agegroups* this reference category is age 18-24, for *incomegroups* this reference category

is below average income. The value of 1,112 in the first column and row means that the odds of being a homeowner are 1,112 times higher for people aged 25-34 as compared to the reference category of people aged 18-24. All interpretations are given the fact that the other characteristics in the model, in this case: income, couple status and migration background, are constant. For the second row, the odds of people in age group 35-44 being homeowners are about 1,714 times higher than odds of people aged 18-24 years. For the other groups, the interpretation works the same way, the number in the table is the change in odds of homeownership as compared to the reference group. For *incomegroups* the interpretation works the same way, the first value in table 2 for model 1 means for example that the odds of being a homeowner are 2,72 times higher for people with an average till 1.5 times average income, as compared to people with below average income.

The variables for *migrant* and *couple* are both binary which makes interpretation rather straightforward. The reference categories are households that do not consist of a couple and native Dutch households. The odds of being a homeowner in model 1 are 2,373 times higher for couples as compared to singles. The odds of being a homeowner are 0,389 times higher for non-native household as compared to native households. Odds below 1 mean that there is a negative association between the characteristic and homeownership. So, the coefficient of 0,389 for households with a migration background means that native household have a significantly higher chance of being homeowners.

$$Tenure\ choice\ (0\ or\ 1) = \ln(\frac{p}{1-p}) = \alpha + \beta_1 X + \beta_2 T + \beta_3 Z + + \varepsilon \ \ (Model\ 2)$$

The difference between model 1 and model 2 is the presence of the control variables *hhsize*, *study* and *municipalsize*. Adding control variables also changes the odds of the independent variables. For example, the odds for *couple* decrease from 2,373 to 1,871 while staying significant. This means that odds of couples being homeowners are only 1,871 times higher compared to single households when adjusted for differences in education, household size, municipal size, year and the other independent variables. The findings in model 2 are consistent with the theory that suggests that age, being a couple, having no migration background and income are all positive associated with homeownership. We can confirm with these results that scientific literature as mentioned in sub question 1 and the theory chapter, is able to determine demographic characteristics that are associated with tenure choice in the Netherlands. All independent variables have the sign which is suggested in theory and are significant on 1% significance level. The control variables increase the pseudo R-squared from 0,222 to 0,257. Because these pseudo R-squared values are about the same type of model, the same dataset and the same dependent variable, we can compare the values and say that the model with control variables is better in explaining tenure choice.

$$\textit{Tenure choice } (0 \textit{ or } 1) = \ln(\frac{p}{1-p}) = \alpha + \beta_1 X + \beta_3 Z + \beta_4 C + \beta_5 X * C + \varepsilon \quad \text{(Model 3)}$$

In model 3 the variable *crisis* that tells something about the timing of an observation relative to the GFC is included. This variable has the value of 1 if the year in which the survey is taken is after 2008 and if the survey is taken before 2008 the value is 0. By interacting this *crisis* variable with the independent variables, change in associations can be measured. The coefficients of the interaction effects tell something about the difference between associations of an independent variable with homeownership before and during the GFC.

Model 3 investigates the short-term influence of the GFC on association of tenure choice with demographics and therefore contains only observations until 2012. We will describe the results of 2009 and 2012 in model 3 as during the GFC instead of during/short after the GFC, to prevent misunderstanding and confusion with model 4. Adding interaction with the crisis variable to the model also affects the non-interacted coefficients compared to model 2. The odds of age groups 35-44 and 45-54 compared to 18-24 are for instance not significant anymore on p=0,1 level. The non-interacted values represent the values before the GFC and changed compared to model 2 that shows associations over the whole 2002-2018 period. Take for example the odds of 65-74 being homeowners compared to the reference category of 18-24 years old which are 1,088 in model 3 while in model 2 they are 1,878. This implies that a large part of the difference in tenure choice between age groups as showed in model 2 originates in the observations after 2008.

The interaction term of this age group with crisis in model 3 is 3,451, which means odds of being a homeowner during the GFC are 3,451 times higher for 65-74 years old as compared to the odds relative to the reference category before the GFC. In other words: before the GFC odds of homeownership for 65-74 years old compared to the reference category were 1,088 times higher, during the GFC the odds of being a homeowner were 1,088*3,451= 3,76 times higher for 65-74 years old compared to the reference category of people between 18 and 24. For the interaction terms of other age groups, the values during the GFC can be calculated by multiplying the odds of agegroups before the crisis with the interaction odds for the same age group. For all age groups, the positive association with homeownership increased during the GFC compared to the reference category. The rationale underneath the findings of model 3 about the short-term influence of the GFC, will be discussed together with the results of model 4.

The positive association of being a couple with homeownership that is found in model 1 and 2, is still present in the non-interacted couple variable of model 3. The odds of being a homeowner before the GFC are 1,994 times higher for couples compared to non-couple households. The interaction effect of couple and crisis is 0,856, which means that the positive association during the GFC becomes smaller. During the GFC the association of couple with being homeowners declined to 1,994*0,856=1,707.

For the migrant variable, the association with homeownership before the GFC is 0,41. The interaction effect of the variables *migrant* and *crisis* in model 3 is 1,2 which means the association increased relative to the situation before the GFC. During the GFC the association of having a migration background with homeownership increased to 0,41*1,2=0,492.

