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INFLUENCE OF COGNITIVE BIASES ON THE DEMAND IN THE PRIVATE HOUSING SECTOR

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Summary

Currently, there are many problems in the housing market. The demand for houses is very high, while not enough houses are available, causing prices to rise. Houses are in danger of becoming unaffordable for many people. To address the need for housing, countries develop their own strategies, policies and rules. To be able to build many houses in a short period of time, trying to solve the housing backlog, these policies and strategies are becoming more important. Since the decision-making process of homebuyers determines what kind of houses people are looking for, this process is important as well. It is therefore good to look into the decision-making process and how it can influence and perhaps put pressure on the demand for housing. Much research is based on the assumption that people make rational decisions. In reality, other factors, such as cognitive biases, also play a role. However, studies that include these biases end up stating only that cognitive biases exist. The researchers do not elaborate on the effect. By looking into this effect, behavioural aspects can be analysed in more detail and can be an effective and efficient tool to improve policymaking by making recommendation.

The three cognitive biases chosen in this study are anchoring bias, framing bias and herd behaviour. The anchoring bias is a selective bias that refers to the assumption that our brain relies on the first information it receives. Framing bias is a process bias and indicates that the way information is presented influences the choice made. Herd behaviour is a social bias and assumes that decisions are influenced by social and cultural expectations. The demand of the private housing sector is represented by housing preferences, which are divided into two categories, dwelling and environment features.

To analyse the effect of biases on housing preferences, a quantitative approach is used in the form of multiple OLS regressions. The first three regressions, without control variables, have no significant models. When control variables are added, consisting of demographic and social-economic features, all models are significant. These results show a positive effect of anchoring bias on housing preferences. Thus, higher anchoring bias leads to stronger housing preferences. For the dwelling features category, none of the biases have an effect, and for environment features, the effect of anchoring bias is again present. This effect is even larger for environment features than for housing preferences in general.

In conclusion, only anchoring bias has an increasing effect on the demand in the private housing sector. This is contrary to the behavioural economic theories that also mention the effect of framing bias and herd behaviour. It is important to remember that the effect of anchoring bias is only present when demographics and social-economic characterises are taken into account. Moreover, the effect is mainly present for environment features, meaning that the surrounding of the house becomes more important when anchoring bias is present. This bias may therefore put pressure on housing demand and its market.

Preface

The completing of this thesis marks the end of my master's degree, ending my study experience at Radboud University after five years. I started with an economic bachelor, followed by a (pre)master in Spatial Planning. A choice I am still very happy with. For me, this thesis is a combination of both interests, behavioural economics and spatial planning, resulting in a thesis about on behavioural economic aspects in the housing market. Writing the master thesis was a process in which I learned several things and sometimes experienced some delays (compared to my original schedule) and setbacks. However, I enjoyed working on the thesis because the topic was close to my interests and everything had its learning curve resulting in the thesis in front of you. It was an interesting period where I learned more about the current housing market, the dominant theories on decision-making and especially the emerging studies on the effect of cognitive biases on decision-making and housing demand. Finally, I would like to thank my thesis supervisor Ary Samsura for his help during this research. His knowledge, support and feedback helped me complete the thesis.

Anouk van den Eijnde
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1. Introduction

1.1 Contextual background

Nowadays the problem in the private-housing market is a well-known problem in the whole world. The demand for housing is much more than the number of houses that is being offered. Prices are too high, and houses are not affordable anymore (Van Sante, 2024). In Europa, the housing crisis began after the financial crisis in 2008, in which many housing markets were affected. Investments for housing were decreasing, supply became smaller because of privatization and deregulation which shifted the dependency on the private housing market as a result. Because of the increasing house prices, a shortage of affordable housing arose, leading to a situation where people have less money to spend on basic services and other necessities. The backlog has an impact on labour mobility too, as workers are not willing to take the risk of relocating to another area with the chance of not finding a new home. Innovation slows down together with a decrease in economic productivity (Moch, 2024; Van Sante, 2024).

In regard to the planning and regulation of housing and housing markets, different decisions are made over time and in countries. Countries developed their own responses, policies and rules to address the need of housing (Gallent, 2019). In the Netherlands housing is a top priority within the government, as the housing deficit rose to 279,000 in 2021 and is expected to rise even further to 317,000 houses. Many more houses have to be built in the following years. To achieve this, in 2022, the government introduced the program ‘Woningbouw’. Aiming at a construction of 900,000 new houses up till 2030 (Ministerie van Algemene Zaken, 2023). To be able to build that many houses is a short period of time, the government of the Netherlands has taken a big role regarding public housing and housing construction. Rules and agreements are being made with provinces, municipalities, corporations and market operators to negotiate about the land available for building houses, affordable housing and the speeding up process for plan implementation.

1.2 Problem statement

The housing problem that the world is facing has multiple reasons. The growing population, long building processes and the shortage of land availability are causes that are often mentioned. When land is scarce, there is only a limited area that can be used as building plots while the need for new houses is huge (Ministerie van Algemene Zaken, 2023; Moch, 2024). Also, the higher the density of the country, the less space there is to build new houses, the higher the land scarcity. With the most inhabitants per square kilometre, the Netherlands is a great example of this problem (Van Sante, 2024). The interplay between the scarce land availability and the housing markets stresses the important role of public intervention. Regulatory systems play an important role in the determination of the housing. For instance,

zoning laws can limit the density within a building plot, constraining the ability to develop more houses and decreasing the housing deficit (Moch, 2024). Besides, it influences the rate at which new houses can be built. Having a high rate can be a sign that the country has favourable rules and/or policies regarding private housing development, for example less problems with the dealing of permits (Van Sante, 2024).

To be able to reduce or even solve the housing backlog, effective public planning policies should be implemented. The well-being of a country and its economic development cannot be accomplished if there is no clear policy direction of the government. Before such policies can be implemented, a decision-making process has taken place between state actors, like the government, provinces and municipalities. This process is difficult. In development, projects involve many different actors with various interests. These interests may conflict with each other. Self-interest often plays an important role in these situations. Actors want to limit their own risks. Negotiation is therefore an important, and even an essential, aspect in these processes. Without discussion it is almost impossible to overcome these problems (Baarveld & Smith, 2015). Besides, policies are affected by the housing market itself as well. The supply and prices of homes are determined by homebuyers among others. To be able to come up and adjust policies that correspondents with the behaviour of those people, it is important to establish how homebuyers make decisions in regard to their search for houses and how that could put pressure on the housing demand (Tan 2021; Mitchell, 2020).

Much research is based on the assumption that people make rational decisions. They want to make the optimal choice to maximize their utility (Marney & Fakhry, 2023). In reality people often do not act according to this principle. Research of Marsh and Gibb (2011) indicates that the standard economic theory of decision making is not suited for understanding the complexity of this process. The researchers highlight the importance of formulating an alternative perspective including behavioural economics perspectives. Marney and Fakhry (2023) looked into the process of decision making within the housing market and the psychological factors that impact the decisions of householders and -buyers. The results of their research states that buyers and sellers of homes are influenced by biases and heuristics, which makes the decision-making process even more complicated. Behavioural factors should thus be taken into account when making policies (Marney & Fakhry, 2023). Most research however, including the research of Marney and Fakhry, stops when the question if behavioural biases are present in the housing market and land use policy is answered. Bao and Robinson (2022) states that the use of behavioural interventions could be effective and efficient tools to improve policymaking. It is therefore important to have more research into which behavioural aspects are important in shaping the housing market behaviour and the potential use of behavioural biases in policymaking (Bao and Robinson, 2022).

The focus of this thesis is on three cognitive biases, namely anchoring bias, framing bias and herd behaviour. The choice of these biases is based on the categorisation of three types of cognitive biases from ACAPS (2016), and on previous studies of Marney and Fakhry (2023), Tan (2021) and Umapathy (2024). The anchoring bias is part of the selective biases, the framing bias fits with process biases and, lastly, herd behaviour belongs to the social biases. With reference to prior research, all three scientific studies highlight the anchoring bias and herd behaviour as processes that often occur during decision-making in the housing market. The framing bias is added, as Umapathy (2024) indicates that this is one of the key concepts of behaviour economics, and one of the most influential biases in economic decision-making. A more detailed explanation of cognitive biases and why these three biases were chosen for this research is given in section 2.3.

1.3 Research question and objective

When converting the research gap into a question, the following research question is developed:

How do cognitive biases in homebuyers affect demand in private-driven housing sector?

To be able to answer the main research questions, several sub-questions are drafted. These consists of:

- How do cognitive biases affect homebuyers' preferences?
- How do cognitive biases affect homebuyers' preferences regarding dwelling features?
- How do cognitive biases affect homebuyers' preferences regarding environment features?

The three questions are focused on the effect of cognitive biases in homebuyers on their housing preferences, which is the measurement for housing demand in this research (more explained in chapter 2.1 and 3.2). It delves into how the anchoring bias, framing bias and herd behaviour effect buyers' preferences. First focused on the housing preferences in its totality and afterwards specified to dwelling and environment features. Giving an insight in why and how people make certain decisions regarding their housing choice.

1.4 Relevance

1.4.1 Scientific relevance

This research will contribute to scientific literature by adding information on behavioural economics aspects among homebuyers during their decision-making processes. More extensive research will be carried out on these aspects impacting housing demand in the private sector housing sector, focusing on the influence of cognitive biases on homebuyer's decisions. The existing literature on the subject is small, consisting of only a few studies on

bounded rationality in housing choices focused on homebuyers. Marney and Fakhry (2023) is among one such study. The research shows that both homebuyers and sellers are influenced by cognitive biases, among other. In addition, Bao and Robinson (2022) investigated the possibility of including behavioural intentions in policymaking. Several behavioural biases relevant for land-use policy are discussed, resulting in evidence that adding behavioural aspects leads to effective and efficient tools to improve land use policy making. Both studies highlight that it is essential to consider behavioural aspects in decision-making in the private housing market and suggest further research is needed.

However, neither studies provide a detailed explanation of the effect of cognitive biases present on the housing market. The authors argue that biases are present and complicate decision-making, but what part of decision-making becomes more difficult, or what feature of the housing market changes, is not addressed. This research therefore builds on the research of both Marney and Fakhry (2023) and Bao and Robinson (2022) by providing empirical evidence from the case of housing development. The effect of the three cognitive biases (framing bias, anchoring bias and herd behaviour) on housing features will be thoroughly investigated to improve the studies with the (expected) results of this research. This will result in a better understanding of homebuyer behaviour and its connection with public policy.

1.4.2 Societal relevance

As explained in chapter 1.1, the housing backlog is a current issue that continues to grow around the world. Land is scarce, construction processes take a long time and the population keeps growing. The demand for houses is much higher than its supply, resulting in high house prices and unaffordable houses for most citizens. It is essential to find a way to solve this problem (Van Sante, 2024). However, the backlog cannot be solved without a good understanding of the housing market, its components and public policies. Many decisions are made throughout the whole process, which are influenced by many elements, for instance economic behaviour factors. Cognitive biases influence the decision-making behaviour of individuals, causing them to behave differently than expected. This uncertainty and change(s) can affect how policies are made and received. In particular, how it is received is important, as it affects homebuyer behaviour. Effective public planning policies are therefore an important part of reducing the housing backlog (Bao & Robinson, 2022; Marney & Fakhry, 2023). In the Netherlands, all spatial decisions must be made in accordance with the Environmental and Planning Act (‘Omgevingswet’). This contains the overarching laws for all spatial development in the country. The emphasis is on shaping policies as much as possible at the municipal level because they can set rules and policies based on their knowledge of the local situation (KVK & Rijksdienst voor Ondernemend Nederland, n.d.; Ministerie van Infrastructuur en Waterstaat, 2017).

The public policies most prominent in the private-driven housing market are planning, land and housing policies. Planning policy sets out the standards and method to be taken into account in decisions on land and building development. It defines the way a development is planned, managed and controlled and consists of a wide range of strategies and documents used to inform and guide decision on planning applications (Policy Planning, 2021; St Helens Borough Council, 2023). Land policy refers to the rules that govern the use, ownership and allocation of land in a country or region. These rules are constrained by the national and regional planning systems and are often (partly) implemented through land-use planning. The focus is on addressing social and economic inequalities to promote a more socially and environmentally desirable outcome and resource efficiency (Franco et al., 2015; Shahab et al., 2020). It can be seen as a response to the competing land use demands to guide people towards optimal use of already scarce land (Lincoln Institute, 2023). According to Shahab et al. (2020), land policy has a key role in providing housing, as it can encourage or restrict land use and influence density and type of houses. Which land policy instrument is chosen depends on the decision maker's strategy and the country and/or region's land policy goals (Shahab et al., 2020). Unlike planning and land policy, housing policy is often not determined by local authorities. It consists of guidelines and regulations set by the government to effect housing market (performance) and ensure affordable, safe and adequate housing (Kholodilin, 2022; Zheng et al., 2014). The instruments used can be divided into three categories: stimulating, restrictive and other housing policies instruments. The main purpose of the first instrument is to make houses more affordable by increasing supply. The other two categories are related to other governmental regulations and decision made by the authorities (Kholodilin, 2022).

To ensure that public policies have the desired effects on the market, and therefore solve the housing backlog problem, it is important to take biases into account when designing and implementing policies. With regard to land and housing policies, for example, a better understanding of the effect of cognitive biases can help determine the best instruments to use for policies. In addition, by developing a deeper knowledge of behavioural economics aspects among homebuyers, in this case the framing, anchoring and herd behaviour bias, and their effects on housing demand, recommendations can be made for public land, housing and planning policies. These suggestions could be effective for adjusting policy aspects and for implementing the effect of those biases into their policies, or, if necessary, counteract these biases and their (negative) consequences. It results in a more rational, equitable and sustainable housing development and thus a decline in the housing backlog (Bao & Robinson, 2022; Tan, 2021; Mitchel, 2020).

2. Theoretical framework

This chapter discusses the theoretical framework. First, a literature review is conducted using scientific literature. Several concepts and existing theories are explained and discussed. The analysis is divided into several subchapters, each representing a different topic required for this study. To answer the question of how cognitive biases affect demand in the private-driven housing sector, it is essential to know more about housing development itself. Chapter 2.1 provides knowledge to understand housing market behaviour and housing preferences. In addition, choices are made to buy a house. How these decisions, according to theory, are made is explained in chapter 2.2. Understanding of cognitive biases is also essential. The most influential biases that influence homebuyers' decision-making are identified and reviewed in chapter 2.3. Following this analysis, the conceptual model is illustrated and clarified in section 2.4, along with the operationalization of the concepts. The final section of the theoretical framework, chapter 2.5, notes the hypothesis derived from the literature review.

