



**DOCTORATE in BUSINESS ADMINISTRATION**

**THE DETERMINANTS OF REAL ESTATE INVESTMENT:  
THE EXAMPLE OF THE UNITED KINGDOM**

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**Thesis Jury:**

## **Mention particulière**

“SKEMA Business School Le Business Science Institute et l’iaelyon School of Management n’entendent donner aucune approbation ni improbation aux opinions émises dans cette thèse. Ces opinions doivent être considérées comme propres à son auteur”.

“SKEMA Business School, the Business Science Institute, and the iaelyon School of Management, Jean Moulin University do not intend to give any approval or disapproval to the opinions expressed in this thesis. These opinions must be considered as specific to its author.”

# Aknowledgements

My interest in the decision-making behavior of real estate investment was triggered by my professional experience as Finance Manager in a Real estate investment trust (REIT) listed on the New York stock exchange (NYSE: NRE).

I witnessed that in real estate investment, what the textbook normative and prescriptive model used in our industry, “what people should do” in theory, is often very different from the final decision. “What we do”. In fact, I witnessed that many times, the final decision comes from the “gut feeling” rather than any normative model of the investment manager

So, I really wanted to understand better where this gap comes from, how it can be explained, and whether it was theorized in academic literature and how it applies to individual property investors.

This Doctorate research made me discover the concepts of behavioral biases and the different schools of thought, ranging from a normative approach with neoclassical and rationalist concepts to a rather descriptive approach that would research the psychological and social dimensions of the decision-making.

Aside from the rationale of a property investment decision that is well documented in the textbooks, an important part of this process was to research the behavioral biases literature. This research investigates the normative model existing in the literature as well as the behavioral biases and other factors that could affect the decision-making process. A quantitative survey is performed to assess whether there is a relationship between normative behavior and the presence of behavioral biases when it comes to investing in a property.

The pursuit of a doctoral degree is not simple. It is also a degree that would be impossible without the guidance, motivation, and support of others, and there are some persons that I would like to thank for the completion of this research.

To my thesis advisor, Professor Jean Francois Gajewski, for your guidance and advice. I am grateful for your time and constructive comments. To professors, Michel Kalika and Isabelle Walsh, thank you for the opportunity to participate in the digital doctoral program. To the SKEMA business school, the Business Science Institute, and the IAE LYON professors, instructors, and staff, you have exposed me to the best practices in research. To Catherine Rousseaux, much thanks for your constant support, follow-up, and successfully helping me to perform this doctoral program. Finally, on a more personal note, I dedicate this work to my spouse Samira, for your support and encouragement throughout this doctoral process.

# Resumé managérial

Suite à la pire crise financière depuis la Grande Dépression, l'investissement immobilier a retenu l'attention des acteurs économiques privés et institutionnels. La hausse des prix de l'immobilier, l'augmentation de l'endettement des ménages, la faiblesse des taux d'emprunt constituent des facteurs qui menacent l'Europe d'un risque de nouvelle crise immobilière.

L'étude est menée sous la forme d'une enquête administrée à 150 répondants employés à temps plein au Royaume-Uni. Les variables dépendantes de cette étude sont la motivation mesurée et les raisons d'investir dans une propriété. Les variables explicatives sont opérationnalisées à l'aide de deux catégories principales ; comportement normatif et dimensions psychologiques de la prise de décision. Les profils d'investisseurs tels que la démographie sont conceptualisés comme variables de contrôle dans ce modèle.

La régression logistique ordonnée nous permet de voir dans un échantillon la relation entre les motivations d'investissement, l'adhérence à un comportement normatif et les dimensions psychologiques que l'on appelle aussi biais comportementaux dans la littérature.

Nos résultats révèlent des associations significatives entre le mimétisme social et chaque logique d'investissement, à savoir, investir pour un rendement financier, investir pour un gain en capital et investir pour se protéger contre l'inflation.

Les résultats montrent également une association entre le comportement normatif de la mesure du risque « Loan-to-value » avec les logiques d'investir pour un rendement financier, d'investir pour un gain en capital et d'investir pour se protéger contre l'inflation. Par conséquent, les résultats suggèrent que les investisseurs utilisent le comportement normatif qui est l'adhésion à une mesure du risque lorsqu'ils investissent pour ces trois logiques conceptualisées tout en faisant preuve d'un comportement de mimétisme social.