The incomegroups variable and interactions of this variable with crisis are all significant. Before the GFC the positive association of income with homeownership is clear, the odds of homeownership increase over the income groups. The interactions between crisis and incomegroups are all significant. Each group shows relative rising odds of homeownership compared to the reference category, except the 2 till 3 times average group. For this group, the odds of homeownership compared to the reference category of below average income before the GFC was 5,44 times higher. During the GFC the odds compared to the reference category slightly decreased to 5,44*0,989=5,38. Since positive association with homeownership for all other income groups has grown, in general, the positive association of income with homeownership has increased during the GFC.
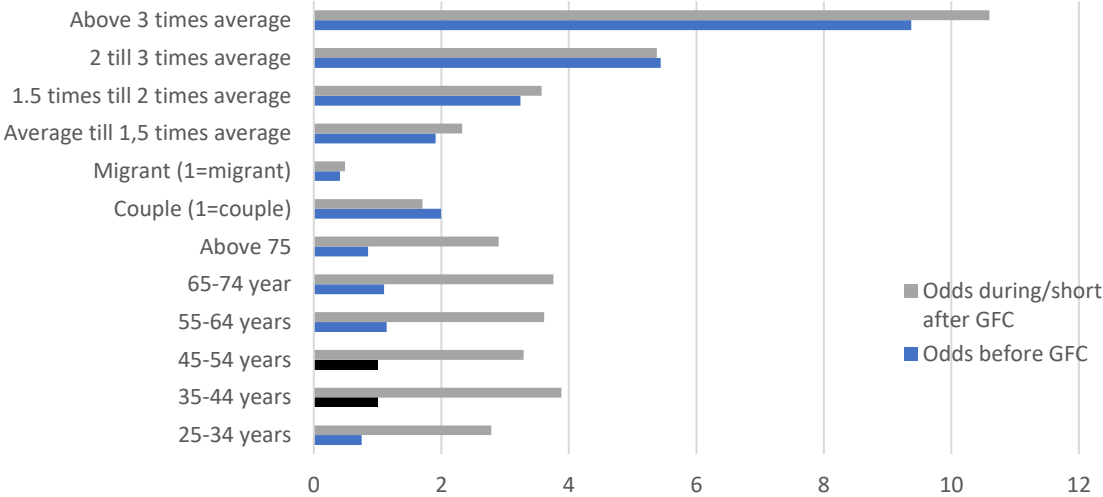


*Figure 5: Odds of being a homeowner for different demographic groups, compared to the reference categories and based on model 3.*

*Note: for age groups 35-44 and 45-54 the odds before GFC are not significant*

$$Tenure\ choice\ (0\ or\ 1) = \ln(\frac{p}{1-p}) = \alpha + \beta_1 X + \beta_3 Z + \beta_6 A + \beta_7 X * A + \varepsilon \ \text{(Model 4)}$$

The interpretation of the interacted and non-interacted coefficients from model 4 works similar as for model 3. However, it is important to note the difference between the *crisis* variable in model 3 and the *aftercrisis* variable in model 4. Model 3 is about the short-term influence of the GFC on tenure choice and uses data until 2012 while model 4 is about the long term and uses data until 2018. The data for 2012 is present in both models because it is debatable whether this point is during or after the GFC since the housing prices stopped declining from the end of 2012 onwards (Wegwijs, 2020). The *aftercrisis* variable has the value of 1 if the year in which the survey is taken is after 2010 and 0 if the

survey is taken before 2008. This means 2009 is the base year, since it is the only year with observations which is undoubtedly overlapping with the GFC, and cases from this year are excluded from model 4. In model 4 the *aftercrisis* variable is interacted with the independent variables. All interactions are significant so results of model 4 provide evidence of variation in associations between demographic characteristics and tenure choice before and after the GFC. The pseudo R-squared compared to model 1, 2 and 3 is the highest which means explaining power of model 4 is the largest. The value of R-squared is 0,2666 which indicates model 4 is a good fitting model (McFadden, 1977).

As we can see in Table 3 and Figure 6, the positive association with homeownership increased for all age groups after the GFC compared to the reference category. This means that 18-24 old have become relatively less likely to live in an owner-occupied home after the GFC. In model 3 we already found that during the GFC, the positive association of age with homeownership increased. So, both in the short and long term, the positive association of age and homeownership became larger in the Netherlands after the start of the GFC. This is in line with findings in other countries like the United States (Gabriel and Rosenthal, 2015) and the United Kingdom (Thomas & Mulder, 2016) were young people became relatively less likely to live in owner-occupied homes during and after the GFC. The increasing positive association of age with homeownership during the GFC has probably to do with the increasing risk of buying a house in times of crisis, since people of older age are assumed to take more investment risk (Cohn et al. 1975; Riley & Chow, 1992). The findings in model 3 and 4 are in line with the expectations from theory and therefore we accept hypothesis 1.

The independent variable *couple* in model 4 has odds of 1,968. This means that before the GFC the odds of being a homeowner are 1,968 times higher for households with a couple as compared to households without a couple. The interaction term of the variables *aftercrisis* and *couple* is 0,87. So after the GFC, the odds of being a homeowner are 1,968*0,87= 1,712 times higher for couples as compared to non-couple households. This means that the association of couple status with homeownership declined by times 0,87 after the GFC. The same kind of change in association is found in model 3 with a decrease by 0,85 times during the GFC. Both findings are not in line with theory suggesting couples are more likely to make higher risk investments (Grable, 1997; Jianakoplos & Bernasek, 2006). The size of the interaction effects on short and long term are quite similar. The decreasing difference in odds of homeownership for couples and non-couples is not consistent with expectations from theory and therefore hypothesis 2 is rejected.

The odds of independent variable *migrant* in model 4 are 0,409. This means that before the GFC, households with a migration background have 0,409 times the odds of being a homeowner compared to native households. The interaction term of the variables *migrant* and *aftercrisis* is 1,207. This means that the odds of being a homeowner for migrants as compared to natives after the crisis are 1,207 times higher than before the GFC. The odds of households with a migration background being a homeowner after the GFC are 0,409*1,207= 0.494 times the odds of non-migrant households. The 1,207 is close to the 1,2 for the interaction of *crisis* and *migrant* in model 3. So, both on the short and

the long term, the odds of homeownership for households with a migration background increased compared to the situation before the GFC. This is not in line with theory that expects people without migration background to be more likely to invest in times of higher risk (Grable, 1997; Jianakoplos & Bernasek, 2006). The association with homeownership for non-natives is found to be more positive during and after the GFC, which means hypothesis 3 is rejected.