2.1 Private-driven housing sector

2.1.1 Housing market

Choosing a house is influenced by many factors. Preferences, market conditions (such as supply factors and housing market transparency), regulations, availability and personal factors (internal and external) all affect the demand for housing (Jansen et al., 2011). In the Netherlands, there are two different types of housing sectors: social housing and private housing. It is important to know the difference because this research focuses only on the private housing sector. The main difference is in the influence of the government. Private housing is a free sector and more flexible than social housing. The rules are liberalised, while social housing is subsidised by the government and therefore subject to strict government rules (Ministry of Housing and Spatial Planning, 2024). Since the private housing sector has no pricing policy, prices are determined by supply and demand. These concepts are often used to explain changes in house prices and their impact on a country's economy. However, this is not a given as both are determined by many determinants in the sector and are not fixed. In the short term, the supply of (new) housing is inflexible, which means that any change in demand is likely to trigger a change in house prices. The effect of an increase in demand is also illustrated in Figure 1. The market demand curve represents household choices in the economy (Mitchell, 2020; Schmitz, 2012).

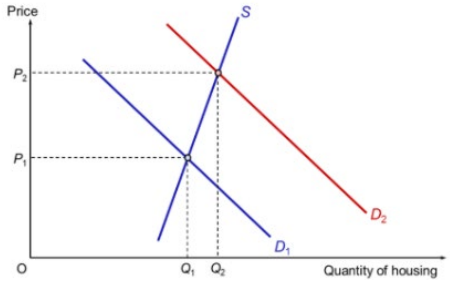

Figure 1: Effect of a rise in housing demand (Mitchell, 2020)

In this research, it is important to know more about demand and what determinants influence it. Demand can be defined as the quantity of houses that homebuyers are willing and able to buy at a given price in a given time period. According to Mitchell (2020), several factors affect the demand for housing. These factors are real income, the cost of a mortgage, availability of credit, economic growth, population, (un)employment and confidence. Most of these factors influence the homebuyers' ability to spend money (Mitchell, 2020). According to O'Sullivan (2003), households make decisions that "maximizes the household's utility subject to its budget constraints" (O'Sullivan, 2003). If real income increases, the demand for housing will increase because homebuyers are willing to pay more for a house. Their standard of living increases. As for the costs of a mortgage, when mortgage rates rise, the costs of a loan become more expensive. Home buyers have fewer opportunities and demand will decrease. Economic growth, on the other hand, leads to higher wages and hence an increase in the demand. Moreover, the higher the level of unemployment in a country, the fewer people are able to buy a house. Confidence is an important aspect as well. If homebuyers feel optimistic about the future of the market, they are more likely to continue purchasing houses (Mitchell, 2020; Schmitz, 2012).

However, the value assigned to houses depends on factors such as amenities, location and internal factors like the size, condition, layout etc. too. Demand does not only depend on a homebuyers' financial situation. The last stages of purchases are affected by non-financial factors too, for instance the personality of the buyer and the emotional attachment towards the house (Levy et al., 2008; Tan, 2021). A change in the social taste of buying is house is also a factor that can result in a shift in the demand curve. For instance, if buying a house is no longer associated with a status symbol, the demand for houses will decline (Schmitz, 2012). A lot of these factors can be linked with housing preferences, which is discussed more in detail in the next section (2.1.2).

It should also be taken into consideration that the housing market is not just like other markets. Housing is a special type of good, making the housing market a special type of market (Davenport, 2003; Jansen et al., 2011). Four features of the housing that makes the market unique are that housing is "highly expensive, spatially immobile, highly durable and multi dimensionally heterogeneous and physically modifiable'' (Jansen et al., 2011). Because of the

high costs, budget allocation decisions take in a big part in selecting a dwelling. The amount of money spend can be influenced and depends on other factors, like income, costs of a mortgage and credit availability among others (described in previous paragraph). Secondly, a house is immobile as the location on the dwelling is not changeable. It comes with its neighbourhood and public services. The satisfaction of someone that comes from the location is different for everyone as housing preferences are not the same. The third feature referrers to the fact that a high share of the houses offered in the market are built in the past. There is a distinction between older and newer homes. Demand for newer houses may increase while demand for older homes decreases at the same time. Buyers therefore have to decide whether to invest in a new house or in renovating an older house. Lastly, every house is different, and the market is always different. New units are being build, other fall away (for instance through demolition) and quality, housing features and size change over time. In other words, every house is different in design and location, making the market very heterogeneous (Davenport, 2003; Jansen et al., 2011).

2.1.2 Housing preferences

Established in previous section, housing and the housing market is complex. Housing has various functions, is a heterogeneous product and influenced by a lot of different factors, as well as the housing market. This complication largely stems from the differences in housing preferences. In general, every person strives towards a certain goal. This includes wanting a house and living environment, consisting of a collection of attributes, that suits that goal (Jansen et al., 2011). “Different people with diverse goals will therefore ascribe different values to these attributes” (Jansen et al., 2011). Working out this preferences structure is crucial for housing research as it gives insight in how people would like to live, which gives information about the existing housing demand. Some assumes that this can be researched by looking at the choices people make. Although the concepts of housing choice and preferences are widely used in the theory, it is important to know that the concepts are not the same. Choice refers to actual behaviour, while preferences relate to the attractiveness of, in this case, a house. It can guide a choice but should be seen as a different concept (Jansen et al., 2011).

Preferences are different from person to person and change over time, often because of changes in someone’s life/career and/or in the market. The life-cycle and life-course model links the changes in life with housing preferences, predicting and explaining residential mobility. The first one is one of the most important models that explains why people move. Different stages in life (marriage, expansion, contraction and dissolution) results in changes in the size and composition of households, often together with changes in their residential preferences and needs. The life-course model also refers to different phases in life, but in the course of time. Individuals are linked to different careers intertwining with different life spheres

(Jansen et al., 2011). According to Jansen et al. (2011) there are four different careers that may explain moves: the educational, the labour, the family and the housing or residential career. Trying to combine goals that arise from these various careers influence choices. In addition, the model studies the interaction between the careers and demographic, economic, institutional and social changes (Jansen et al., 2011). In Figure 2 the conceptual model of housing preference research is illustrated.

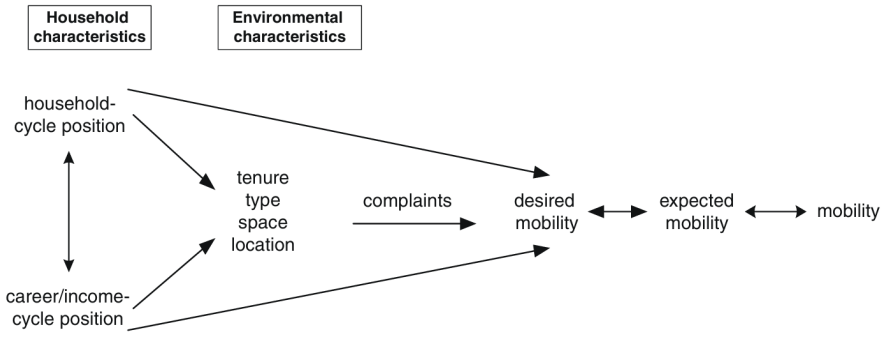

Figure 2: The modified career/life cycle model (Jansen et al., 2011, p. 29)

Besides, preferences are not the same for everyone, partly because a house has various functions leading to various goals to be satisfied. It is used as a shelter to sleep and eat, but it is also seen as a place to have privacy and feel protected. Not only a house, but a home. It should be viewed as "a collection of characteristics that are used to satisfy goals, such as comfort and esthetics [*sic*]" (Jansen et al., 2011). Jansen et al. (2011) mentions six functions of a house. The first one is a centre for shelter and personal care, followed by a centre for domestic activities which refers to a place for work, leisure and social life related activities. Besides it can be seen as a part of the socio-geographical network of a person in two ways: the functional and social neighbourhood. Firstly, it is a base for daily external activities. Secondly, it is a place to for example talk to family, friends and neighbours, experiencing social activities. In addition, a house can be a durable and financial or social good as well as an investment good (Jansen et al., 2011).

2.2 Decision-Making Approach Decision theory

An approach to unravel the considerations of housing choice comes from decision-making. Understanding this process is very important as homebuyers need to make many choices when buying a house. Most important, the selection of the characteristics of the house and the destination. The choices made by individuals and/or households are a reflection is their housing preferences (Jansen et al., 2011; Tan, 2021). According to the business dictionary, decision making is "the thought process of selecting a logical choice from available options" (Decision Making, n.d.). Further elaboration on the process that homebuyers go through when

buying a (new) house is displayed in this section. First, the focus is on the problem-solving process which consists of several stages. Secondly, one of these stages is further studied with the help mainstream economic theories about choice behaviour and decision-making processes.

2.2.1 Problem-solving process

The choice of people to move to another place starts with having a problem. If someone does not experience issues with their current situation it is not necessary to move and not needed to look for a (new) house. Searching for a dwelling can therefore be seen as a problem-solving process (Jansen et al., 2011). Jansen et al. (2011) distinguishes seven stages of problem-solving: recognition, formulation, designing and screening, choice, deliberating about commitment, action and feedback. As mentioned, the process begins with the realization that there is a problem which is in need of (a) solution(s). In regard to housing, the current housing situation is experienced as unsatisfactory. Having a new house is seen as an instrument to solve this problem. When the issue is recognized, the next stage, formulation, refers to exploring and classifying the situation. It contains knowing the goals and values that need to be achieved, and the constraints that need to be taken into account. In this phase, the housing preferences are of great importance. After the problem formulation, the focus is on one or more alternative solutions, the designing and screening stage. Multiple solutions are screened, individuals seek information and advice from others. Solutions that do not meet goals, based on the preferences and constraints, will be eliminated. For housing, multiple dwellings are looked at and evaluated, housing advertisements are read and if possible, trying to remember how the problem was tackled in earlier moves. At the end of this phase, the solutions should be narrowed down to a set of options that appear to have a chance of solving the problem. To make a choice, households do an even more thorough search and evaluation in order to select the best available option. In addition to the previous process, this phase focuses on the positive and negative aspects of the remaining solutions. After the decision is made, the last three stages are carried out. These are focused on executing the decision made and looks back at the process to learn from it. In general, every solution goes through all these stages. However, the order of the phases is not entirely fixed. Not every problem follows the stage from 1 to 7. It is possible to go back and forth, especially if something (important) changes (Jansen et al., 2011).

Because the focus of this research is on decision making, the first five stages mentioned are the most important ones. Economics theories are a mainstream to get a better understanding of choice behaviour and decision-making processes. These theories can be categorized under two economic models: Neoclassical Economics Models and Behavioural Economic Models (Tan, 2021). Both are elaborated and discussed in the following two sections (2.2.2 and 2.2.3).

In general, the reasoning for preferring one option over another is described by decision theory. Within this theory, the individual who makes a decision is referred to as an agent, in other words the agent's choice (Steele & Stefánsson, 2020; Uzonwanne, 2022).

2.2.2 Decision theory – Neoclassical Economics

Neoclassical economists explore decision-making choices with the use of the rational model of decision making. The main characteristic of the model is that the agent is rational. Rationality assumes that individuals make decisions according to reason and facts. It focuses on the process of choosing, rather than the chosen alternative, by using facts, information, analysis and a step-by-step procedure to reach to a decision. Each option is evaluated, costs and benefits are calculated, options are weighted by probabilities, all to determine the excepted result for each choice and make the optimal choice. In regard to housing, under the rationality assumption, the property research process does not matter. Agents are assumed to have the willpower to carry out this optimal choice. Social behaviour is therefore the result of the individual behaviour (Eisenführ et al., 2010; Uzonwanne, 2022).

There are two central concepts in rational decision-making theory: preferences and prospects (also called options). Both refer to the assumption that the agent has a preferences order and has the ability to express that order. Meaning that individuals prefer one choice alternative over other prospects, for example preferring option A over B. In addition, there are several axioms about preferences, statements that are assumed to be true. The first is completeness, which says that an agent can compare and rank each prospect. It illustrates which option is preferred more or whether they are indifferent to each other. Transitivity, the second axiom, refers to a situation with multiple choices where different rankings automatically lead to another. In other words, if option A is chosen over option B, and option B is chosen over option C, then option A is automatically preferred over option C. Besides, it is possible to come up with a situation in which the agent is indifferent between different prospects. This is called continuity. Finally, there is the assumption of independence of irrelevant alternatives, meaning that preferences are fixed and therefore do not change. The presentation of options or the addition of other variables/factors should not influence the outcome of the agent's choice (Eisenführ et al., 2010; Steele & Stefánsson, 2020; Uzonwanne, 2022).

However, not everything can be influenced and known. Sometimes choices have to be made under uncertainty. The decision theory associated with rationality and this uncertainty is the Expected Utility (EU) Theory (Chaudhuri, 2021; Steele & Stefánsson, 2020). Utility is used to measure a given person's satisfaction with a particular state of the world or with a service or good. Based on rational choice, individuals seek to maximise their utility (Investopedia, 2024; What Is Utility, n.d.). Preferring option A above option B indicates that option A gives the agent at least as much utility as option B. Utility cannot be measured, but it can be applied to the

choices people make because their preferences are revealed. There are two types of utility measures of preference: ordinal preference ordering and cardinal preference ordering. For ordinal utilities, the distance between prospects is not known. The concrete values do not matter, only the order of the options. For cardinal utilities, not only the preferred order of the options is shown but also the distance between them. Any size between these prospects is acceptable as long as the assignment of utilities represents the desirable interval (Chaudhuri, 2021; Steele & Stefánsson, 2020).

2.2.3 Decision theory – Behavioural Economics

However, there are economists who suggest that decision-making processes are not rational. Allais introduced the Allais paradox, which illustrated a situation which violates the independency axiom and called rationality into question. The paradox illustrates that people are often more sensitive to losses than to gains. In other words, the regret experienced by winning nothing compared to a situation where one could have had €100 for sure is bigger than the regret by winning nothing when the option turned down also had a high chance of getting nothing. It shows that people tend to overvalue complete certainty, are thus not always behave rational, also referred to as bounded rationality (Steele & Stefánsson, 2020). Loewenstein (2001) focused on individual behaviour and found that each individual acts differently. Not only across situations and time, but also when being in the same situation. This is in contrast with rational theory as it assumes human behaviour can be conducted from individual behaviour due to acting the same. It rose the question whether the rational model is good enough to predict human behaviour (Loewenstein, 2001). Camerer and Fehr (2006) suggest that bounded rationality is better in predicting human behaviour compared to the neoclassical economic theories.