Sur la base des résultats de l'étude, la recherche propose un cadre conceptuel de rationalité limitée "NDP", où la dimension normative (N), la dimension psychologique (P) et les traits démographiques des investisseurs (D) sont des composants et des moteurs de la rationalité de l'investissement et, finalement, la motivation et l'intention individuelle d'investir dans un bien immobilier.

Cette recherche donne du crédit au concept de rationalité limitée qui postule que les investisseurs ne sont pas irrationnels mais plutôt cognitivement limités dans leur rationalité au sens néo-classique du terme.

Mots-clés : cadre NDP, investissement immobilier, immobilier, rationalité limitée, biais comportementaux

# Summary

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# Abstract

Following the worst financial crisis since the Great Depression, real estate property investment has gained increased attention from both private and institutional economic actors. Rising real estate property prices, increasing household debt, and the low borrowing interest rate constitutes factors that threaten Europe with the risk of another real estate crisis;

The study is conducted in the form of a survey administered to 150 full-time employed respondents from the UK. The dependent variables of this study are the measured motivation and rationales for investing in a property. The explanatory variables are operationalized using two main categories; normative behavior and the decision-making's psychological dimensions. Investor profiles such as demographics are conceptualized as the control variables in the model.

Ordered logistic regression allows us to see in a sample the relationship between rationales for investing, rationales of investing for financial return, investing for a capital gain, investing for hedging against inflation, normative behavior, and psychological dimensions that are referred to as behavioral biases in the literature

Our results reveal significant associations between social herding and each rationale for investing, namely, investing for financial return, investing for capital gain, and investing for hedging against inflation.

The results also show an association between the risk metric Loan-to-value measurement's normative behavior with the rationales of investing for financial return, investing for a capital gain, and investing for hedging against inflation. Therefore, the results suggest that the investors use the normative behavior that is the adherence to a risk metric measurement when investing for these three conceptualized rationales while at the same time exhibiting social herding.

Based on the study findings, the research proposes a “NDP” bounded rationality conceptual framework, where Normative dimension (N), psychological dimension (P) and investors demographic traits (D) are components and drivers of rational for investing and ultimately the motivation and individual intention to investing a property.

This research gives credence to the concept of bounded rationality, which posits that the investors do not come out to be irrational but rather cognitively bounded and would rather work with ordinary heuristic frameworks rather than a comprehensive ordinary equilibrium model.

Keywords: NDP framework, property investment, real estate, bounded rationality, behavioral biases

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# CHAPTER 1

## Introduction

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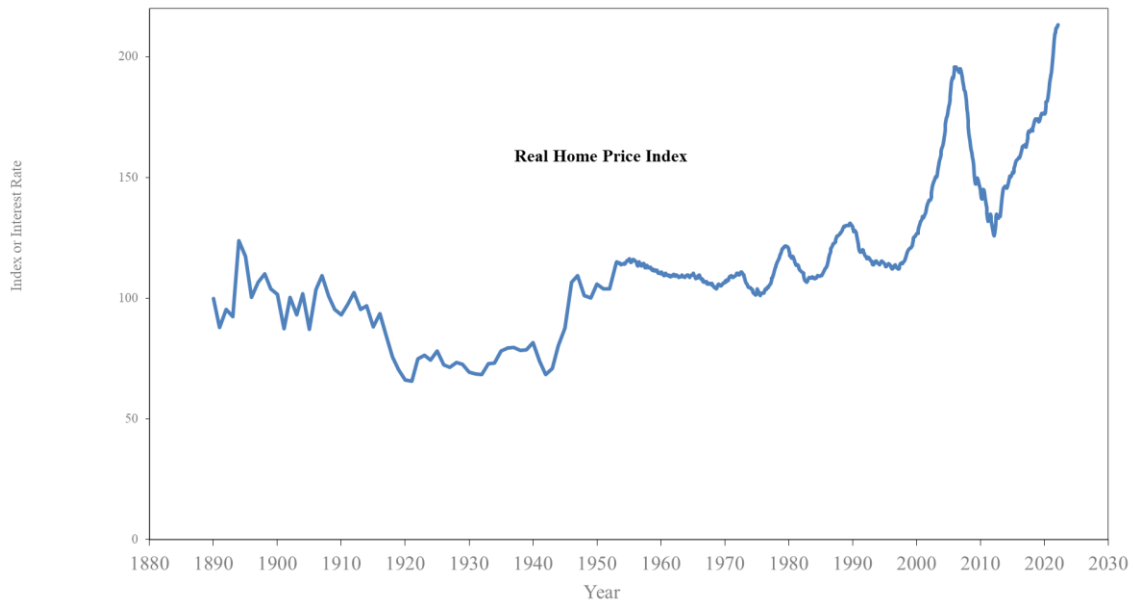
### **The cyclical nature of the real estate market**