For all *incomegroups* and interactions with this variable, the odds in model 4 are significant on p=0,01 level. The odds of being a homeowner for households with average till 1.5 times average income before the GFC are 1,954 times higher compared to the reference category of below-average income households. After the GFC the odds of being a homeowner for this same income group compared to the reference category are 1,954*1,498=2.927. For other income groups, the association of being a homeowner as compared to reference category also increased after the GFC. This pattern is in general consistent with the findings of model 3 about the short-term influence of the GFC on association between tenure choice and income. Except for one category, during the GFC the positive association of income and homeownership in model 3 is larger than before the GFC. So, both on short and long term, the odds of the higher income groups have in general increased compared to the reference category with below average income. This in line with theory suggesting households to become more likely to do risky investments as their income increases (Cohn et al. 1975; Grable 1997). This means that hypothesis 4 is accepted and the positive association of income with homeownership has indeed increased during and after the GFC. The associations with homeownership of all demographic groups compared to the reference categories before and after the GFC as found in model 4, are summarized in figure 6 for the long term. For the short term, the odds of homeownership before and during the GFC are summarized in Figure 5. The figures answer for a large part sub question 2 about the impact of the GFC on associations between tenure choice and demographic variables.
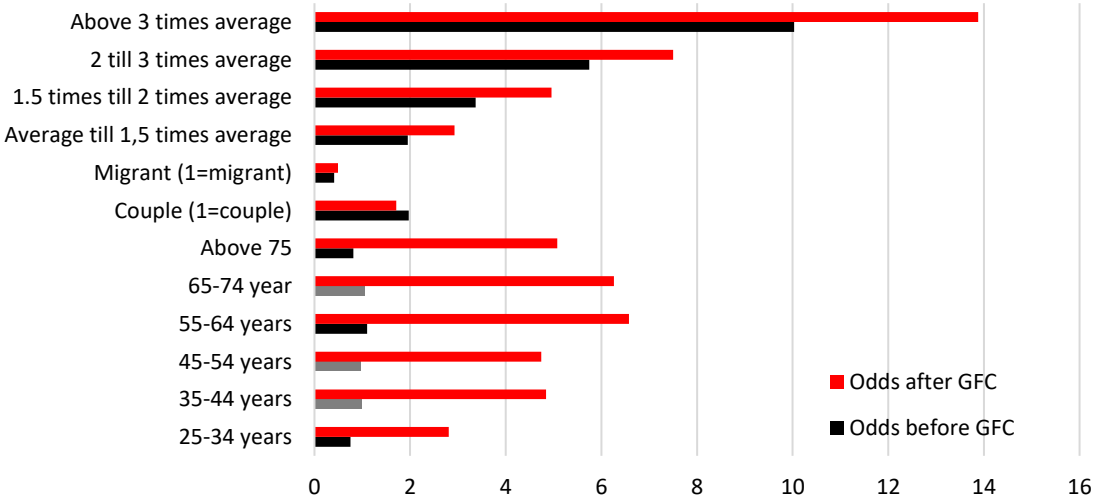


*Figure 6: Odds of being a homeowner for different demographic groups, compared to the reference categories and based on model 4.*

*Note: for age groups 35-44, 45-54 and 65-74 the odds before GFC are not significant*

Important to note when we compare model 3 (short term) and model 4 (long term), is that adding interaction variables to the model also affects the non-interacted coefficients of the variables. Therefore the non-interacted (before GFC) coefficients of model 4 and 5 also differ.

Looking at the independent variables, we see that the change in association of couple status and migration background compared to the situation before the GFC are more or less similar on short term and long term.

For *agegroups* and *incomegroups* the differences between change in associations on short and long term are larger. The increase in positive association of age and income with homeownership on the short term is what is expected from theory due to the increased risk of home buying during the GFC. However, in the long term, when risk decreased and housing prices went up again, the associations of tenure choice with age and income did not decrease. When we compare the coefficients of the interactions from model 3 and 4 in table 3 and figure 5 and 6, we see that the positive associations of age and income with homeownership increased even further on the long term. This is an important indication that the GFC has influenced the association between demographic characteristics and tenure choice probably longer than expected when we only look at housing prices. The number of transactions and housing prices stabilized in 2012 and 2013 after years of decline since 2008 and started to rise in 2014 (Wegwijs, 2020). The idea in NOS (2020) that the GFC of more than 10 years ago is still influencing the tenure choice, for instance because due to the lack of affordable owner-occupied housing, is endorsed by these findings.

An explanation for the difference between short- and long-term impact of the GFC on tenure choice demographics, might also be in the Dutch housing policies. During the GFC, policies like increasing the National Mortgage Guarantee (RSA Nederland, 2010) and increasing taxes for expensive houses (CPB, 2010), are intended to stimulate homeownership and limit the differences between income groups. Risk and uncertainty on the housing market increased during the GFC (Elsinga et al. 2011) and this is expected to decrease homeownership rates (Rosen et al. 1983). As shown in Figure 2 this decrease is observed from 2007 onwards in the United States and United Kingdom (Tradingeconmics, 2020). However, in the Netherlands homeownership rate increased from 53,7% in 2006 to 55,7% in 2009 and 57,6% in 2012 (CBS, 2019a). This is probably one of the intended effects of the policy, and policies could also have diminished the effect of the increased risk on homeownership among lower income households and young age groups. However, during the GFC the differences in tenure choice still significantly increased. For all age groups, the interactions are above 3 which means the reference category of 18-24 during the GFC is relatively very less likely to own their home. For income groups, the effects are smaller but the increase in positive association of income and homeownership is still present despite policy changes.

The outcomes of this research indicate that despite levelling policy measures during the GFC, differences between income and age groups in tenure choice increased significantly. What also should be noted regarding risk and policy, is that homeownership stimulation in the Netherlands has led in

general to higher asset risk for Dutch households. This leads to welfare losses because without government interference, risk-taking in the housing market lowers and household make a tenure choice that better meets their capabilities (CPB, 2010). Housing subsidies or tax benefits for homeowners also lead to higher housing prices. These higher prices make it harder for starters on the housing market and people that want to move from rental to owner-occupied housing to buy a home which is probably not what policymakers would achieve with these measures. These insights could be used to evaluate the policy changes during the crisis.