In reality, people act differently than expected from rational theory simply because they are human. Their rationality is limited because not all information can be known, the amount of time to make a decision is not infinite and humans are affected by psychological factors (cognitive and emotional). As stated by Bernard Baruch (n.d., cited in Marney & Fakhry, 2023, p. 4): “What is important in market fluctuations are not the events themselves but the human reactions to those events”. In regard to the housing market, purchases are affected as well by the buyers’ personality, the amount of information that is in possession, emotions and cognitive limitations. Decisions are influenced by social surroundings too. Family, friend and other socio-economic and cultural factors can result in unexpected outcomes and choices. This can be associated with emotions as well, because the emotional responses from and towards social groups has an effect on housing choices (Levy et al., 2008; Tan, 2021). Levy et al. (2008) found that even though extensive research was undertaken, many homebuyers made their final decision based on a feeling which was hard to explain (Levy at al., 2008). Three concepts

which characterize cognitive psychology are reference dependence, loss aversion and the endowment effect. Decisions are often made based on a reference point. This point can be very diverse, especially in housing, as a house sold in the neighbourhood or a purchase price. From this reference, the desires, expected losses and gains can be evaluated (Marney & Fakhry, 2023). According to Seiler et a. (2008) people tend to be attracted to a false reference point, resulting in wrong comparisons. Loss aversion means that humans are more averse to losses than gains of the same magnitude. The Allais Paradox, explained in the beginning of the section, is a clear example of this concept. In regard to housing, home sellers for example are therefore reluctant to sell their house for a price below their reference point and for home buyers, to buy a house more expensive. The endowment effect refers to individuals demanding more for an object than they would be willing to pay. It suggests that people often put a higher value on an object when it is in their possession (Marney & Fakhry, 2023).

2.3 Cognitive biases

2.3.1 Definition of cognitive biases

Research show that individuals are often influenced by cognitive biases, whether they are aware of it or not. Decision making should therefore be considered with care (Gallimore et al., 2000; Umapathy, 2024). However, before diving deeper into the influence of biases on decision making, it is important to know what a cognitive bias is. Cognitive biases are associated with our brains. It is a term used to describe the systematic process of our brain, using personal experiences and preferences, that influences judgement- and decision-related problems. This process can come from many different sources, for instance the limited capacity of information processing. Because the information received by the brain every day is too much to acknowledge, the brain tries to navigate the through the information received, simplifies information processes and prioritizes. Because the process is subconscious, people are not aware when they are acting upon a cognitive bias. Other causes of cognitive biases include emotions, motivations and social influence. Faster decision making, because of these mental shortcuts (heuristics), is a result of this process, which is helpful when timing is more important than accuracy. It can, however, has negative impacts as well because it impacts the decision-making ability of individuals. How receptive people are towards new or contradictory information is affected and biases can result in generating misconceptions or misinformation, e.g. the ability to think critically (Nikolopoulou, 2023; Umapathy, 2024). Important to acknowledge is that cognitive biases are thus different from emotional biases, which refers to the inability of individuals to separate emotions from decision making (Marney & Fakhry, 2023).

There are many different cognitive biases, each of them having different potential impacts on the way the brain perceives, forms memories and make judgements. According to ACAPS (2016), all biases can be divided into three categories: selection biases, process biases and

social biases. Selection biases are caused by choosing non-random data for analysis. An individual is misled into the wrong conclusions, because some information may be chosen or disregarded unconsciously. The process biases refer to biases that increase the tendency of individuals to process information based on cognitive factors rather than evidence. Decisions and/or judgements are affected by irrelevant information. Lastly, individuals can be influenced by interactions with other people, which refers to social biases. The relation with those persons affects the way our brain processes and analysis the information given by those same people (ACAPS, 2016).

2.3.2 Cognitive biases in the private-driven housing market

As there is not much research done yet on cognitive biases in homebuyers, it is difficult to know which of all these biases will be the most influential. Some research does mention some potential influences on the housing choice and/or economic choices, resulting in the focus of this research being on three cognitive biases. Each of them represents a different type of psychological biases and is connected to a different part of the decision-making process (Figure 3). Marney & Fakhry (2023) studies psychological factors in householders and –buyers and Tan (2021) mentions bounded rationality behaviour observed in the process of choosing a house. The biases presented in both are anchoring and herding. According to them, herd behaviour is often displayed with uncertain and limited information. Because of herd behaviour in buyers and positive/contrary information that filters in, potential housing price bubbles/crises arises, and housing prices increase. Also, people tend to unconsciously compare new given information to what is known already. This can have a huge influence of how that new piece of information is processed in our brains. The anchoring bias represents this phenomenon. Umapathy (2024) shows a lot of biases that impact economic choices (nothing specified on housing or homebuyers). Just like the other two studies, the anchoring bias and herd behaviour are mentioned. Both influence the way individuals make economic choices. The author however also criticizes the earlier mentioned research as this study includes framing as one of the biases that have a big influence on economic decisions and as one of the key concepts of behavioural economics. The reason is the fact that framing is concerned with the presentation of information and people are exposed to a lot of information and rely on how that information is presented. Besides, the bias is part of the process biases which makes it even more important to include in the research. With the addition of this bias, alongside the anchoring bias and herd behaviour, the biases mentioned ensures that all three categories (selection, process and social biases) are represented (ACAPS, 2016).

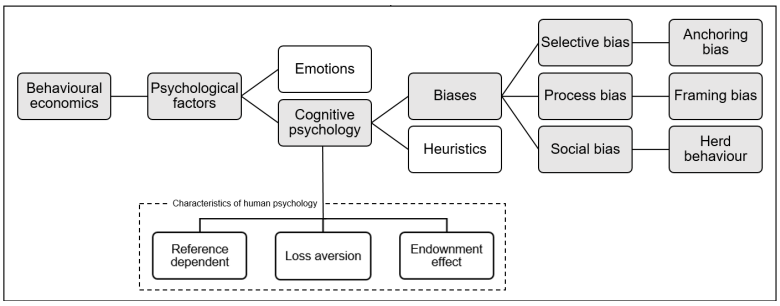

Figure 3: Illustration of psychological factors from behavioural economics (own work)

The anchoring bias (selection bias) is the brain's tendency to rely heavily on the first information it receives. This initial information, the reference point, is used as the basis for all decision-making processes. New information or experiences is thus being compared and evaluated to a reference point. Economic behaviour can change because of this bias. For example, the initial price of a house can influence the perceptions of buyers, as the brain uses it as its reference, which can cause the value to be assed inaccurately.

Regarding the framing bias (process bias), information can be presented in many ways. When evaluating this information, the brain can have the tendency to draw different conclusions from the same data due to the presentation. In other words, which conclusion is drawn by our brain depends on the way information and data are framed. The outcome of a decision can thus changes if the way information is presented changes, despite showing the same data. Resulting in individuals may choosing a product based on whether it is described in favourable term or not ACAPS, 2016; Marney & Fakhry, 2023; Umapathy, 2024). In this research, the framing bias will be linked to loss aversion. The concept refers to a phenomenon in which individuals experience losses more than gains. Losses are perceived as more impactful compared to an equivalent gain value (Liberto, 2024). It can result in people making different choices or judgements because options are described as positive (gains) or negative (losses). This effect is referred to as valence framing (effects) (McDonald et al., 2021).

The last bias, herding behaviour (social bias), is closely connected with social and cultural expectations. It refers to the tendency of individuals making decisions affected by the social surroundings of individuals, deviating from own preferences and interests. People may dismiss their first intuition and go along with the herd, given the context, while their initial perception might be the correct one. Those choices are therefore shaped by the interaction with others, then solely based on what is considered as the optimal outcome. A decision may be the right one for the larger part of the society, but it can be wrong for the individual. In the housing market, it can lead to bubbles as prices do not reflect the real value of the houses anymore due to individuals following each other (ACAPS, 2016; Marney & Fakhry, 2023; Umapathy, 2024).

2.4 Conceptual and operational framework

2.4.1 Conceptual model

All the theories mentioned in the literature review are connected with each other. This link is represented using a conceptual model, which is illustrated in Figure 4. By following this model, the research question(s) can be answered. The whole framework looks into the behavioural economic aspects in the private-driven housing market. This perspective is divided into different aspects, namely cognitive biases in home buyers and demand in the market. Cognitive biases are split into several elements to make the visual representation even more clear. It shows which cognitive biases influence which part of the decision-making process of home buyers. These biases, and thus the decision-making process, influence the demand in the private-driven housing sector, divided into two groups of housing preferences to be able to investigate the effect on both.

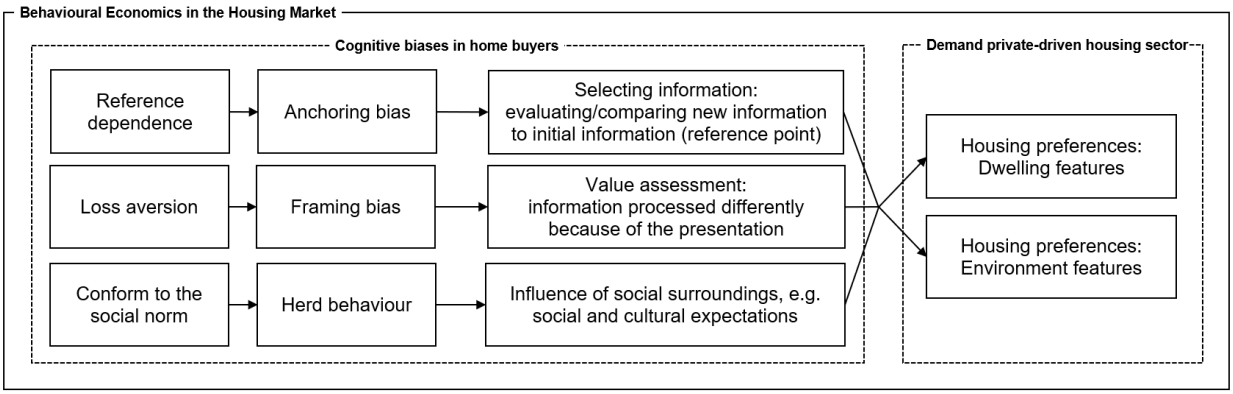

Figure 4. Conceptual Model (own work)

2.4.2 Operationalisation

In Table 1 the operationalisation of the research is showed. The concepts are transformed into clear and measurable variables. It increases the reliability and decreases the subjectivity of the research. Also, it is important as it makes sure that all necessary data can be collected, even of concepts that less obvious at first. (Scharwächter, 2022). This thesis consists of four different concepts. Each divided into dimensions (if necessary, sub dimension(s) as well) and their indicators. It is important to acknowledge that the indicators used for the demand are based on subjectivity. The concept will be measured by asking about the perceptive view of people about their housing preferences, in other words how important they find a certain characteristic.

Table 1. Operationalisation of the concepts

Concept	Dimension	Sub dimension 1	Sub dimension 2	Indicators
Anchoring bias	Sensitivity to anchoring	Reference point/anchor value		Anchoring score (Teovanović et al., 2015; Berthet, 2021)
		Anchor-free estimation		
Framing bias	Resistance to framing	Valence framing effect (Berthet, 2021; De Bruin et al, 2007)	Risky-choice framing (Berthet, 2021; De Bruin et al, 2007)	Difference between the mean ratings for the loss and gain frames (Berthet, 2021)
			Attribute framing (De Bruin et al, 2007)	
Herd behaviour	Sensitivity to social and cultural expectations	Recognizing social norms and expectations (De Bruin et al, 2007)		Rank-order correlation between judged proportion and actual proportion
		Imitating others (IMI) Discounting one's own information (DOI) (Erjavec & Manfreda, 2021; Sun, 2013)		Average score of the six items
Demand in private-driven housing sector	Perceptive housing preferences (Jansen et al., 2011)	Perceptive dwelling features	Importance of housing attributes	Type of dwelling
			Importance of land use	Preferred total useable surface area of dwelling
				Number of rooms
				Backyard present or not
				Year/period build
				Quality/level of maintenance
				Energy label
				Exterior of the house
		Perceptive environment features	Importance of location	Location (city/village)
			Importance of desired location attributes	Proximity to amenities in the area
			Importance of neighbourhood	Proximity to work
				Proximity to friends
			Importance of privacy	Proximity to family
				Proximity of public transport
				Proximity to highway
				Proximity to city center
				Green and water
				Proximity to schools
				Type of neighbourhood (e.g. quit/busy, child(un)friendly, safety)
				Building density

Source: own work

2.5 Hypothesis

In summary, there is growing criticism of the traditional literature on decision making that only looks at rationality. People are influenced by other factors as well, leading to the merge of behavioural economics theories (Camerer and Fehr (2006); Steele & Stefánsson, 2020; Loewenstein (2001)). An important part of this changing view is the existence of cognitive biases, which influence the decision-making process of individuals (Marney & Fakhry, 2023; Tan, 2021; Umapathy, 2024). To test the influence of cognitive biases and answer the research question(s), the following hypothesis are drawn up:

H1. The anchoring bias has a significant effect on housing preferences.
H2. The anchoring bias has a significant effect on housing preferences in regard to dwelling features.
H3. The anchoring bias has a significant effect on housing preferences in regard to environment features.

H4. The framing bias has a significant effect on housing preferences.
H5. The framing bias has a significant effect on housing preferences in regard to dwelling features.
H6. The framing bias has a significant effect on housing preferences in regard to environment features.

H7. Herd behaviour has a significant effect on housing preferences.
H8. Herd behaviour has a significant effect on housing preferences in regard to dwelling features.
H9. Herd behaviour has a significant effect on housing preferences in regard to environment features.

3. Methods

This chapter outlines the data and methods used in the thesis. It starts with describing the research philosophy and what kind of research approach and method will be used. Next, how the data is collected and analysed will be described, followed by the explanation of the reliability and validity. Lastly, it mentions some important ethical issues to consider doing research.

3.1 Research philosophy

Any research is influenced by prevailing concepts and patterns of thinking, also known as the paradigm (Van Thiel, 2014). According to Van Thiel (2014), a paradigm is a “theoretical tradition or accepted method in a certain discipline, which guides a coherent research agenda and is coupled to a certain scientific method”. This method is generally shared and supported by a large group of researchers and influences the way research is conducted (Van Thiel, 2014). There are several research paradigms that dominate academic research. One is post-positivism, the philosophy used in this research. This approach looks at the reality that is perceived and how underlying mechanisms or structures create this reality. It assumes that knowledge is socially constructed and contextual, which means that the data collected comes from a contextual setting. Post-positivism criticises positivism by saying that research cannot be completely value-free. The researcher cannot detach him- or herself entirely from the research (Saunders et al., 2023). As this research looks at the influence of the anchoring bias, framing bias and herd behaviour on housing demand in the Netherlands, the observed influence is located in the contextual setting of this country. In addition, post-positivism acknowledges that there are other effects influencing a dependent variable, but keeps it focus on specific (independent) variable(s) (Saunders et al., 2023). This approach suits this research because it is known that housing demand is influenced by many different factors. However, the focus is on the influence of the cognitive biases.