While the 2008 real estate bubble's souvenir is still fresh for many of us, it is still easy to forget that real estate bubbles are recurrent and assume that real estate price has a substantial long-term uptrend. It is completely ignoring that real estate markets are cyclical and that the trend can change, and as a result, the price can suddenly decline. This sudden drop in real estate price is commonly referred to as a real estate bubble burst.

To better understand real estate bubbles Case & Shiller (2004) developed an index of home price based on the sales price of existing standard houses to measure the worth of housing as a investment across time in constant measures over 116 years while taking inflation into account to highlight the frequency of real estate market bubbles.

Figure 1 - U.S. Real Home Price index

adapted from Robert J. Shiller, *Irrational Exuberance*, 3rd. Edition, Princeton University Press, 2015 adapted to include data up to 2021.



The way it works is that if an American house price going back to 1890 is sold at \$100,000, an equivalent house would have sold for \$66,000 (66 on the index scale) in 1920 and \$199,000 (199 on the index scale) in 2006.

While the real estate price rise and drop can be attributed to external factors such as world wars or the Great Depression, denying its cyclical nature by justifying an external event, the real estate bubble in our recent history can still be traced back fifty years.

Hence, by using this index, it is possible to identify a 1970's real estate price boom above the 120 level, followed by a return to a level consistent since the late 1950s at 110.

A similar boom can be identified in the 1980's that goes beyond the 125 level, followed by a return to the 110 level in the early 1990's.

It is, therefore, possible to identify two real estate price booms and the subsequent burst in the last decades.

The latest real estate bubble burst can be witnessed by a boom period from late 1990 to 2006 followed by a return to the 140 level. This "return to prior level" translates into the real-life negative equity for many households and the subsequent financial distress.

As of December 2020, the Shiller index is at 240, making many people believe that it is just a matter of time before a correction occurs.

When we are writing those lines, we expect a decrease due to the Covid 19 situation in 2020. However, no real data is available yet, and the future remains uncertain as to the possible bubble bursts in the years to come.

In fact, following the worst financial crisis since the Great Depression, real estate property investment has gained increased attention from both private and institutional economic actors. Rising real estate property prices, increasing household debt, and the low borrowing interest rate constitutes factors that threaten Europe with the risk of another real estate crisis; Alarmingly, the European Systemic Risk Board (ESRB), identified in 2019 significant systemic risks in several European countries.

The risk is real; in 2004, Case & Shiller warned of the dangers of a real estate bubble in which fundamental domestic economic variables such as revenue, demographics, long-term interest rates, and construction costs could not justify the rise in property prices (Wong, Ho, & Tsang, 2015). In 2008, the prediction became a reality, with property declining sharply and leaving many investors and homebuyers in financial distress.

Before going deeper into the discussion, it is essential to define a real estate bubble: Blanchard & Watson (1982) define a housing bubble as the portion of the house prices which exceeds the houses' fundamental values. Thus, we can expect the absence of a bubble when the present values of future rental incomes equal the houses' current prices.

From there, the housing bubbles can be divided in two main categories: the rational bubble and the irrational bubble:

## **The rational real estate bubble**

The rational explanation for the housing bubble phenomenon is that when home values include a part of overvaluation generated by rational anticipated future rental earnings and interest income, the property bubble occurs.

A dominant rationalist framework is generally used with a substantial body of knowledge based on theories that reflect rational, normative models and treats investor behavior as highly structured and formalized (Gallimore et al., 2000).

This rationalist framework originates from traditional finance theories that attempt to explain how individual investors reach their investment decisions after considering the assets' return and risk characteristics.