When after the GFC, the Dutch housing policies moved towards less homeownership stimulation, by reducing tax benefits (Schilder & Conijn, 2013) and setting a maximum loan to value on mortgages (DNB, 2015). The positive associations of age and income with homeownership increased further. As Boelhouwer & Schiffer (2016) expected the new policies made it harder for low-income households to buy homes which is confirmed by the results of model 4. The risk of buying on the housing market decreased after 2012 but model 4 shows that groups with lower homeownership rates (younger ages and lower-income households) became relative even less likely to own their homes. These increasing differences in tenure choice might be related to the Dutch housing policies in this period and the effects of the policy changes are probably foreseen. However, we could not know how the association of demographic characteristics with tenure choice would have developed with other policies and it is therefore hard to measure the precise effect of the policy.

$$Tenure\ choice\ (0\ or\ 1) = \ln(\frac{p}{1-p}) = \alpha + \beta_1 X + \beta_2 T + \beta_3 Z + + \beta_8 X * T + \varepsilon\ (\text{Model 5})$$

In model 5 the interactions between the independent variables and the exact years of the observations is included instead of the *aftercrisis* variable in model 4. Model 5 is intended to give an even more detailed picture of the change in tenure choice demographics than model 3 and 4. The postestimation linktest of model 5 (Appendix C, Table A6) indicates that there is specification error because variable hatsq is significant on 5% significance level. When this variable is significant, the whole linktest is significant which indicates that the independent variables are indeed associated with the dependent variable but that not all relevant variables are included or interacted in the model (UCLA, n.d.). For model 3 and 4 the variable hatsq in the linktest is not significant and this indicates that the models are properly specified, while hat is significant thereby indicating good predictive power of the model. On base of these results model 3 and 4 are preferred above model 5 to draw conclusions on. The results of model 5 will not be extensively discussed but can be found in Appendix C along with the results of the linktests for the three models.

Because the results of model 5 show the changing coefficients over a smaller time frame than model 3 and 4 do, it can be interesting to investigate these more precise associations that could be called cohort effects. A cohort effect means that respondents who filled in the WoON survey may have common characteristics (for instance year of birth) that can influence associations (ThoughtCo, 2019).

For example, the age group 25-34 years in the dataset of 2006 will be almost the same age cohort as the age group of 35-44 year in 2015. This specific group may have other homeownership preferences and values than the cohort of 55-64 years old in 2006 who are mostly 75+ in 2015. We will not interpret the results of model 5 here, because of the great number of interactions and the specification error in the model, but these cohort effects could be interesting for further research.

## 7. Conclusions

The association of demographic characteristics with tenure choice has been central in this analysis. The change in this association over the period around the GFC in the Netherlands is not much researched earlier and is explored with logistic regression models in this thesis. The assumed general associations of demographic characteristics age, couple status, migration background and income with tenure choice are derived from theory. In the descriptive statistics and first regressions, it became clear that the assumed associations are indeed present in the WoON dataset. Higher age, being a couple and higher income are positively associated with probability of homeownership in the Netherlands while having a migration background has negative associations with the odds of homeownership.

The hypotheses state that positive associations of the discussed demographic characteristics with homeownership become larger during and after the GFC due to the increased risk of buying a house in this period. The groups with relative low homeownership rates are in general more risk-averse and will become even less likely to be owner-occupier in times of high risk like the GFC. To investigate these expectations, logistic regression models with interaction effects are used. The independent variables *agegroups, couple, migrant* and *incomegroups* are interacted with the *crisis* variable that indicates if an observation is before or during the GFC and *aftercrisis* variable that states if an observation is made before or after the GFC. Since the interactions in model 3 and 4 are all significant, the association between the demographic characteristics and tenure choice, depends indeed on the timing of observation before, during or after the GFC.

For the variables *agegroups* and *incomegroups*, all interactions except one are positive and above 1. This means that the odds of homeownership compared to the reference categories of 18-24 year and income below average, increased during and after the GFC. The hypotheses that the positive association of age and income with homeownership has increased during and after the GFC are accepted. The variable that tells if a household consists of a couple shows interactions below 1, which means that positive association with homeownership compared to the reference category of non-couples, decreased during and after the GFC, so hypothesis 2 is rejected. For migration background, the association also changed in a non-expected manner. During and after the GFC, households with a migration background have become relatively more likely to own a home compared to native Dutch. Hypothesis 3 about an increase in the positive association of being native Dutch with homeownership after the GFC is therefore rejected.

A not yet mentioned explanation for the increasing differences in tenure choice between age groups and especially income groups can be sought in the fast-rising housing prices after the GFC. Too little houses have been built in the years after the GFC to stabilize the market as suggested by NPORadio 1 (2019). This led to higher house prices and thereby the differences in tenure between income groups have become larger. On the one hand, the Dutch government tried to encourage homeownership during the GFC, with policies like the national mortgage guarantee and the law stimulation homeownership (Tweede Kamer, 2013). On the other hand, they made a lot of (planning) rules that made it hard to build new homes. The rising prices of houses make people pay more for the same amount of house. Some people indicate that the only people that profit are the financial industry, real estate developers and landowners. The costs of the rising prices are for the home buyers (Groene Amsterdammer, 2017). The results of this analysis gain additional insight in this discussion by showing that rising house prices and shortage on the housing market, made differences in tenure choice between age and income groups bigger. Younger age groups and lower-income households, that were already more likely to rent their homes, have become even less likely to buy a home during and especially after the GFC.