This thesis combines inductive and deductive research. Inductive research refers to creating a new theory based on empirical findings. This new theory is based on finding patterns in the data that is collected from observations. It is often used for questions about the future, for research that has little to no literature available. The purpose is to come up with a new theory and investigating if that theory can is generalizable (Benders, 2022). As there is little to no research on the effect of cognitive biases on homebuyers and its effect on housing demand, the investigation of this impact is based on finding patterns in the data collected from the surveys (from the framing bias, anchoring bias and herding behaviour observed in buyers and their preference). Conclusions are made from this observation, resulting in a newly discovered theory. The choice of the biases is based on theories found in the literature and their presence

will be tested in this thesis, which is the deductive part of the research. A deductive method relates to the past or present and is often used when there is much literature available already which can be tested. Compared to inductive research, deductive is a top-down research method. It starts from a theory that will be observed and analysed, resulting in a confirmation of the theory tested or not (Benders, 2022).

There is also mix of qualitative and quantitative research. A quantitative approach is needed to understand the behaviour of the housing market. The indicators used for the biases are presented in numbers to investigate the effect on decision making and the housing demand. Besides, “housing preference research is characterized by quantitative data collection” (Jansen et al., 2011), as the features researched mostly consist of attributes and attribute categories. A qualitative approach is used for the understanding of non-financial key indicators of the demand in private-driven housing development.

3.2 Research design

This paragraph relates to all the indicators in the operationalisation. The indicators will be explained and some of them will be elaborated to make it more clear how to use the measure. Besides, information on how the data is collected part of this section, as well as how the collected data will be analysed.

3.2.1 Data requirements

A schematic overview of all concepts, and their dimensions and indicators, important in this study is already shown in Table 1. This table represents all the data that is collected with the use of the chosen indicators. The first concepts are related to the cognitive biases that influence the demand in the private-driven housing developments. A standard method to measure the anchoring bias is the use of the Anchoring Index (AI). This index refers to difference (ratio) between a given estimated value and the anchoring value for two different anchors. The result indicates that the higher the anchoring index is, the bigger the anchoring effect would be (Jacowitz & Kahneman, 1995; Teovanović et al., 2015). Teovanović et al. (2015) criticizes this approach as it does not include information about anchor-free estimates. This estimate is added before using the standard paradigm to have an adequate result of the anchoring effect. The method is as follows: At the beginning, all participants are instructed to answer some questions by giving their estimate *(E_1)*, without the presentation of an anchor (24 questions in Teovanović et al. (2015) and 12 questions in Berthet (2021)). After these estimations, the participants received the same questions as before and had the opportunity to change their initial responds. This opportunity consists of two tasks, a comparative task and a final estimation task. For the comparative task an anchor value *(A)* is represented. People have to declare whether their final response would be higher or lower than the value of the

anchor showed. In these two studies, the anchor value was determined automatically based on the anchor-free estimates *(E_1)* multiplied by a factor that ranged from 0.2 to 1.8 between the questions. Afterwards, during the estimation task, participants have to give their final response *(E_2)*. For each item the anchoring bias can be calculated by the difference between the two estimates divided by the distance of the anchor from the initial estimates: (E_2 - E_1) / (A - E_1). Values lower than 0 (lack of anchoring) and higher than 1 (total anchoring) should be removed. The sensitivity of the anchor bias is equal to the average anchoring score from each question (Teovanović et al., 2015; Berthet, 2021).

Measuring the valence of framing effect will be performed through risky-choice framing and attribute framing. Both measurements make use of two types of frames, a gain frame and a loss frame. For the risk-choice framing, three problems are presented to the participants, consisting of a sure-thing option (S) and a risky-choice option (R). Each problem has two versions, a gain and a loss version, which are identical expect for the framing (outcome is the same)). A 6-point scale is used by the people to make a choice between the option, ranging from 1 (“I would definitely choose option A”) to 6 (“I would definitely choose option B”). In regard to the attribute framing, also three items are displayed to the participants, again one positively described (gain frame) and one described negative (loss frame) and asked to rate both versions from 1 (e.g. no effectiveness, quality, cannot be done) to 6 (e.g. effective, high quality, can be done for sure) (De Bruin et al, 2007; Berthet, 2021). Because people are more likely to choose the risky option in loss frame and the sure option in the game frame, Berthet (2021) argues that “the difference, rather than the absolute difference (De Bruin et al., 2007), between the mean ratings of the loss frames and the mean ratings of the gain frames” should be used to calculate the framing scores. Hereby, a positive score indicates that the bias is present and 0 of negative indicates there is no of even a reversed bias (Berthet, 2021) (meaning that people are less risky with losses instead of taking more risk if losses are at stake (Liberto, 2024)).

Herd behaviour is divided into two different indicators. The first one measures how well people assess social norms of other participants, based on the study from De Bruin et al. (2007). First, participants are asked whether it is okay to participate in six undesirable behaviours. Based on the responses, the percentage of participants who would endorse each behaviour is calculated. Then, the same people have to estimate how many out of 100 people would support each behaviour mentioned before. The total ‘score’ for each participant is measured using rank-order correlation between the actual and estimated percentages (De Bruin et al., 2007). Rank-order correlation captures how accurate people are in judging social norms by looking at what they prioritize more or less, instead of looking at precise numbers. Both the estimated and actual percentage of each behaviour is ranked separately, e.g. the highest percentage gets rank 1 and the lowest percentage rank 6, and are compared to each other. The correlation can vary between -1.0 and 1.0 in which 1.0 indicates perfect agreement

in the ordering and -1.0 refers to an order of the participant that is totally wrong. To calculate the rank-order correlation the Spearman's rho (ρ) is used, because it focuses on the ordinal data and on the order rather than the exact values (Statistics Solutions, n.d.). If observations are equal to each other the average rank will be assigned to them. For example, three observations which involve place 2, 3 and 4, will be given rank 3 (Forthofer et al., 2007).

The second measurement is based on the study of Sun (2013). The researcher distinguishes two kinds of behaviours regarding herd behaviour: imitating others (IMI) and discounting one's own information (DOI). IMI refers to the degree in which a person follows other's decision and DOI refers to the degree to which a person ignores his/her own beliefs when making decision (Sun, 2013). Erjavec and Manfreda (2021) used the same items but changed the subject of the questions to fit their research better. Since their study is about online shopping, which is well-known and accessible to most people, and the research of Sun about a fictional new technology, the items from Erjavec and Manfreda (2021) are copied for this research. Both are measured using three items to be answered using a 5-point scale, where 1 represents strongly disagree and 5 represents strongly agree. To get a score, the average of the answers is calculated. Both measurements (the rank-order correlation and the score for IMI and DOI) will be converted into one score, which will be used for the analysis. To be able to combine them, the rank-order correlation is converted into a 5-point scale as well.

The demand in the private-driven housing sector is analysed based on making choices regarding housing. This choice corresponds with the behaviour of individuals in the market, which is guided by the attractiveness of a house, in other words their housing preferences. The indicators used can be split up into characteristics of the house itself, the dwelling features, and characteristics about the surroundings of the house, the environmental features (Jansen et al., 2011). Each of them is measured using a 6-point Likert scale as well in which 1 represents 'not important at all' and 6 represents 'very important'. By giving each characteristic a score, a total value for housing preferences can be calculated, as well as for dwelling and environmental features.

3.2.2 Data collection

For the data collection, primary and secondary data will be used. The primary data will be collected at the individual level through online surveys, using Qualtrics, to gathering information about the participants itself (including demographic and socio-economic features, like gender, type of household, income), the presence of the cognitive biases and the subjective housing preferences of the participants. The method allows for the collection of new and many data on a large scale, which makes it an efficient approach (Van Thiel, 2014). The secondary data consists of the review of existing scientific literature and data about the topic. There are several approaches and models that can be used to collected data about housing

choice and housing preferences. Which method is the best, depends on the purpose of the measurement as each method leads to different outcomes. In other words, the choice should be made based on the type of information the researcher is interested in. For this research, the data collected about buyers' preferences will be analysed using the Traditional Housing Demand Research Method. In general, this is a relatively simple and straight forwards method consisting of asking questions about the willingness to move, housing preferences characteristics. It is a compositional, in other words attribute-based, method, which refers to exploring the preferences separately and exploring how these housing preferences are evaluated by each person. The goal of the method is to have an accurate insight into the future demand for housing in a qualitative, but mostly a quantitative way. This method is prominent for the analysis of the decision making for housing preferences. (Jansen et al., 2011).

The method is based on stated preferences, which relates to the origin of the data. It means that the preferences are based on stated choices and preferences collected from responses to survey questions. Because of the design of methods, there is generally no freedom of attribute choice, meaning that respondents cannot chose their own attributes. The advantage of this technique is that is not costly or time-consuming compared to allowing entirely free choice in attributes (Jansen et al., 2011). Besides, this type of questions provides structured data which is easier to sort and quantify as the answers fit into a limited number of categories (Qualtrics, 2024b).

As mentioned before, the focus on this research is on the population of the Netherlands 18 years or older living in Noord-Brabant, Gelderland or Limburg (southeast of the Netherlands), who want to buy a house and/or have bought a house in the past. By having both the level of cognitive biases and the preferences of the participants in one overview, the effect of cognitive biases can be connected with the demand. However, it is clearly not feasible to determine the level of the biases and housing preferences of all individuals in the country. The housing demand is therefore based on the preferences of a representative smaller group from the population, known as a representative sample. This group is sampled randomly and represents the characteristics of the larger group, reflecting the same results as if the questions were answered by the entire population that fits in the target population of this research (Qualtrics, 2024a). As mentioned in paragraph 3.2.1 the anchoring bias consists of open-ended questions, in which the respondents have to give an estimated values as answers. The framing bias, both risky-choice and attribute framing effects, as well as the housing preferences, uses closed-ended question types with a Likert-scale to answer them. For housing preferences this scale refers to people indicating how important they consider (the proximity of) a housing feature.

In regard to the questions posed to homebuyers, in other words the content of the survey, for the anchoring bias the questions used are adopted from Berthet (2021), which can be found

in Appendix A. The items are very similar to the ones used by Teovanović et al. (2015), there are just a few less of them (6 instead of 24) to make sure that the survey is not to long which can result in respondents dropping out during the process. The questions for the framing bias, in this case the risky-choice framing effect (Appendix B), are equal to the situations used in Berthet (2021) as well. Since this research consists of two studies, the situations outlined in Study 2 are used because those are an improvement of the measures used in Study 1. For the attribute framing effect, the same items are used as in De Bruin et al. (2007), which are derived from previous studies and discussed more in detail in Appendix C. The questions regarding herd behaviour are outlined in Appendix D and Appendix E. For the recognition of social norms and expectations (Appendix D) the same items are used as in De Bruin et al. (2007). Again, the number is reduced to 6 items for this research. For the IMI and DOI (Appendix E) questions are adapted from (Sun, 2013) to the research area of this thesis. In regard to the housing preferences, questions are asked about their subjective dwelling and environment features, in other words their own perception. In the Netherlands, a nationwide survey is conducted every three years on households' housing situation, satisfaction, moving preferences and housing costs (the WoON, WoonOnderzoek Nederland) (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, 2022). Since this survey is focused on the objective housing preferences, and this research on the subjectivity of housing preferences, the questions will not be copied but will be used as reference and inspiration for the survey in this research. Both versions are mentioned, because for the most recent one (2018) only a summary version is available. Besides, the questionnaires focus on much more than only the housing preferences used in this research, so only some of the sections will be adopted in the survey. These are block 19 'Desired Property Characteristics' and block 21 'Desired Neighbourhood or City' (Centraal Bureau voor de Statistiek, 2017; Centraal Bureau voor de Statistiek, 2020).

3.2.3 Data analysis

Before the data collected from the surveys could be analysed and evaluated, the raw data had to be processed further, in this case using Excel. Missing values are removed, responses are looked over and the score for each bias is calculated for every person, in order to be able to make more generalized statements later. After that, the data is analysed with descriptive and statistical analysis. Descriptive analysis gives an overview of the data set by summarizing and organizing the data. The data is put into its context. Characteristics of the responses are described, for example the different demographics within the sample, and the correlation between variables are illustrated (Bhandari, 2023; Qualtrics, 2024b). The statistical analysis is used to give certainty (as closely as possible) about the results of the survey and to make sure that the results are not there by chance but have a statistical significance (Qualtrics, 2024b).

There are multiple ways to carry out a statistical analysis. Which analysis is the best depends on the variables and how they are measured. In this research the dependent variable, housing preferences, is measured as an interval data using a Likert-scale. This kind of measurement is common in social science research (Mohd Rokeman, 2024), which is used to investigate human behaviour and relationships (Saigo & Dance-Schissel, 2023). Structural Equation Modelling (SEM) is a powerful method when dealing with psychological constructs. However, it requires a larger sample size compared to other methods to give a reliable estimate of the relationships between variables. Besides, one of the key characteristics of SEM is the use of latent variables. This means that a variable is not directly observable and multiple survey questions are needed to estimate the construct. It therefore uses multiple indicators to measure cognitive biases (Hair et al., 2021; Statistics Solutions, 2024). However, in this research all questions from the survey regarding biases are averaged together into a single composite score, which is not ideal for SEM. An Ordinary Least Squares (OLS) regression on the other hand allows for smaller sample sizes, making it more reliable, and can be used with a single-score bias, which makes OLS a better method for this research (Alto, 2025). Because the demand is divided into several dimensions in the operationalisation (Table 1), multiple regressions will be carried out to investigate the effect of each bias on housing preferences in more detail as well. The equations used are shown in equation 1 to 3. AB refers to the anchoring bias, FB to the framing bias and HB to herd behaviour. β_0 is the intercept, referring to the baseline level of housing preferences if all biases have a score of 0 and ε represents the error term of the model (Alto, 2025).

$$(1) \qquad \text{Housing preference} = \beta_0 + \beta_1(AB) + \beta_2(\text{FB}) + \beta_3(\text{HB}) + \varepsilon$$

$$(2) \qquad \text{Dwelling features} = \beta_0 + \beta_1(\text{AB}) + \beta_2(\text{FB}) + \beta_3(\text{HB}) + \varepsilon$$

$$(3) \qquad \text{Environment features} = \beta_0 + \beta_1(\text{AB}) + \beta_2(\text{FB}) + \beta_3(\text{HB}) + \varepsilon$$

3.3 Validity and reliability

Validity and reliability are very important for the quality of the research. Validity refers to the accuracy and precision of the measuring instruments used. This can be divided into internal and external validity. Research in internally valid if the research methods and instruments measured what is intended to be measured. External validity is about the extent to which results can be generalized to other people, instruments and studies. For quantitative research, the external validity is of greater importance as it often relates to bigger projects. Qualitative research is often related to specified projects, less people are involved and therefore always differ from each other. Generalizability is thus not a necessary requirement (Van Thiel, 2014).