These theories assume that all individuals are risk-averse, rational, normal, and pursue the maximization of their utility. Markowitz (1952), developed a normative base with the Modern Portfolio Theory (MPT), a Markowitz-efficient portfolio is one in which diversification can reduce risk while maintaining a certain return expectation.

The Markowitz Efficient Frontier is a collection of all strategies that will provide the highest expected return for any degree of risk. Portfolio optimization theory considers this idea of an

efficient frontier to be essential. French (2003) points out that these concepts of portfolio efficiency were crucial in creating the capital asset pricing model.

In fact, the modern portfolio theory (MPT) and capital asset pricing model (CAPM) are one of the most critical contributions in finance and are arguably the most widely used (Ross, Westerfield, Jordan, & Biktimirov, 2008). Conceptual approaches for rational decision-making are considered to be progressed. Decision theory has evolved into a comprehensive topic since the end of WWII, with a clear distinction between gambling (where gamblers stake their resources and speculate foolishly) and entrepreneurship (where owners analyze the risks associated and the anticipated benefits) (Hargitay & Yu, 1993).

Investment is furthermore defined as the use of resources rationally to achieve maximum rewards in the future. In fact, according to current portfolio theory, there will always be optimal ownership of investment assets over a defined investment period, and there is an optimum profit for the investment at whatever level of risk.

However, as pointed out by (French N. , 2001), Markowitz's theory is flawed by the use of ex-post data to construct his portfolios, and that future returns will not necessarily match past performance. The Rationalist paradigm is further challenged in the last two decades by Behavioralist studies demonstrating a departure from a rational assumption.

The rational explanation for the bubble has been controversial, with many critics pointing to its rejection of any systematic aberrations in asset prices from their underlying values. These reasonable assumptions have been extensively questioned in recent years by the empirical discovery that stock values are more volatile than fundamentals or potential return (Lux 1995). Excess volatility thesis data is compelling, according to West (1988), and it cannot be effectively explained by existing models of expected returns or rational bubbles. The discovery of excessive volatility alludes to inherent dynamic factors in the speculative market unrelated to fundamental considerations, implying that "non-standard models" may be required.

In a seminal publication, Case, 1988 sought to explain the Boston property price boom using economic fundamentals data. The author's approach incorporated demand-side and supply-side factors like population increase, employment rates, interest rates, building costs, earnings growth, and income taxes.

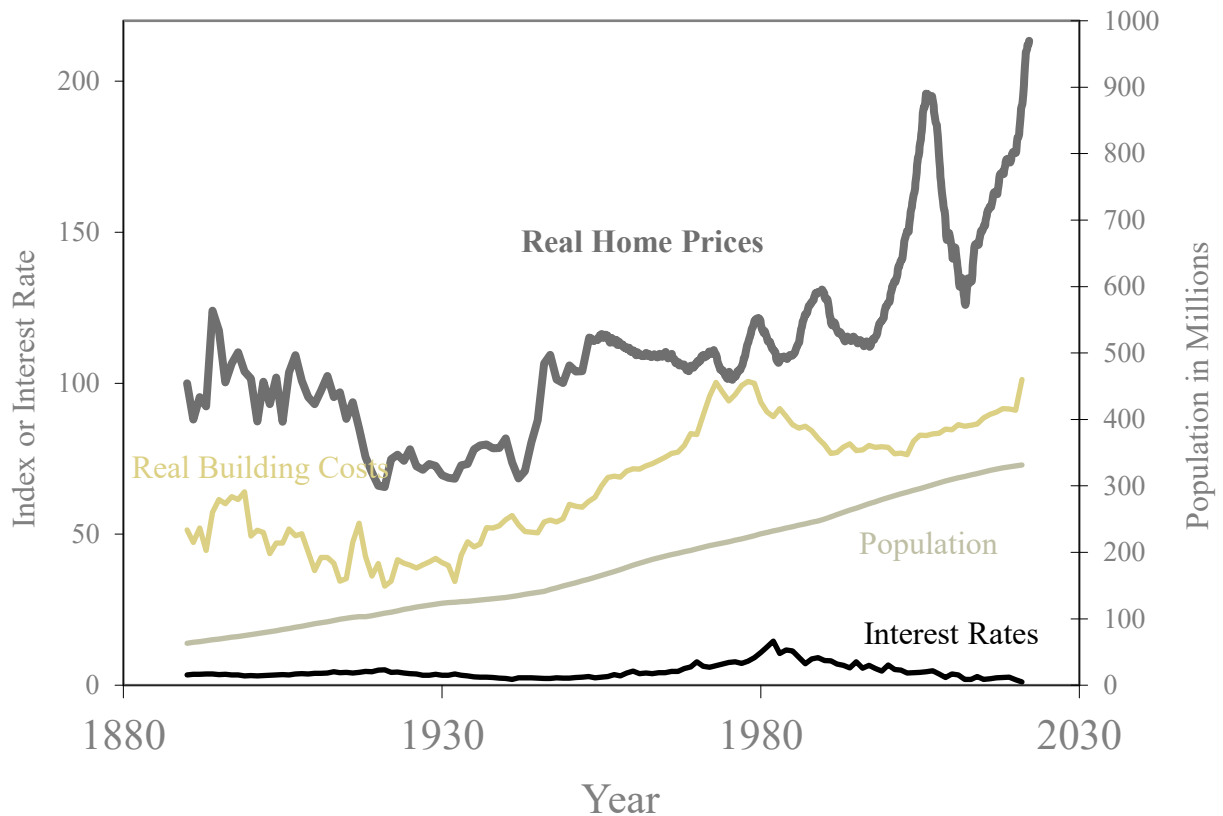
Nonetheless, the developed model could not account for more than a fraction of the observed increase in Boston housing prices, showing that expectations mostly drive the bubble.