The homeownership stimulation in the Netherlands is comparable with Australia, where policy regimes developed to give low-income households access to risky finance to buy a home, have more or less failed (Beer et al. 2011). In the Netherlands, the government tried to stimulate homeownership among all groups during the GFC, despite that differences in tenure choice between income and age groups increased as discussed in Chapter 6. After the GFC Dutch policy was less focussing on homeownership stimulation and differences between age and income groups increased even further. Changing the long tradition of homeownership stimulation in western countries like The Netherlands is debatable and its effects could be an interesting topic for further research. The first signs from scientific research indicate that fostering tenure diversity can probably have more positive wellbeing effects than homeownership stimulating policies (Beer et al. 2011). The Dutch government has made a start with new policies that are less focused on homeownership stimulation which include the lowering of the mortgage guarantee, diminishing tax benefits and setting a maximum loan to value (DNB, 2015). The government is planning to further decrease the maximum LTV in a stepwise manner, this should lower the number of households that cannot afford their mortgage payments and increase financial stability. As discussed in Chapter 6, policy changes could explain part of the differences between short term on long term changes in tenure choice demographics after 2008. The current measures are assumed to increase the average age and incomes of owner-occupiers even further. Future research could explore the effects of these new policies on tenure choice in the Netherlands. Will the observed trends from this analysis continue, or are there big unexpected changes in association of demographic characteristics with tenure choice? With the WoON datasets of 2018 and 2021, this topic can be further investigated in the future.

For couple status and migration background, the differences between the demographic groups in odds of homeownership declined during and after the GFC. This is not as expected from theory regarding risk. It might have to do with larger demographic shifts, that are going on over a larger time period than the data used in this research. When we take a closer look, results might not be that surprising, as Ministerie van Binnenlandse Zaken en Koninkrijksrelaties (2016) indicate slowly rising relative homeownership rates for non-couple households as compared to couples over the last decades. The same goes for relatively rising homeownership rates among households with a migration background (SCP, 2019). So, the decreasing differences in odds for the couples and migration background variables are perhaps not that surprising. They could probably be partly explained by long-term demographic shifts that influence housing patterns across Europe as described in Thomas & Mulder (2016). What is for sure, is that the GFC has influenced tenure choice patterns among demographic groups in different ways. The main question that asks how association between tenure choice and demographic characteristics changed during and after the GFC has not an unambiguous answer that goes for all researched variables. For income and age, the already existing positive association with homeownership increased while for couples and native households the positive association decreased. As patterns in crises tend to repeat, policymakers and market analysts could learn from the findings in this research for future situations.

## 7.1. Limitations

Every research has limitations and conclusions always must be interpreted carefully. One of the limitations of this research is linked to the way tenure choice is described and included in the dataset. Tenure choice is set as a binary variable that tells if a household is renting or owning their home. This means that only the outcome of the last tenure choice of a household is included. This tenure choice does not necessarily mean that they do not want to switch tenure. Tenure choice in this type of research tells something about the tenure status at a moment in time, this moment may be close to or far from the actual moment of making the tenure choice. The models reflect the lagged effect of choices from the past and are therefore considered to be biased. Tenure choice in this research is actually the current tenure of a household.

Another important limitation is the lack of economic and housing market indicators in the models. Drew (2015) and Gabriel & Rosenthal (2015) both found that demographic characteristics in times of crisis contribute less to homeownership changes than in other periods. We have tried to incorporate these economic factors by searching for a variable like the relative costs of owning compared to renting but due to data issues and time constraints, this did not work out. Instead, the timing variables year fixed effects and after crisis are used to control for business cycle effects.

The availability of suitable houses is limiting the options of households and therefore also constraining rational tenure choice. When households live in a rental dwelling and want to move to owner-occupied housing, there must be suitable housing for their wishes to be able to move. When

there are no suitable houses available, their current tenure choice will probably not be their preferred tenure choice. In this research and most other tenure choice studies, it is assumed that all households make rational choices. This means that they will move when they can improve their situation and wellbeing by doing so. In reality, it is not always true that people make the most rational choice. However, this could also be seen as a benefit since this research is about the tenure choice people make in reality, not about the theoretical best or most rational choice.

A final limitation for this research is that it is written from a Western world perspective. In countries where most people build their own home and people move without knowing where they will go, things work very different and cannot be compared to the results of this research. Future research could investigate the association between demographic characteristics and tenure choice from another perspective in developing countries.

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## Appendix A

*Table A1: definitions and categories of the variables*

| Variable | Definition and categories |
|---|---|
| *Rentbuy* | Tenure choice of the household: renter = 0 and owner-occupier =1. |
| *Age* | Absolute age of the head of the household in years. |
| *Agegroups* | Age group in which the head of the households belongs. Group 1 = 17-24 years, Group 2= 25-34 years, Group 3= 35-44 years, Group 4= 45-54 years, Group 5= 55-64 years, Group 6= 65-74 years, Group 7= 75 years and above. |
| *Couple* | Existence of a romantic relationship between members of the households. No couple = 0 and couple = 1. |
| *Migrant* | Background of members of the household. Both native Dutch= 0 and one of the members has a migration background = 1. |
| *Income* | Income after deduction of taxes which is spend on savings and consumption. Values in euro's. |
| *Logincome* | Logarized value of income as described above. |
| *Incomegroups* | Relative values of income compared to Dutch average in the year of observation. Group 1: income below average, Group 2: income between average and 1.5 times average, Group 3: 1,5 till 2 times average income. Group 4: 2 till 3 times average income. Group 5: income of above 3 times average. |
| *Study* | Highest obtained degree in the household. Group 1: primary school and other, group 2: lower vocational education (LBO), group 3: lower General Secondary Education, group 4: higher general secondary education (HAVO) or pre-university education (VWO), group 5: higher Vocational Education (HBO) or University |
| *HHSize* | Absolute number of people living in the household. |
| *Municipalsize* | Number of inhabitants in the municipality. Group 1: less than 5000 inhabitants, group 2: 5000 till 10.000 inhabitants, group 3: 10.000 till 20.000 inhabitants, group 4: 20.000 till 50.000 inhabitants, group 5: 50.000 till 100.000 inhabitants, group 6: 100.000 till 150.000 inhabitants, group 7: 150.000 till 250.000 inhabitants and group 8: 250.000 inhabitants or more. |
| *Year* | Year of observation. 2002, 2006, 2009, 2012, 2015 and 2018. |
| *Aftercrisis* | Timing of observation. Before 2008= 0 and after 2010 is 1. |
| *Crisis* | Timing of observation. Before 2008= 0 and after 2008 =1. |