However, some results are possible to generalize, as it can be assumed that, for instance, the preferences for housing are only partially context specific. It is possible to apply those results for other projects too. The use of inductive research can also limit the external validity, as conclusions drawn are often difficult to prove and can also be invalidated. The conclusions drawn cannot automatically be applied to everyone (Benders, 2022).

The reliability refers to the accuracy and the consistency of which the variables are measured. The higher these two factors are, the smaller the chance that results are coincidental. For descriptive analysis, it means that there is no distortion. Regarding accuracy, the measure used, in this case questionnaires and document/literature analysis, should capture the variable as correctly and precisely as possible. The questionnaire used in this research should produce the same findings when it is done for a second time. Consistency is more difficult for social sciences more difficult to achieve, because the focus is on repeatability. It refers to the same problem with the external validity, repeating a study can lead to different results because human subjects are involved. People are more context dependent and can learn from past experiences. Creating a sample large enough, limits this kind of risk and is therefore important for social science research (Van Thiel, 2014).

One way to increase the reliability and validity of research is by triangulation. This refers to using multiple methods (Van Thiel, 2014). For this reason, this research combines surveys, analysis of documents and literature review. Besides, a limitation of both the external validity and reliability is the lack of generalizability as different research can result in different outcomes. To make up for this, it is important to have big research. The bigger the research, (the more different results), the more representative results and conclusions will be (Van Thiel, 2014). With the addition of individuals who have bought a house in past, instead of only people who want to buy a house, the target group is larger, resulting is more answers and more data that can be analysed. In regard to the survey, to have a good internal validity the concepts are operationalized in detail and the questions of the survey are formulated properly. In regard to the consistency of measuring the framing bias, according to De Bruin et al. (2007) it is important for the internal consistency to limit the amount of framing problems that are researched. This research is therefore focused on valence framing problems (risky-choice and attribute framing), as explained earlier in section 2.3.

To increase the internal validity of the analysis, control variables are added. According to Jansen et al. (2011), housing preferences are closely linked to demographic and social-economic features. The demographic characteristics added are gender, living place (province) and household type (one-person private household, two-person private household, multiple-person private household (CBS, 2024)) and the socio-economic variables added are income and education level (Jansen et al., 2011). Since all of these variables are categorical, they have to be converted to dummy variables before they can be included in the regression

analysis. There is a rule of thumb that should always be used when creating dummy variables: the categorical variable should be replaced be the number of categories there are (k) minus 1. Each observation scores a 1 or a 0 on the dummy variable(s), making it clear which category to observation belong to. The category that is not represented by a dummy is called the reference category. If this rule is not followed, problems with linear dependence arise, making multiple regressions impossible to estimate (Van Rossem, 2010). This results in 1 dummy for gender, 2 for living place, type of household and income, and 6 for education level. To avoid the risk of larger standard error on the reference category, the risk of multicollinearity and to keep the interpretation of the results easier, the largest category is chosen as the reference (Van Rossem, 2010). The dummy coding scheme for each variable can be found in Table 10 to Table 14 in Appendix F.

3.4 Research ethics

Research ethics is becoming more important in studies, especially in research involving people. It is important to mention how a lawful basis for processing personal data could be identified and documented, since the researcher is responsible for the rights, well-being and interest of the people involved. Besides, including mortal integrity is of importance for having a trustworthy and valid research process and findings (Jones, n.d.; Rauhala et al., 2021).

The most important procedure for studies involving people is informed consent. Participants must agree to participate in the research project and indicate that information/letter has been read. This letter should give the participant detailed information about the nature of the project, how the participation will contribute to the purpose of the study, what the intentions are with the results, potential risks and so on. Also, if participants want, follow up, have questions or concerns, the information should include how to contact the researcher. Importantly, it should be completely clear that participation is voluntary and that it is possible to opt out of the study before, during or even after the participation. Overall, it gives people a fair chance to assess whether or not they want to be part of the research. By giving consent, participants the researcher(s) permission to use their information. In return, the researcher(s) ensure(s) that the data are protected property, including by indicating how this confidentiality is ensured, and data are destroyed when no longer needed (Jones, n.d.; Rauhala et al., 2021).

4. Results

This chapter focuses on the regression analysis. Multiple assumptions, like multicollinearity, heteroscedasticity and autocorrelation, are tested. Besides, the data will be described and things that stand out have been noted. Multiple OLS regression analyses are carried out as well, with the associated significance tests of the coefficients and the interpretation of the results. In the last subchapter, the results of the regression analysis are reflected on the theories and conceptual model introduced.

4.1 Assumptions of OLS

Before results could be analysed, tests are conducted to determine whether the assumptions of the OLS regression model are violated or not. This consists of tests for the normal distribution of residuals, heteroscedasticity and multicollinearity. The result of each test is shown and explained in more detail in Appendix G. In summary, there is no normal distribution for the Anchoring Score. The p-value is less than 0.05 (Table 15 in Appendix G). This skewed distribution is also shown in Figure 5 in Appendix H. To ensure a normal distribution, the variable is converted to a log variable to meet the assumption (Table 21 in Appendix G and the histogram in Figure 6 in Appendix H), resulting in a stronger analysis. Moreover, there is no multicollinearity as all VIF values are below five. Heteroscedasticity is also not present, as all three test results have a p-value above 0.05. Another assumption of OLS is autocorrelation. But since this study consists of cross-sectional data, meaning the data is collected at one point in time and each respondent is chosen without structure or sequence, testing this assumption is not necessary. It is only necessary for time-series data or when observations are not independent of each other (Smith, 2024; Thomas, 2022).

Besides, because this analysis uses dummy variables, there is a chance of multicollinearity between these dummies (Van Rossem, 2010). As this may cause problems for the regression analysis, it is important to test whether this is present of not, focusing on the dummy variables. The correlation between the dummies is calculated and analysed, displayed in Table 26 to Table 29 in Appendix I. All correlation coefficients are below 0.80, meaning there is no multicollinearity between the dummy variables (Statistics Solutions, 2025).

4.2 Descriptive analysis

This chapter focuses on the descriptive statistics. Table 2 shows both the dependent and independent variables. What is noticeable is that the mean and median of the anchoring score are relatively low because the score can reach 1, which means total anchoring. The transformation to a log variable for anchoring score resulted in a lower mean, median and standard deviation. For the framing score, it is somewhat surprising that the minimum, negative

score, is larger than the maximum, positive score. Standard theory suggests that people take fewer risks when losses are at stake. However, the negative score indicates that there are people behave differently and actually take more risks when losses are at stake. Moreover, the difference between the minimum and maximum score is quite large and there is a high standard deviation. But, since the mean and median are both above zero, it can be concluded that the framing bias is present. For the score on herd behaviour, the table shows that there is at least one respondent who if not effected by others, since the minimum score equals 1. Also, there is no one who is completely influenced by others, as no one scored the maximum score of 5 (the maximum score is 3.612). For the housing preferences (both the variable itself and the dwelling and environment features), there is not much difference between the mean and median scores, indicating that dwelling features are on average as (un)important as environment features. In contrast, the minimum score for environment features is almost one point lower compared to all housing preferences and dwelling features.

For the control variables, also the respondents' characteristics and demographic and social-economic features, shown in Table 3, there are also some things that stand out. The type of gender represented among the respondents (men/female) is almost the same. In terms of household type, the majority belong to households with 3 or more persons. One of the categories of the variables income and province stands out significantly compared to the other categories. Most respondents earn more than 3.000 euros per month and live in Noord-Brabant. The level of education completed is most represented by three categories, MBO, HBO and WO, with HBO being the most completed of the three levels.

Table 2. Descriptive analysis: (in)dependent variables

Variable	Obs.	Mean	Median	Std. dev	Min	Max
Anchoring Score	65	0.280	0.251	0.182	0.000	0.667
Log_Anchoring Score	65	0.237	0.224	0.142	0.000	0.511
Framing Score	65	0.167	0.167	0.540	-1.667	1.333
Herd Behaviour Score	65	2.190	2.141	0.605	1.000	3.612
Housing preferences	65	4.458	4.479	0.374	3.688	5.479
Dwelling Features	65	4.637	4.625	0.426	3.625	5.625
Environment Features	65	4.279	4.333	0.482	2.833	5.333

Source: authors' calculations

Table 3. Descriptive analysis: control variables (respondents)

Item		Proportion
Gender	Men	0.446
	Female	0.554
	Other	0.000
Type of Household	1-personshousehold	0.108
	2-personshousehold	0.215
	Multi-persons household	0.677
Income	< 3000	0.185
	3000 (+/-)	0.169
	> 3000	0.646
Province	Noord-Brabant	0.861
	Gelderland	0.108
	Limburg	0.031
Level of education	Elementary school	0.015
	HAVO	0.046
	VWO	0.015
	VMBO or lower (MAVO)	0.031
	MBO	0.231
	HBO	0.462
	WO	0.200

Source: authors' calculations

Table 30 in Appendix J provides the correlation between each variable. The table shows the statistical relation between variables one on one. The coefficient ranges from -1 to 1, where a negative correlation refers to a negative relation and vice versa. The lower the negative score or the higher the positive score, the stronger the relation between the variables. -1 indicates there is a perfect negative correlation, 0 indicates no correlation and 1 corresponds to a perfect correlation (Van Thiel, 2014). The matrix shows a positive correlation between the anchoring and framing score on dwelling and environment features (0.1685 and 0.2325 respectively), hinting at a positive relation between the biases and both features. The herd behaviour score, on the other hand, has a negative coefficient for all dependent variables, indicating a negative relationship between herd behaviour and housing preferences (including both features).

Regarding all other coefficients, it is important that the correlations are below 0.80 to ensure no independent variable is highly correlated with another. The matrix shows that none of the variables has a score higher than 0.80. Only the correlation between housing preferences and environment features is higher (and with dwelling features very close). But all three variables are dependent variables, in different regressions, so it is not a problem. Besides, housing preferences is a combined score of both features, thus it makes perfect sense that there is a high correlation between the variables.

4.3 Regression analysis

In this subchapter six regressions are carried out, the first three without control variables, followed by three regressions with the control variables included. Each model, in other words regression results, is evaluated and interpreted. This means considering the economic plausibility, the significance of the overall model and coefficients, the goodness of the fit and an interpretation of the findings.

4.3.1 OLS regression

The results of the first three regressions can be found in the tables below. The model consists of multiple numbers, each representing something different. To determine whether the model is useful for interpretation, the significance of the overall model is tested using the F-test (Prob > F). The coefficients show the change in the dependent variable in case a variable changes by one unit. The significance of these coefficients is tested with the t-test (Pr (> | t |)). In addition, the intercept represents the baseline of the dependent variable when all other variables are equal to 0. How much of the variance in the dependent variables is explained by the model, e.g. the independent variables, is indicated by the (multiple) R-squared. Another form of the R-squared is the adjusted R-squared. This indicator is similar to the multiple R-squared but corrects for the number of predictors in the model. In other words, if variables are added that do not improve the model, the coefficient may decrease of remain the same. In overall, it is a better indicator when multiple variables are used, which is the case.

In Table 4, the regression with housing preferences as the dependent variables is shown. The F-test has a result of 0.211, which means the model is not significant. The model does not properly explain the dependent variable. Despite the model not being significant overall, it seems that the anchoring score could have a positive effect on housing preferences. This means that an increase of the anchoring bias by 1 causes an increase in the importance of housing preferences with 0.63121. However, this should be interpreted with caution.

The model with dwelling features (Table 5) and with environment features (Table 6) are also not significant, with a p-value of the F-test of 0.2726 and 0.3308, respectively. What is notable, however, is that no other variable is statistically significantly related to dwelling features. The previous significant relationship with anchoring bias is not present for this type of housing preferences. In Table 6, that is, in the analysis with environment features, the same variable is significant again, referring to an increase in the importance of environment features by 0.793138 when the presence of the anchoring bias goes up by 1. Although this interpretation should be taken with caution too, it may indicate that the effect of the anchoring bias is only (slightly) present for one type of housing preferences, the environment features.

All hypotheses formulated state that there is a significant effect of anchoring bias, framing bias and herd behaviour on housing preferences and its specified categories, dwelling features

and environment features. Since the analysis does not show statistically significant models for all three dependent variables, all nine hypothesis are rejected. The lack of significance suggests that the (economic) rationality theories are right, as they argue that biases have no effect on decision-making. People make housing choices based on rationality and are not influenced by underlying behavioural mechanisms. However, this is not consistent with the behavioural economic theories that prompted this study.

Table 4. Regression with housing preferences as dependent variable

R-squared						
Multiple	=	0.07079		F(3, 61)	=	1.549
Adjusted	=	0.02509		Prob > F	=	0.211
Housing Preferences			*Coefficient*	*Std. Error*	*t-value*	*Pr (> | t |)*
(Intercept)			4.43717	0.19536	22.713	$< 2e^{-16}$ ***
Log_AnchoringScore			0.63121	0.32691	1.931	0.0582*
Framing Score			0.02081	0.08547	0.243	0.8085
Herd Behaviour Score			- 0.06026	0.07652	- 0.788	0.4340

Note: *** significance with p<0.01, ** significance with p<0.05, * significance with p<0.1
Source: authors' calculations

Table 5. Regression with dwelling features as dependent variable

R-squared						
Multiple	=	0.06143		F(3, 61)	=	1.331
Adjusted	=	0.01527		Prob > F	=	0.2726
Dwelling Features			*Coefficient*	*Std. Error*	*t-value*	*Pr (> | t |)*
(Intercept)			4.79310	0.22366	21.430	$< 2e^{-16}$ ***
Log_AnchoringScore			0.46928	0.37427	1.254	0.215
Framing Score			0.03390	0.09785	0.346	0.730
Herd Behaviour Score			- 0.12475	0.08760	- 1.424	0.160

Note: *** significance with p<0.01, ** significance with p<0.05, * significance with p<0.1
Source: authors' calculations

Table 6. Regression with environment features as dependent variable

R-squared						
Multiple	=	0.05416		F(3, 61)	=	1.164
Adjusted	=	0.007642		Prob > F	=	0.3308
Environment Features			*Coefficient*	*Std. Error*	*t-value*	*Pr (> | t |)*
(Intercept)			4.081250	0.254125	16.060	$< 2e^{-16}$ ***
Log_AnchoringScore			0.793138	0.425245	1.865	0.067*
Framing Score			0.007719	0.111182	0.069	0.945
Herd Behaviour Score			0.004229	0.099533	0.042	0.966

Note: *** significance with p<0.01, ** significance with p<0.05, * significance with p<0.1
Source: authors' calculations

4.3.2 OLS regression with control variables

In these regressions the control variables are added to the analysis. Since all of them are categorical and therefore included as dummy variables, it is important to acknowledge that the interpretation of the dummy coefficients is different from the interpretation of the numerical variables. The coefficient shows the difference from the reference category, rather than the effect on the dependent variable. Moreover, as mentioned before, the intercept represents the baseline of the dependent variables when all other variables are 0. For the dummy variables, this means they are equal to the reference group.