**Appendix B**

*Table A2: correlation table*

| | Rentbuy | Agegr | Couple | Migrant | Incomegr | Hhsize | Study | Mcplsize | Year |
|---|---|---|---|---|---|---|---|---|---|
| Rentbuy | 1 | | | | | | | | |
| Agegroups | -0,034 | 1 | | | | | | | |
| Couple | 0,372 | -0,099 | 1 | | | | | | |
| Migrant | -0,131 | -0,079 | 0,103 | 1 | | | | | |
| Incomegroups | 0,464 | -0,112 | 0,487 | -0,046 | 1 | | | | |
| Hhsize | 0,262 | -0,324 | 0,573 | 0,086 | 0,371 | 1 | | | |
| Study | 0,293 | -0,0311 | 0,204 | -0,042 | 0,413 | -0,166 | 1 | | |
| Municipalsize | -0,221 | 0,099 | -0,161 | -0,19 | -0,086 | -0,096 | 0,27 | 1 | |
| Year | 0,616 | 0,156 | -0,047 | 0,039 | 0,068 | -0,079 | -0,077 | 0,025 | 1 |

*Table A3: VIF values*

| Variable | VIF |
|---|---|
| Rentbuy | 1,42 |
| Agegroups | 1,29 |
| Couple | 1,79 |
| Migrant | 1,07 |
| Incomegroups | 1,7 |
| Hhsize | 1,73 |
| Study | 1,37 |
| Municipalsize | 1,12 |
| Year | 1,06 |

## Appendix C

*Table A4: linktest model 3*

|  | Coefficient | Standard error | z | p |
|---|---|---|---|---|
| Hat | 0,9981976 | 0,0041306 | 231,57 | 0 |
| Hatsq | 0,0037033 | 0,0028032 | 1,32 | 0,186 |
| Cons | 0,0048074 | 0,0060555 | -0,79 | 0,427 |

*Table A5: linktest model 4*

|  | Coefficient | Standard error | z | p |
|---|---|---|---|---|
| Hat | 1,00083 | 0,0041316 | 242,42 | 0 |
| Hatsq | -0,0012319 | 0,0025384 | -0,49 | 0,627 |
| Cons | 0,0016053 | 0,0056401 | 0,28 | 0,776 |

*Table A6: linktest model 5*

|  | Coefficient | Standard error | z | p |
|---|---|---|---|---|
| Hat | 0,9930508 | 0,0035942 | 276,29 | 0 |
| Hatsq | 0,0120997 | 0,0022509 | 5,38 | 0 |
| Cons | -0,0163977 | 0,051343 | -3,19 | 0,001 |

*Table A7: results model 5*

| Variable/Model | 5 |
|---|---|
| **Agegroups** | |
| 25-34 years | 0,6805706 *** (0,0210891) |
| 35-44 years | 0,9086431** (0,0288396) |
| 45-54 years | 0,9513684 (0,0311523) |
| 55-64 years | 1,016098 (0,0343063) |
| 64-74 years | 0,8566969*** (0,0313652) |
| 75 years and older | 0,7646125*** (0,0310863) |
| **Couple** | 2,38276 *** (0,0495593) |
| **Migrant** | 0,3300444*** (0,0126403) |
| **Incomegroups** | |

| | |
|---|---|
| Average till 1,5 times average | 1,582229*** (0,0367345) |
| 1,5 till 2 times average | 2,539783*** (0,0733665) |
| 2 till 3 times average | 3,979064*** (0,1347837) |
| Above 3 times average | 6,753226*** (0,3298908) |
| **Aftercrisis** | - |
| **Agegroups * year** | |
| **25-34 years** | |
| 2006 | 2,744015*** (0,1909528) |
| 2009 | 3,94373*** (0,2452945) |
| 2012 | 4,188381*** (0,2716306) |
| 2015 | 4,418964*** (0,3215462) |
| 2018 | 3,609671*** (0,2901285) |
| **35-44 years** | |
| 2006 | 2,76623*** (0,1920254) |
| 2009 | 4,054987*** (0,2530246) |
| 2012 | 4,658701*** (0,304879) |
| 2015 | 6,596471*** (0,4874156) |
| 2018 | 5,347622*** (0,4372674) |
| **45-54 years** | |
| 2006 | 2,319836*** (0,1629955) |
| 2009 | 3,031786*** (0,1906558) |
| 2012 | 3,975897*** (0,2602118) |
| 2015 | 6,219993*** (0,4556349) |
| 2018 | 5,49147*** (0,4443884) |
| **55-64 years** | |
| 2006 | 2,552553*** (0,1793049) |
| 2009 | 3,089488*** (0,1938732) |

| | |
|---|---|
| 2012 | 3,872931*** |
| | (0,2527593) |
| 2015 | 6,27252*** |
| | (0,4582571) |
| 2018 | 5,436289*** |
| | (0,4373223) |
| **65-74 years** | |
| 2006 | 3,497373*** |
| | (0,2538162) |
| 2009 | 3,543206*** |
| | (0,2307763) |
| 2012 | 5,179891*** |
| | (0,3501645) |
| 2015 | 8,102825*** |
| | (0,6037829) |
| 2018 | 8,996286*** |
| | (0,7335019) |
| **75 years and older** | |
| 2006 | 2,667816*** |
| | (0,2017673) |
| 2009 | 3,048946*** |
| | (0,2118704) |
| 2012 | 4,474301*** |
| | (0,3202803) |
| 2015 | 7,210068*** |
| | (0,5618166) |
| 2018 | 9,187394*** |
| | (0,7748119) |
| **Couple*year** | |
| 2006 | 0,6534132*** |
| | (0,0202275) |
| 2009 | 0,7156632*** |
| | (0,0205017) |
| 2012 | 0,7726466*** |
| | (0,023005) |
| 2015 | 0,8113631*** |
| | (0,0249522) |
| 2018 | 0,685073*** |
| | (0,0214278) |
| **Migrant*year** | |
| 2006 | 1,429416*** |
| | (0,0691417) |
| 2009 | 1,461683*** |
| | (0,0674526) |
| 2012 | 1,569197*** |
| | (0,0755303) |
| 2015 | 1,427524*** |
| | (0,0706142) |

| | |
|---|---|
| 2018 | 1,534159***<br>(0,0770438) |
| **Incomegroups*year** | |
| **Average till 1,5 times average** | |
| 2006 | 1,685386***<br>(0,0603705) |
| 2009 | 1,50168***<br>(0,0502372) |
| 2012 | 1,453232***<br>(0,0499633) |
| 2015 | 1,59152***<br>(0,0565881) |
| 2018 | 2,714012***<br>(0,0978776) |
| **1,5 till 2 times average** | |
| 2006 | 1,960836***<br>(0,0860667) |
| 2009 | 1,471386***<br>(0,0601205) |
| 2012 | 1.391669***<br>(0,059428) |
| 2015 | 1,635606***<br>(0,0742479) |
| 2018 | 3,227001***<br>(0,1479169) |
| **2 till 3 times average** | |
| 2006 | 2,320757***<br>(0,120879) |
| 2009 | 1,382633***<br>(0,0647892) |
| 2012 | 1,40989***<br>(0,0704019) |
| 2015 | 1,452981***<br>(0,0766132) |
| 2018 | 3,058912***<br>(0,1621733) |
| **Above 3 times average** | |
| 2006 | 2,732142***<br>(0,2314271) |
| 2009 | 1,615977***<br>(0,1135326) |
| 2012 | 1,66365***<br>(0,1305167) |
| 2015 | 1,548526***<br>(0,1277641) |

| | |
|---|---|
| 2018 | 2,986979*** (0,2378343) |
| Control variables | Yes |
| Year fixed effects | Yes |
| After crisis variable | - |
| Constant | 0,4844 (0,0163175) |
| Pseudo R² | 0,2666 |

*Note: dependent variable is tenure choice.*
*Standard errors between*
*parenthesis*
*Significance: * p < 0,10 **p < 0,05  *** p <0,01*

**Appendix D: Stata commands**

**//In dataset 2009:**
*rename cbshh cbschh*
**//In dataset 2012**
*rename BESTINKH cbschh*
**//In dataset 2015:**
*rename LftHH lfthh*
*rename VltOplOP vltoplop*
*rename VltOplPA vltoplpa*
*rename bestinkh cbschh*
**//In dataset 2018**
*rename bestinkh_r cbschh*


*//* **Include years in datasets 2002:**
*generate year = 2002*
**//In dataset 2006 and so on**
 *generate year 2006*


**//Put datasets together**
*append using "C:\Users\teunb\Desktop\Master Thesis\Data\Schone data losse*
*jaren\Woon2002.dta" "C:\Users\teunb\Desktop\Master Thesis\Data\Schone data losse*
*jaren\Woon2006.dta" C:\Users\teunb\Desktop\Master Thesis\Data\Schone data losse*
*jaren\WoON2009_e_1.5.dta" "C:\Users\teunb\Desktop\Master Thesis\Data\Schone data losse*
*jaren\WoON2012_e_1.1.dta" "C:\Users\teunb\Desktop\Master Thesis\Data\Schone data losse*
*jaren\WoON2018_e_1.0.dta", force*
**//Recode huko and rename rentbuy**
*recode huko (2=0)*
*tabulate year*
*tabulate huko*
*drop if missing(huko)*
*rename huko rentbuy*


**//Create new variable to distinct observations before and after crisis**
*generate double aftercrisis = 1 if year > 2010*
*generate double beforecrisis = 0 if year < 2008*
*replace aftercrisis = beforecrisis if missing(aftercrisis)*

**// Prepare independent variables:**

**// Age:  lfthh missing in 2018. Therefore take the average of each age group as value for 2018 .**

*generate age2=lfthh7*

*recode age2 (1=20.5)*

*recode age2 (2=29.5)*

*recode age2 (3=39.5)*

*recode age2 (4=49.5)*

*recode age2 (5=59.5)*

*recode age2 (6=69.5)*

*recode age2 (7=80)*


*Gen age= lfthh*

*replace age = age2 if missing(age)*

*replace age = age2 if missing(age)*

*histogram age*

*histogram age, by(rentbuy)*


**//also make categorical variable for age**

*gen agegroups = leeftijd*

*replace agegroups = Leeftijd if missing(agegroups)*

*tabulate agegroups year*


**//Marital status:**

*generate couple = hhkern*

*tabulate couple*

*recode couple (7=5)*

*recode couple (6=5)*

*recode couple (5=1)*

*recode couple (4=1)*

*recode couple (3=1)*

*recode couple (2=0)*

*tabulate couple*

**//It appears that there are no values for people who live on their own because they did not fill in this question. Therefore we use the variable household size.**

*recode hhsize (1=0)*

*replace couple = hhsize if missing(couple)*

*tabulate couple*


**//Migrant status**

*gen migrant = gblop3 if gblop3 > gblpa3*

*gen migrant2 = gblpa3 if gblpa3 > gblop3*

*replace migrant = migrant2 if missing(migrant)*

*replace migrant = gblop3 if missing(migrant)*

*recode migrant (2=3)*


**//For 2002 we use *etni_op***

*tabulate etni_op,*

*tabulate etni_op, nol*

*recode etni_op (1=0)*

*recode etni_op (2=1)*

*recode etni_op (3=1)*

*recode etni_op (4=1)*

*recode etni_op (5=1)*

*recode etni_op (6=1)*

*recode etni_op (7=1)*

*recode etni_op (8=1)*

*recode etni_op (9=1)*

*recode etni_op (10=1)*

*recode etni_op (11=1)*

*recode etni_op (12=1)*

*recode etni_op (13=1)*

*recode etni_op (14=1)*

*recode etni_op (15=1)*

*recode etni_op (96=1)*

*replace migrant = etni_op if missing(migrant)*


**//Income:**

*Rename cbschh= income*

*histogram income, by(huko)*

*histogram income*

**//Clear that this variable is not normal distributed. So we gonna take the logarithm**

*gen logincome = ln(income)*

*histogram logincome*

*summarize logincome*

**//Now we can see that it is normal distributed. Taking the logarithm makes around 1200 negative values drop.  Also make a categorical variable for income:**