Although the basis model with only bias scores was not significant, the model visibly improved after adding the control variables. All three models are significant. This indicates that the inclusion of demographic and social-economic features is important in explaining housing preferences and their specific features. It could mean that that in combination with the control variables (gender, household, province, income, level of education) the anchoring bias, framing bias and herd behaviour can explain the variance in the dependent variable, or that the control variables alone can explain the variance together or that some of the control variables are a stronger predictor than the main variables, the biases.

Table 7 shows the results of the regression with housing preferences. The value of the F-test is equal to 0.03425, which means that the model is significant with a significance level of 5% and above and useable for interpretation. Looking at the R-squared, it is clear that the model can explain some of the variance of housing preferences. The value of the adjusted indicator (which is preferred) is equal to 19.80% and the multiple indicator even higher at 39.85%. This is much higher than the values of the model without controlling variables, which has a multiple R-squared of 7.079% and an adjusted R-squared of 2.509%. Again, a sign that the model has improved with the addition of the extra variables. The anchoring bias (Log_AnchoringScore) has a statistical significance result with a significant level of 5% of higher. According to the regression, the presence of the anchoring bias has a positive effect on housing preferences. An increase in the bias with 1 results in an increase in the importance of housing preferences by 0.69313, in other words stronger housing preferences.

The fact that the coefficient of the anchoring bias (Log_AnchoringScore) is higher, as well as the increase of R-squared and the significance of the whole model, indicates that the biases explain the variation of housing preferences together with the control variables, and that the variance is not only explained by the control variables. However, this does not mean that the control variables do not explain housing preferences as well, since some of those dummy variables have a statistical significance. These are dummy variable 1 of household and dummy variable 1 and 5 of education level. For the type of household, the reference category is multi-persons household (3 or more), and D1 is a 1-personshousehold. D1_Household has a p-value of 0.0122 meaning that it is statistically significant with a significance of 5% and higher,

and a coefficient of -0.45069. Being in a 1-personshousehold is thus associated with a lower housing preferences score of 0.45069 than being in a multi-persons household, holding everything constant. In other words, people who live alone, have weaker housing preferences compared to people who live with 3 or more. For the level of education, the reference is HBO, the first dummy is elementary school, and the fifth dummy is MBO. Both dummies have are statistically significant with a significance level of 5% and higher and are negative related with the reference category. Therefore, people who have completed elementary school and MBO as highest education level, have less strong housing preferences than people that completed HBO. Especially the difference with elementary school is quite big, since this correspondent with a value of – 0.67028 (compared to – 0.26580 for MBO).

This regression analysis relates to hypotheses 1, 4 and 7, formulated in section 2.5. All three hypotheses indicate that each bias has a significant effect on housing preferences. The results cause hypothesis 1 to be accepted, as it states that anchoring bias has a significant effect on housing preferences. However, hypothesis 4 and 7 are rejected as there is no significant effect of framing bias and herd behaviour on housing preferences. In addition, the results do confirm some assumptions from behavioural theories, as it indicates that the biases have an effect on decision-making for housing preferences, but in this case only the anchoring bias. Both the framing score and herd behaviour does not affect the decision-making. It also verifies the life-cycle and life-course model mentioned by Jansen et al., 2011, since the inclusion of demographics and social-economics features improves the model.

Table 7. Regression with housing preferences as dependent variable incl. control variables

R-squared					
Multiple	=	0.3985	F(16, 48)	=	1.987
Adjusted	=	0.1980	Prob > F	=	0.03425**

Housing Preferences	*Coefficient*	*Std. Error*	*t-value*	*Pr (> | t |)*
(Intercept)	4.37132	0.22288	19.316	$< 2e^{-16}$ ***
Log_AnchoringScore	0.69313	0.34310	2.020	0.0490**
Framing Score	- 0.03925	0.09436	- 0.416	0.6793
Herd Behaviour Score	0.06220	0.08056	0.772	0.4438
D1_Gender	- 0.10687	0.09688	- 1.103	0.2755
D1_Household	- 0.45069	0.17297	- 2.606	0.0122**
D2_Household	- 0.06804	0.12793	- 0.532	0.5973
D1_Income	- 0.16597	0.12791	- 1.297	0.2007
D2_Income	- 0.01593	0.13822	- 0.115	0.9087
D1_Province	0.23678	0.15701	1.508	0.1381
D2_Province	- 0.32034	0.25609	- 1.251	0.2170
D1_Education	- 0.67028	0.36795	- 1.822	0.0747*
D2_Education	- 0.18835	0.22308	- 0.844	0.4027
D3_Education	- 0.07370	0.38090	- 0.193	0.8474
D4_Education	0.04004	0.29037	0.138	0.8909
D5_Education	- 0.26580	0.12072	- 2.202	0.0325**
D6_Education	0.00889	0.13892	0.064	0.9492

Note: *** significance with p<0.01, ** significance with p<0.05, * significance with p<0.1
Source: authors' calculations

Table 8 shows the results of the regression with dwelling features as dependent variable. The model is statistical significance with a F-test score of 0.09504. However, in contrast with the previous model (with housing preferences) it is significant with a significance level of 1% and higher. The R-squared values increased to 0.3530 for the multiple R-squared and 0.1373 for the adjusted indicator. Note that this value is lower than in the model with housing preferences. Meaning that the variance in dwelling features is not as much explained by the variables as the variance in housing preferences. It is, however, still a big difference with the model without control variables which were 0.06143 and 0.01527. The bias variables are not significant, and the coefficients are lower than those in the model without the demographics. The hypotheses related to this regression analysis are hypotheses 2, 5 and 8. All hypotheses aim at the significant effect of the biases on dwelling features. According to the results, none of the biases has a significant effect, resulting in the rejection of all three hypotheses.

In contrast, some of the control variables (dummies) are statistically significant with a level of 1%. This hints at a stronger effect of the control variables than the effect of the biases. It seems that the control variables can explain the variation of dwelling features without the use

of the biases. The significant control variables are the first dummy of province and the first and fifth dummy of the level of education. For the variable province, Noord-Brabant is the reference category and D1 is Gelderland. The coefficient of D1_Province is 0.412996, indicating that living in Gelderland is associated with higher importance of dwelling features than people who live in Noord-Brabant. Their dwelling features preferences are stronger. Besides, people who have completed elementary school or MBO as the highest education level have a lower dwelling features score of 0.77452 and 0.278699, respectively, than people who completed HBO.

Table 8. Regression with dwelling features as dependent variable incl. control variables

R-squared					
Multiple	=	0.3530	F(16, 48)	=	1.637
Adjusted	=	0.1373	Prob > F	=	0.09504*
Dwelling Features		*Coefficient*	*Std. Error*	*t-value*	*Pr (> | t |)*
(Intercept)		4.573263	0.63320	17.368	$< 2e^{-16}$ ***
Log_AnchoringScore		0.399581	0.405346	0.986	0.3292
Framing Score		- 0.005873	0.111478	- 0.053	0.9582
Herd Behaviour Score		0.008543	0.095173	0.090	0.9289
D1_Gender		0.052055	0.114456	0.445	0.6513
D1_Household		- 0.284148	0.204351	- 1.390	0.1708
D2_Household		0.102907	0.151145	0.681	0.4992
D1_Income		- 0.161838	0.151121	- 1.071	0.2896
D2_Income		- 0.034593	0.163299	- 0.212	0.8331
D1_Province		0.412996	0.185497	2.226	0.0307**
D2_Province		- 0.441384	0.302546	- 1.459	0.1511
D1_Education		- 0.77452	0.434711	- 1.788	0.0800*
D2_Education		- 0.038937	0.263547	- 0.148	0.8832
D3_Education		- 0.214520	0.450001	- 0.477	0.6357
D4_Education		0.132056	0.343047	0.385	0.7020
D5_Education		- 0.278699	0.142620	- 1.954	0.0565*
D6_Education		0.091718	0.164128	0.559	0.5789

Note: *** significance with p<0.01, ** significance with p<0.05, * significance with p<0.1
Source: authors' calculations

Table 9 shows the results of the regression with environment features as dependent variable. Given the value of Prob > F is equal to 0.07104, the model is statistically significant with a significance level of 1% and above. The model does explain some of the variation in environment features, but not that much since the adjusted R-squared is 0.1559. The multiple R-squared is higher with 0.3669, but less accurate for this analysis. However, it is quite larger

than the explanatory power of the model without control variables, since these are 0.007642 and 0.05416 (Table 6). The values is also a bit higher than the values in

Table 8, which hints that the biases and control variables are slightly better in explaining the variance in environment features than in dwelling features. The anchoring score (Log_AnchoringScore) is statistically significant with a significance level of 5% and above. The coefficient is positive, referring to a positive effect of the bias on housing preferences. If the anchoring score increases by 1, the environment features become more important by 0.98667. Thus, people find environment features more important when the anchoring bias is stronger. The value is the highest one compared to all the other models in which the anchoring bias has a significant effect (0.986667 > 0.63121 in Table 4, 0.98667 > 0.793138 in Table 6, 0.98667 > 0.69313 in Table 7). Since the R-squared has increased, the model is significant, and the coefficients of the variables have increased, it can be indicated that the combination of the control variables and the biases results in a better explanation of the variance of environment features. Thus, the addition of the control variables improved the model.

Some of the dummy variables are significant too, the first dummy of gender and household. For gender, the reference category is female, meaning that D1_Gender is male. The coefficient is -0.265785 meaning that being male is linked with a 0.265785 lower environment features score compared to being female. In other words, men have weaker preferences for environment features than women, the distance to some aspects are less important. Regarding the household dummy, the coefficient indicates that 1-personshouseholds have a 0.617240 lower score for environment features than people living is a multi-persons household. Meaning that people who live alone consider it less important in what environment they live.

With regard to the hypotheses formulated, this regression analysis tests hypotheses 3, 6 and 9. Again, each hypothesis indicates a significant effect of anchoring bias, framing bias and herd behaviour on environment features. Since the results show only a significant effect of anchoring bias on environment features, hypothesis 3 is accepted while hypotheses 6 and 9 are rejected.

Table 9. Regression with environment features as dependent variable incl. control variables

R-squared					
Multiple	=	0.3669	F(16, 48)	=	1.739
Adjusted	=	0.1559	Prob > F	=	0.07104*

Environment Features	*Coefficient*	*Std. Error*	*t-value*	*Pr (> | t |)*
(Intercept)	4.169372	0.294816	14.412	$< 2e^{-16}$ ***
Log_AnchoringScore	0.98667	0.453830	2.174	0.0347**
Framing Score	- 0.072622	0.124812	- 0.582	0.5634
Herd Behaviour Score	0.115859	0.106556	1.087	0.2823
D1_Gender	- 0.265785	0.128146	- 2.074	0.0435**
D1_Household	- 0.617240	0.228794	- 2.698	0.0096***
D2_Household	- 0.238991	0.169223	- 1.412	0.1643
D1_Income	- 0.170098	0.169197	- 1.005	0.3198
D2_Income	0.002725	0.182831	- 0.015	0.9882
D1_Province	0.060565	0.207684	0.292	0.7718
D2_Province	- 0.199297	0.338733	- 0.588	0.5591
D1_Education	- 0.563105	0.486707	- 1.157	0.2530
D2_Education	- 0.337771	0.295070	- 1.145	0.2580
D3_Education	0.067126	0.503825	0.133	0.8946
D4_Education	- 0.051973	0.384079	- 0.135	0.8929
D5_Education	- 0.252894	0.159679	- 1.584	0.1198
D6_Education	- 0.073937	0.183759	- 0.402	0.6892

Note: *** significance with p<0.01, ** significance with p<0.05, * significance with p<0.1
Source: authors' calculations

4.4 Discussion

Looking at the results of this study, it can be seen that the assumptions of behavioural economics and bounded rationality, introduced in the theoretical framework, hold. The housing market is influenced by behavioural economic aspects, as the anchoring bias has an effect on housing preferences. An increase in the bias results in stronger housing preferences, implying that people make decisions based not only on reason and facts (rationality), but experience bounded rationality. The bias highlights one of the three concepts, reference dependence, from cognitive psychology mentioned by Marney & Fakhry (2023), explaining that decisions are often made based on a reference point. This dependence is linked to anchoring bias, as this bias is tested using reference points, the anchors. While the results show that there is no complete rationality among home buyers, they also show that framing bias and herd behaviour have no effect on housing preferences. This contradicts part of the same theory because it suggests that all three cognitive biases affect housing demand in the private sector. The framing bias is linked to another concept from cognitive psychology by Marney & Fakhry (2023) namely loss aversion, and herd behaviour is linked to the influence of the social environment mentioned by several researchers including Marney & Fakhry (2023), Levy et al. (2008) and Tan (2021). Despite the absence of the significant effect of two of the biases, it does not take away the cognitive influences in making decisions in the housing market.

Because of the significant result of only one bias, the conceptual model developed does not capture the actual dynamics observed in the regression results. The answers of the survey do show that all three biases are represented among the respondents. Some experiences all biases, while others have only one or two biases. This indicates that part of the conceptual model, where there is a line between the biases and their influence on the decision-making process (information selection for anchoring bias, value assessment for framing bias and the influence of social and cultural expectations for herd behaviour), portrays the actual dynamics observed. However, not all of these influences (the effects on decision making) affects demand in the private housing sector, as only the anchoring bias has an effect on housing preferences, especially environmental features. Which makes about a third of the conceptual model correct in terms of reflecting the actual effect.