*recode inkmodal (2=1)*

*recode inkmodal (3=1)*

*recode inkmodal (4=2)*

*recode inkmodal (5=3)*

*recode inkmodal (6=4)*

*recode inkmodal (7=5)*

*gen incomegroups = inkmodal*

*replace incomegroups =inkmod5 if missing(incomegroups)*

*replace incomegroups =INKMOD5 if missing(incomegroups)*

*replace incomegroups =inkmod5_r if missing(incomegroups)*

**//Control variables: Education level**

**//remape study, to only include the highest obtained degree of the household**

*gen study = vltoplop if vltoplop > vltoplpa*

*gen study2 = vltoplpa if vltoplpa>vltoplop*

*replace study = study2 if missing(study)*

*replace study = vltoplop if missing(study)*

*recode study (9=1)*

**//For 2018 we use vltoplop5**

*recode vltoplop5 (11=1)*

*recode vltoplop5 (99=1)*

*recode vltoplop5 (12=2)*

*recode vltoplop5 (21=3)*

*recode vltoplop5 (31=4)*

*recode vltoplop5 (32=5)*

*replace study = vltoplop5 if missing(study)*

**//Household size: For 2018 only variable is aantalpp5 which categorizes the number of persons in a household in 5 categories: 1 person, 2 persons, 3 persons, 4, persons and 5 or more persons. I decided to take the number of 6 persons since it is around the average of the households with 5 or more persons in the other years. Since it is only about 3000 cases this will not have a large influence on the outcomes.**

*tabulate aantalpp5 year*

*tabulate aantalpp5, nol*

*recode aantalpp5 (5=6)*

*tabulate aantalpp5*

**//Now take all years together. aantalpp for 2002, 2006 and 2009, AantalPP from 2012 and 2015 and aantalpp5 from 2018.**

*gen hhsize = aantalpp*

*gen hhsize2 = AantalPP*

*replace hhsize = hhsize2 if missing(hhsize)*

*replace hhsize = aantalpp5 if missing(hhsize)*

*tabulate hhsize year*

**//municipality size**

*rename ggk8 municipalsize*

*tabulate municipalsize*

**//Descriptive statistics:**

*summarize age*

*summarize age, detail*

*summarize agegroups*

*summarize agegroups, detail*

*summarize couple*

*summarize couple, detail*

*summarize migrant*

*summarize migrant detail*

*summarize income*

*summarize income, detail*

*summarize incomegroups*

*summarize incomegroups, detail*

*summarize hhsize*

*summarize hhsize, detail*

*summarize education*

*summarize education, detail*

*summarize municipalsize*

*summarize municipalsize, detail*

*summarize year*

*summarize year,detail*

**// Exploration**

*mean age, over(rentbuy)*

*mean marital, over(rentbuy)*

*mean migrant, over(rentbuy)*

*mean income, over (rentbuy)*


**// Percentage homeowners per group**

*mean rentbuy, over (marital)*

*tabulate marital*


*generate logcincome = ln(income)*

*graph box logcbschh, over (huko)*

*histogram logcbschh, by(huko)*


**// assumption testing**

*graph twoway scatter e age*

*graph twoway scatter e agegroups*

*graph twoway scatter e couple*

*graph twoway scatter e migrant*

*graph twoway scatter e income*

*graph twoway scatter e incomegroups*



**//Correlation and multicollinearity:**

*correlate rentbuy agegroups couple migrant incomegroups hhsize study municipalsize year*

*collin rentbuy agegroups couple migrant incomegroups hhsize study municipalsize year*


***//Model 1***

 *logistic rentbuy i.agegroups couple migrant i.incomegroups i.year*

***//Model 2***

*logistic rentbuy i.agegroups couple migrant i.incomegroups hhsize study municipalsize i.year*

**//Model 4**

 *logistic rentbuy i.agegroups##aftercrisis couple##aftercrisis  migrant##aftercrisis*

*i.incomegroups##aftercrisis hhsize study municipalsize*

**//Check model validity**:

*Linktest*

**//Model 5**

*logistic rentbuy i.agegroups##year couple##year  migrant##year i.incomegroups##i.year hhsize study municipalsize*

*linktest*


**//Check association during GFC**

*logistic rentbuy i.agegroups couple migrant i.incomegroups hhsize study municipalsize i.year if year >2008 <2010*


**//test regressions that are no longer used in the analysis**

*logistic rentbuy age marital migrant income*

**//with logincome**

*logistic rentbuy age marital migrant logincome*

**// with aftercrisis:**

*logistic rentbuy age marital migrant logincome aftercrisis*

**// with control variabeles:**

*Logistic rentbuy age couple migrant logincome study hhsize aftercrisis*


**// make two different datasets for comparison**

*drop if rentbuy >=1*

*drop if rentbuy<=-0*

**// descriptive statistics for both datasets**

*summarize age*

*summarize age, detail*

*summarize agegroups*

*summarize agegroups, detail*

*summarize couple*

*summarize couple, detail*

*summarize migrant*

*summarize migrant detail*

*summarize income*

*summarize income, detail*

*summarize incomegroups*

*summarize incomegroups, detail*

*summarize hhsize*

*summarize hhsize, detail*

*summarize education*

*summarize education, detail*

*summarize municipalsize*

*summarize municipalsize, detail*

*summarize year*

*summarize year,detail*

**//To check the effects until 2012**

**//Model 3:**

*drop if year==2015*

*drop if year==2018*

*generate double crisis = 1 if year > 2007*

*replace crisis = aftercrisis if missing(crisis)*

*logistic rentbuy i.agegroups##rcrisis couple##crisis migrant##aftercrisis i.incomegroups##crisis*

*hhsize study municipalsize*

*linktest*