For the analysis, housing preferences are divided into two categories. This split certainly adds value to the study as the results are different on both features. Despite the absence of the effect of herd behaviour and framing bias, the results do show that anchoring bias affects demand in the private housing sector, mainly focused on environment features. The demand for these homes increases, putting pressure on the housing market. Especially for certain areas and/or neighbourhoods, as the analysis shows a large effect of the anchoring score on environment features. The higher the anchoring bias, the more important environment features become. Without the breakdown of housing preferences into these two types of characteristics,

it would not be possible to recognise and suggest that the effect of the bias is different for the two categories. The conclusion would be that anchoring bias affects housing preferences, but details would be missing, such as what type of preferences are affected. With the addition of both environment and dwelling features, the effect can be considered in more detail and it can be said that anchoring bias statistically affects environment features and not dwelling features. Moreover, the split is not made without reason. It is based on research by Jansen et al. (2011), who based the categories on the assumption that housing preferences are different for everyone. First, because a house has different functions and thus having a house can fulfil different and/or multiple purposes. For instance, having a house for shelter and personal care is more linked with dwelling features, while seeing a house as a centre of socio-geographical network refers more to the environment features of a house. Second, preferences are influenced by the life-cycle and life-course model. Different life stages influence dwelling features, for example needing a bigger house because of household size, as well as environment features, for instance moving because someone wants to be closer to family. Both reasons refers to having different achievements and/or ideas regarding housing, which can be captured by separating housing preferences into dwelling and environment features.

5. Conclusion

This final chapter concludes and reflects on the research. Main points, key findings are summarised and the research questions are answered in 5.1. In addition, the empirical findings are reflected against the previously mentioned theoretical ideas, concepts and discourses in section 5.2. Moreover, since the research of cognitive biases in homebuyers can improve policy-making, paragraph 5.3 focuses on recommendations regarding changing policies based on the results to improve housing. The last section, 5.4, is used to indicate the boundaries and constraints of the study, such as the methodological and data-related limitations. Ideas for future research are discussed as well.

5.1 Answers to research questions

This study sought to answer the question “How do cognitive biases in homebuyers affect demand in private-driven housing sector?”. The research is conducted to gain a better understanding of behavioural economics aspects in the housing decision-making, in other words, the demand in the housing sector. Three cognitive biases are examined into more detail, the anchoring bias, the framing bias and herd behaviour. These biases where chosen based on research of Marney and Fakhry (2023), Tan (2021) and Umapathy (2024). Further research on the effect of biases and housing demand is needed as the housing market is experiencing increasing problems. A better understanding of the factors influencing demand will help the market through more effective and efficient policies and recommendation. A quantitative survey was carried out for this purpose.

Three sub-questions have been formulated to answer the main questions. The first is “How do cognitive biases affect homebuyers’ preferences?”. This model looked at the influences of biases on housing preferences in general, in other words without classification into particular aspects. The anchoring bias is the only bias, of the three, that shows a positive significant result in the analysis, meaning that it can be concluded that framing bias and herd behaviour have no influence on (the importance of) housing preferences, only the anchoring bias. The stronger the bias, the stronger the housing preferences. However, it should be taken into account that this relationship is only present when the control variables are included. Without the demographics and social-economic factors there is no effect, no influence of all biases on how important housing preferences are. Regarding those other, additional, factors, the coefficients of the (dummy) variables of people living alone and having finished elementary school/MBO as the highest level of education are also significant. All three values are negative, meaning that these people consider housing preferences less important than people living in households with three of more people and those who have completed HBO.

The other two sub-questions focus on a particular category of housing preferences. The second question deals with preferences about the house itself and reads as follows: “How do cognitive biases affect homebuyers’ preferences regarding dwelling features?”. Since there are no significant results in the regression models, both in the model without and with control variables, it can be concluded anchoring bias, framing bias and herd behaviour have no effect on the preferences for dwelling features. The biases cannot explain the variance in the importance of characteristics related to the house itself. The third and final sub-question focuses on environment features: “How do cognitive biases affect homebuyers’ preferences regarding environment features?”. Only the anchoring bias has a significant positive effect. So, since only this bias is statistically significant, it can be concluded that only the anchoring bias has an effect on the importance of the surroundings of the house, its environment. As the anchoring biases increases, environment features become more important as well. It is important to keep in mind that this effect is, again, only occurs when demographics and social-economic factors are included. For the control variables, it can be said that men and people living in a 1-personshousehold consider the environment of the house less important than women and people in multi-persons households, as these dummy variables have significant values.

To answer the main question, it can be concluded that only the anchoring bias has an effect on demand in the private housing sector. Despite multiple models and distinguishing between two categories, framing bias and herd behaviour have no effect on the demand. Regardless of which dependent variable is chosen. This conclusion refers to the assumption that only the presence of the anchoring bias can but more pressure on the demand as housing preference become stronger. This effect is mainly present with environment features, or in other words, certain areas, in particular where people are looking for a house, are pressured by the anchoring bias. In conclusion, the more the anchoring bias is present, the stronger the housing preferences, mainly environment characteristics, the higher the demand for houses within a certain area or with specific features, the greater the pressure on the housing market, especially in (desired) areas.

5.2 Theoretical reflection

This thesis contributes to the further development of behavioural housing theory by empirically testing the effects of cognitive biases on housing preferences. While previous studies, such as Galimore et al. (2000) and Umapathy (2024), emphasize the influence of cognitive biases on the decision-making process of individuals and should thus be considered with care, and researchers, such as Marney and Fakhry (2023), Bao and Robinson (2020) highlighted the presence of cognitive biases in housing decision, they generally not mention the effects on specific aspects of housing preferences and demand, and did not quantity the

effects. The results of this study challenges the broader behavioural economics expectations that multiple biases (such as framing and herd behaviour) shape decision-making. In contrast, the findings show that only the anchoring bias, especially with respect to environment features, has a statistically significance influence. This suggests that reference dependence, captured by the anchoring bias, may be particularly relevant for understanding housing preferences. It therefore contradicts behavioural theories that indicate that the way something is presented should be taken into account, especially in terms of loss aversion, and several theories that speak of a strong influence of the social environment.

This discovery provides further insight into the use of bounded rationality and other behavioural economic aspects in housing studies (Tan, 2021; Marsh & Gibb, 2011) and support a more nuanced theoretical approach in which cognitive biases for decision making are not a constant, uniform influence, but differ in importance depending on housing preference dimensions. Future research could build on this by theorising how anchoring effect interact with neighbourhood identity, price expectations and policy communication. In other words, forming or improving theories through a bigger focus on reference framing and environmental valuation as behavioural mechanisms in housing decisions.

5.3 Recommendations for praxis

As explained in the first chapter, giving the ongoing housing shortage in the Netherlands and the urgent need to accelerate the construction of new houses, this study emphasises the importance of incorporating behavioural insights into public policy. In this case, integrating the effect of cognitive biases into policy making. The observed effect of anchoring bias on housing preferences, especially for environment features, suggests that people's decision regarding housing are not only shaped by affordability or infrastructure, but also by references points. These points could refers to familiar locations, advertised benchmarks, social narratives, housing prices and policy signals. This finding opens up opportunities for municipalities (provinces, the government) and developers to design communication strategies and policies that steer housing demand more effectively.

An example is transparent pricing information. Intervening in the market by providing information about prices leads to a more accurate and up-to-date reference point. Outdated anchors, or anchors based on artificially high or ow prices (such as asking prices based on different type of situation, for example during a boom), distorts demand and can discourage market entry. Misleading anchors can be counteracted by promoting new rules/laws for truthful prices and information in (new) developments and by providing clear and well-founded value anchors. In others words, providing sufficient and truthful information to homebuyers resulting in clear and grounded value anchors. Another example is framing less popular or emerging areas in more appealing ways to create a different reference point as well. In addition, creating

a sense of proximity and easy access to certain areas/place, for example a park or shopping centre, can change the reference point or opinions about locations. In summary, many of these potential policy recommendations relate to providing information to influence the reference point, the anchor, of those looking to buy a home. By paying attention to how homebuyers actually form preferences, policy interventions and strategies can better address behavioural patterns that might otherwise reinforce spatial inequality or overburden high-demand regions. This could result in behavioural-informed policies that contribute to more balanced, realistic and inclusive housing development. Especially in a context where land is scarce, housing costs are rising and conventional planning tools alone may not be enough.

5.4 Limitations and further research

As described in the methodological chapter (Validity and reliability 3.3), some measures were taken in this study to increase the internal and external validity. Regarding internal validity, control variables corresponding to demographics and social-economic factors were added, as mentioned by Jansen et al. (2011). Since all regression models without the control variables could not be used for interpretation due to insignificance, it can be said that these additional variables thus definitely improved the internal validity of the research. However, the external validity is slightly more difficult because the sample size of this study is not that large. It is equal to 65, which may make generalizing the results difficult. In the future, this may be solved if there is more time for the data collection, like more time to distribute the survey and collect responses.

In addition, the choices of dimension indicators and methodology also have some limitations. Although housing preferences are used for the demand of the private housing sector, they are not directly related with the actual housing choice made and thus demand. It is important to recognize that preferences can give an unrealistic picture, a dream situation, despite giving a good overview of the people's (ideal) situation. Many people dream of a spacious house with a backyard, close to urban amenities in a green and quit environment. It is their subjective ideal home. In practice, the ideal house is not achievable for most people. Instead, they search for their objective ideal house, which refers to a house that is ideal considering supply and budget constraints. The magnitude of demand is therefore also influenced by other factors, such as government regulations, availability and accessibility (supply factors), affordability and transparency of the housing market (Jansen et al., 2011).

This limitation described in the paragraph above is closely related to a limitation of the method used for housing preferences, the Traditional Housing Demand Research Method. As mentioned, this method is characterized by stated preferences, which refers to people's initial preferences and not their actual behaviour (revealed preferences) (Jansen et al., 2011). This need not be a major limitation, as Jansen et al. (2011) suggests that in some situations it is

better to use a stated preference approach. One such case is a tight market in which there is a chance that people have to accept things that does not accurately reflect their wishes and/or criteria. The actual choice is then not a good reflection of their preferences and it may be an option to use an approach with stated preferences (Jansen et al., 2011). There is currently a tight housing market in the Netherlands, as supply is very low and demand is high. The problem that does remain is the less realistic predictability of preferences. Another potential limitation of the Traditional Housing Demand Research Method is that no trade-offs between different attributes. The compositional method assumes that features can be valued without having information about other characteristics. According to some researchers, having a trade-off better reflects one's value. However, it is also very time-consuming and cognitively and emotionally burdening (Jansen et al., 2011; Payne et al., 1999).

Besides, the absence of the influence of framing bias and herd behaviour can perhaps be explained by the indicators used to measure the biases. There are different ways to estimate these biases and it is possible that the ones chosen for herd behaviour and framing bias are not correct for the desired outcome in this study. Another explanation could be that the questions asked to the respondents in the survey are not related to housing. An idea could be to transform these questions to make housing the main topic. Perhaps that this would make people make a connection between those questions and housing choice, and thus make different choices in the questions used to identify the biases.

For the future, it may be an improvement to investigate the effect of cognitive biases with a larger sample size. As mentioned earlier, with 65 respondents, this study does not have a large sample size. Having more people answer the questions may result is a group that is more representative of the entire population living in Noord-Brabant, Gelderland and Limburg, making more generalisable. There is a chance it could even explain why framing bias and herd behaviour have no significant effect. Also, as mentioned in the previous paragraph, a direction for future research would be to tailor the survey questions more directly to housing decision context. In addition, follow-up research could further explore the effect of biases on demand by focusing on a specific category of housing preferences. By delving deeper into the differences within categories, new effects could be identified. It could perhaps provide a more detailed explanation of the effect of the anchoring bias on dwelling features or a clearer clarification why the other two biases (framing bias and herd behaviour) have no effect on housing preferences while some other studies indicate this. Perhaps a significant result could emerge when looking at specific preferences within a category, for example only the type of house or only the proximity to family, friends or a city center. Besides, more research could be done on the effect of the anchoring bias on demand in the private housing sector, as this is the bias with a significant effect in this study. More research could confirm (or perhaps contradict) these findings. It is also a recommendation to look more into the effect of selection biases on

the demand, as the anchoring bias can be placed under the category of selective biases (according to ACAPS (2016)). There is a chance that there are more biases that fall under the same category and have an effect on housing demand. In regard to the methodological choices made, further research could use a combination of multiple methods, for example, combining survey results with qualitative methods (such as interviews or experimental designs) to further explore how housing preferences and housing demand are shaped. Finally, the findings from housing preferences and hence housing demand can be used to evaluate current policies on public planning, land and housing. Ways to improve these policies can be explored and recommendations can be made on how policies could mitigate biases.

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6. Appendix

Appendix A – Items Anchoring Bias

The items used in the survey to test for the anchoring bias are from the research of Berthet (2021) and consist of:

1. The heat record in the city of Paris (in °C).
2. The average monthly salary for the first job of students graduating from a business school in the Netherlands.
3. The average number of births per day in the Netherlands.
4. The average length of a dinner at home in the Netherlands (in minutes).
5. The number of African states in the United Nations.
6. The gestation period of the African elephant (in months).

Appendix B – Items Risky-Choice Framing Effect

Gain frames (Berthet, 2021)

1. Imagine a storm approaching a city of 150 000 people. If nothing is done, 12 000 homes could be degraded. Public authorities must choose between two interventions:
If plan A is adopted, 3000 homes will be saved.
If plan B is adopted, there is a 25% chance of saving all 12 000 homes and a 75% chance that no home will be saved.
Which option would you choose?

2. Imagine that after a serious traffic accident, 60 people are stranded in a tunnel. Public authorities must choose between two interventions:
If plan A is adopted, 20 people will be saved.
If plan B is adopted, there is a 1/3 chance of saving 60 people and a 2/3 chance of not saving anyone.
Which option would you choose?

3. Imagine that you have just spilled liquid on your external hard drive. 12 GB of personal data is at stake. You must quickly choose between two options:
If you choose option A, you will save 3 GB of data.
If you choose option B, there is a 1/4 chance of saving your 12 GB of data and a 3/4 chance that you will save no data.
Which option would you choose?

Loss frames (Berthet, 2021)

1. Imagine a tsunami approaching a city of 150 000 people. If nothing is done, 12 000 homes could be degraded. Public authorities must choose between two interventions:
If plan A is adopted, 9000 homes will be degraded.
If plan B is adopted, there is a 25% chance that no home will be affected and a 75% chance that all 12 000 homes will be affected.
Which option would you choose?

2. Imagine that after a fire in a college, 60 students are stranded in a classroom. Firefighters must choose between two interventions:
If plan A is adopted, 40 students will die.
If plan B is adopted, there is a 1/3 chance that no student will die and a 2/3 chance that all 60 students will die.
Which option would you choose?

3. Imagine that your laptop is attacked by a computer virus. 12 GB of personal data is at stake. You must quickly choose between two options:
If you choose option A, you will lose 9 GB of data.
If you choose option B, there is a 1/4 chance of not losing any data and a 3/4 chance of losing all data.
Which option would you choose?

Appendix C – Items Attribute Framing

The three attribute framing items included in the survey for participants (De Bruin et al., 2007):

1. Cheating at a university where students' self-reports indicate that 65% have cheated or 35% never have.
2. Counselling a student who received either 90% correct on the midterm exam and 70% correct on the final exam or 10% and 30% incorrect, respectively.
3. Fining a woman with a 20% chance of not knowing that she had parked illegally or an 80% chance of knowing that she had.

Appendix D – Items Herd Behaviour: Recognizing social norms and expectations

For the actual percentages

"The following problems ask whether it is sometimes OK to do different things. For each question, please indicate whether in your opinion the answer is yes or no)" (adopted from De Bruin et al., 2007).

Do you think it is sometimes OK …

1. … to steal under certain circumstances?
2. … to use your fists to resolve a conflict?
3. … to drink and drive?
4. … not to tell the police when you witness a crime?
5. … not to be on time for appointments?
6. … not to keep secrets that a friend told you?

For the estimated percentages

"The following problems ask out of 100 people your age, how many would say that it is sometimes OK to do different things. For each question, please circle a number between 0 (meaning no one thinks that it is sometimes OK) and 100 (meaning everyone thinks that it is sometimes OK)" (adopted from De Bruin et al., 2007).

0	10	20	30	40	50	60	70	80	90	100
No one										Everyone

Out of 100 people, how many would say it is sometimes OK …

1. … to steal under certain circumstances?
2. … to use your fists to resolve a conflict?
3. … to drink and drive?
4. … not to tell the police when you witness a crime?
5. … not to be on time for appointments?
6. … not to keep secrets that a friend told you?

Appendix E – Items Herd Behaviour: IMI and DOI

Imitating Others (IMI) (Erjavec & Manfreda, 2021)

- IMI1. It seems online shopping is the dominant type of shopping; therefore, I would like to use it as well.
- IMI2. I follow others in accepting online shopping.
- IMI3. I would choose to accept online shopping because many other people are already using it.

Discounting Own Information (DOI) (Erjavec & Manfreda, 2021)

- DOI1. My acceptance of online shopping would not reflect my own preferences for shopping.
- DOI2. If I were to use online shopping, I wouldn't be making the decision based on my own research and information.
- DOI3: If I did not know that a lot of people have already accepted online shopping, I might choose another wiki system for my work.

Appendix F – Scheme dummy coding

Table 10. Dummy coding scheme for gender

Gender	D_1
Men	1
Female	0

Source: authors' calculations

Table 11. Dummy coding schema for type of household

Type of Household	D_1	D_2
1-personshousehold	1	0
2-personshousehold	0	1
Multi-persons household	0	0

Source: authors' calculations

Table 12. Dummy coding schema for income

Income	D_1	D_2
< 3000	1	0
3000	0	1
> 3000	0	0

Source: authors' calculations

Table 13. Dummy coding scheme for living place

Province	D_1	D_2
Gelderland	1	0
Limburg	0	1
Noord-Brabant	0	0

Source: authors' calculations

Table 14. Dummy coding scheme for level of education

Level of education	D_1	D_2	D_3	D_4	D_5	D_6
Elementary school	1	0	0	0	0	0
HAVO	0	1	0	0	0	0
VWO	0	0	1	0	0	0
VMBO or lower	0	0	0	1	0	0
MBO	0	0	0	0	1	0
HBO	0	0	0	0	0	0
WO	0	0	0	0	0	1

Source: authors' calculations

Appendix G – Statistical tests: assumption specific tests

One of the assumptions of OLS regression is that the residuals are disturbed normally. Otherwise, there is a chance that the results are not valid. To test for this assumption, the Shapiro-Wilk-test is used. When the p-value is lower than 0.05, the null-hypothesis will be rejected and which that concluded that there is no normal distribution (Van Heijst, 2023b; Statistics Solutions, 2025). From the tests, shown in Table 15 to Table 20, it appears that only the Anchoring Score does not meet the assumption. This is solved by converting the variable into a log variable, Shapiro-Wilk-test shown in Table 21.

Table 15. Shapiro-Wilk-test for the Anchoring Score

Anchoring Score	
w	0.95867
p-value	0.02923

Source: authors' calculations

Table 16. Shapiro-Wilk-test for the Framing Score

Framing Score	
w	0.96767
p-value	0.08687

Source: authors' calculations

Table 17. Shapiro-Wilk-test for the Herd Behaviour Score

Herd Behaviour Score	
w	0.98664
p-value	0.70980

Source: authors' calculations

Table 18. Shapiro-Wilk-test for Housing Preferences

Housing Preferences	
w	0.98168
p-value	0.44800

Source: authors' calculations

Table 19. Shapiro-Wilk-test for Dwelling Features

Dwelling Features	
w	0.98217
p-value	0.47130

Source: authors' calculations

Table 20. Shapiro-Wilk-test for Environment Features

Environment Features	
w	0.97178
p-value	0.14320

Source: authors' calculations

Table 21. Shapiro-Wilk-test for log_AnchoringScore

Log_AnchoringScore	
w	0.96522
p-value	0.06442

Source: authors' calculations

Another assumption is that there is no multicollinearity, which means independent variables are not linked to each other. In other words, there is perfect multicollinearity, there is a perfect linear function between two or more independent variables. Having multicollinearity can result in a poor estimate of the coefficients in the regression, since the independent variables explain each other instead of explaining extra variance in the model. The possible multicollinearity is tested with the use of the Variance Inflation Factor (VIF). Since VIF only measures the multicollinearity between the independent variables, it is not needed to do the tests multiple despite having more than one regression analysis because only the dependent variables changes (Tieleman, 2023; Van Heijst, 2023a). The results can be found in Table 22. The rule of thumb is that the assumption is violated when the VIF is more than five (a high VIF for control variables is no problem (Tieleman, 2023; Van Heijst, 2023a). In this case, every value is smaller than five, concluding there is no multicollinearity.

Table 22. VIF test for multicollinearity

	VIF-value
Log_AnchoringScore	1.345492
Framing Score	1.481536
Herd Bias Score	1.353898
D1_Gender	1.343786
D1_Province	1.372618
D2_Province	1.133191
D1_Income	1.427110
D2_Income	1.556338
D1_Household	1.665832
D2_Houshold	1.602637
D1_Education	1.188315
D2_Education	1.269346
D3_Education	1.273376
D4_Education	1.456898
D5_Education	1.498906
D6_Education	1.789206

Source: authors' calculations

In addition, it is important to have no heteroscedasticity. This refers to the error term having a constant variable, in others words the variance of this term should be equal. If heteroscedasticity is present, the results of the regression can become unreliable (Van Heijst,

2023a). The assumption is tested with the use of the Breusch-Pagan test. When the p-value is less than 0.05 the null hypothesis, homoscedasticity is present, should be rejected, meaning there is heteroscedasticity in the model (Bobbitt, 2022). Since this test is specific for the variables used, and this study consists of multiple regressions (one with Housing Preferences as the dependent variable, one with Dwelling Features and one with Environment Features), the Breusch-Pagan test is done three times. All three results are shown in Table 23, Table 24 and Table 25. All the p-values are far above the necessary value leading to the conclusion that the null hypothesis is not rejected and there is no heteroscedasticity.

Table 23. Breusch-Pagan test with Housing Preferences as dependent variable

	Coefficient
BP	13.021
df	16
p-value	0.6712

Source: authors' calculations

Table 24. Breusch-Pagan test with Dwelling Features as dependent variable

	Coefficient
BP	8.28775
df	16
p-value	0.9398

Source: authors' calculations

Table 25. Breusch-Pagan test with Environment Features as dependent variable

	Coefficient
BP	14.631
df	16
p-value	0.5518

Source: authors' calculations

Appendix H – Histogram anchoring score

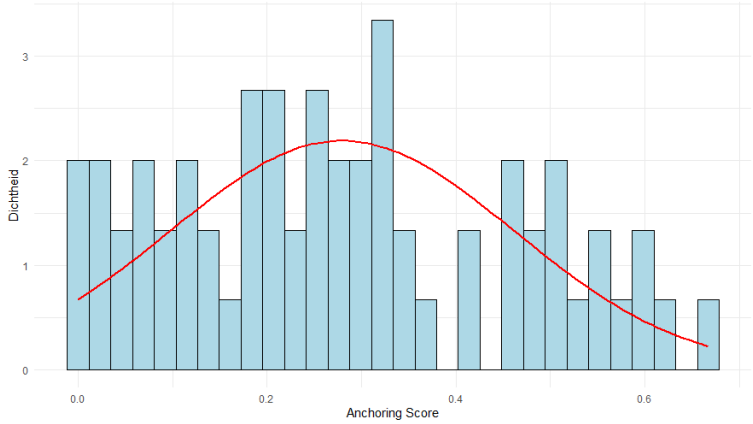

Figure 5. Histogram anchoring score (own work)

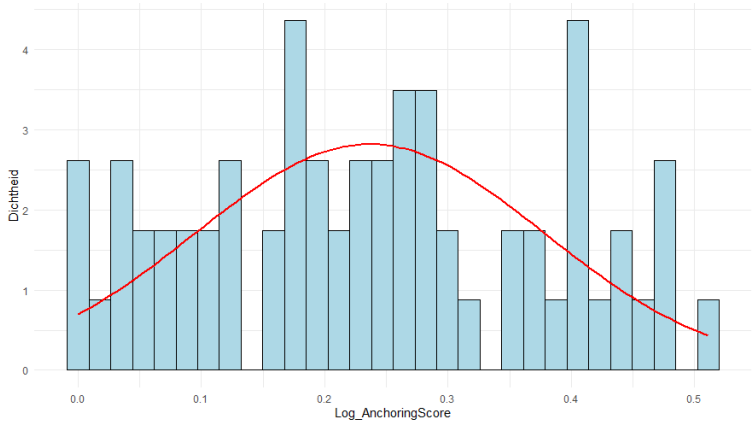

Figure 6. Histogram Log_AnchoringScore (own work)

Appendix I – Correlations between the dummy variables

Table 26. Correlations between household dummies

	D_1	D_2
D_1	1.000	
D_2	-0.182	1.000

Source: authors' calculations

Table 27. Correlations between income dummies

	D_1	D_2
D_1	1.000	
D_2	-0.215	1.000

Source: authors' calculations

Table 28. Correlations between province dummies

	D_1	D_2
D_1	1.000	
D_2	-0.062	1.000

Source: authors' calculations

Table 29. Correlations between education dummies

	D_1	D_2	D_3	D_4	D_5	D_6
D_1	1.000					
D_2	-0.027	1.000				
D_3	-0.016	-0.027	1.000			
D_4	-0.022	-0.039	-0.022	1.000		
D_5	-0.068	-0.120	-0.068	-0.098	1.000	
D_6	-0.063	-0.110	-0.063	-0.089	-0.274	1.000

Source: authors' calculations

Appendix J – Correlation matrix

Table 30. Correlation matrix

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
(1) Log_AnchoringScore	1,0000																		
(2) Framing Score	0,0058	1,0000																	
(3) Herd Behaviour Score	-0,0696	0,0001	1,0000																
(4) Housing Preferences	0,2458	0,0314	-0,1141	1,0000															
(5) Dwelling Features	0,1685	0,0439	-0,1879	0,7978	1,0000														
(6) Environment Features	0,2325	0,0100	-0,0109	0,8463	0,3541	1,0000													
(7) D1_Gender	-0,0084	-0,1348	-0,0351	-0,1921	-0,0062	-0,2925	1,0000												
(8) D1_Province	0,0511	0,2470	-0,1690	0,2065	0,2987	0,0564	-0,2120	1,0000											
(9) D2_Province	-0,0855	0,0831	-0,0415	-0,1349	-0,1366	-0,0886	0,1985	-0,0619	1,0000										
(10) D1_Income	0,0997	-0,1357	0,0653	-0,1131	-0,1420	-0,0500	-0,1878	0,0905	-0,0848	1,0000									
(1) D2_Income	-0,1022	0,0000	-0,0082	-0,1033	-0,0366	-0,1279	-0,0749	0,1079	-0,0804	-0,2148	1,0000								
(12) D1_Household	0,1877	-0,0154	0,2095	-0,2170	-0,1122	-0,2375	0,0876	0,1995	-0,0619	-0,0374	0,3726	1,0000							
(13) D2_Household	-0,1070	-0,1164	0,1013	-0,0857	0,0632	-0,1887	-0,0185	-0,0613	-0,0934	-0,0564	0,1628	-0,1820	1,0000						
(14) D1_Education	-0,1394	0,0389	0,0119	-0,2525	-0,1882	-0,2254	0,1393	-0,0434	-0,0223	-0,0595	-0,0564	-0,0434	0,2386	1,0000					
(15) D2_Education	-0,0410	0,1368	-0,0852	-0,1027	-0,0494	-0,1157	-0,0499	-0,0764	-0,0392	0,2733	-0,0993	-0,0764	-0,1153	-0,0275	1,0000				
(16) D3_Education	-0,1543	-0,2333	0,1022	-0,0280	-0,1143	0,0576	-0,1122	-0,0434	-0,0223	0,2627	-0,0564	-0,0434	-0,0655	-0,0156	-0,0275	1,0000			
(17) D4_Education	0,1393	-0,0277	0,0122	0,0702	0,1532	-0,0265	0,1985	-0,0619	-0,0317	-0,0848	0,1572	-0,0619	0,3401	-0,0223	-0,0392	-0,0223	1,0000		
(18) D5_Education	-0,0049	-0,0454	0,2586	-0,2599	-0,3173	-0,1228	-0,1243	-0,1903	-0,0976	0,1158	0,0449	-0,0725	0,1572	-0,0685	-0,1205	-0,0685	-0,0976	1,0000	
(19) D6_Education	0,1947	-0,3110	-0,2698	0,1948	0,2252	0,1032	0,0155	-0,0496	0,1336	-0,0397	-0,2257	-0,1737	0,1123	-0,0625	-0,1100	-0,0625	-0,0891	-0,2739	1,0000

Source: authors' calculations