This is furthermore illustrated on figure 2, in which, according to Shiller (2015) home prices in the United States cannot be explained solely in terms of building costs, population, or interest rates. The pattern of change from year to year in home prices bears no consistent relation with any of these factors. Especially none of these can explain the "rocket-taking off" effect starting around 1998.

The figure shows U.S. Home Prices, Building Costs, Population, and Interest Rates, 1890–2014 with real (inflation-corrected) home price index 1890 = 100, for the United States, constructed by the author from various existing indices and raw data on home prices; real (inflation corrected) building cost index, 1979 = 100, constructed by the author from two published construction cost indices U.S. population in millions, from the U.S. Census long-term interest.

Figure 2 - Figure U.S. Home Price and Related data

Source: Robert J. Shiller, *Irrational Exuberance*, 3rd. Edition, Princeton University Press, 2015 adapted to include data up to 2021. <http://www.econ.yale.edu/~shiller/data.htm>



The author suggests that the market is locked into an expectation spiral, where the buyer factor expectation of capital gains into their willingness to pay, actually creating the anticipated gains. The resulting price "bubbles" burst when asset values get far enough from the level justified by their fundamental yields or when prices ultimately bump into budget constraints.

### **The Irrational real estate bubbles**

With the classical approach failing to address the rapid rise in property prices in the United States with long-term financial indicators, Nobel Laureate Shiller (2005) proposes that the

problem affects all actors in the real estate market; respondents and policymakers alike presumed that home values would continue to rise indeterminately. Compared to the 1990s technological boom, "irrational exuberance" sprouted and spread like a social epidemic. What is fascinating here is the use by Shiller of the word "contagion," which usually belongs to the epidemiology field of research.

The real estate bubble has generally been seen as a significant factor conferring to the current financial and economic crises. As the Nobel Prize Shiller posits, irrational thinking can be the fundamental reason that negatively affects the market, suggesting that it is the irrational thinking that causes bubble formation (Case & Shiller, 1988).

The authors go on to say that such "exuberance" and the arising speculative bubble went up as a result of feedback mechanisms: "House prices rose, exacerbating public to believe prices would rise even more, as well as increasing the frequency of contagion of the same presumption, so individuals rushed to purchase homes, causing a further increase in costs."

This so-called irrational exuberance was occurring in major metropolitan areas in the United States and many other regions of the world, particularly in Europe, particularly in the United Kingdom, Spain, and Ireland.

This is supported by Connor, Flavin, and O'Kelly (2010) research, which identifies "irrational exuberance" and accompanying stock prices bubbles as among the "deep common" elements behind the current credit crisis in the US and Ireland. Shiller cautioned us about the intricate distributional repercussions of property investment bubbles in a 1988 report, stating that proprietors benefit at the cost of non-owners at all income levels. The author concluded with the critical need for further research on the property market's puzzling nature.

In order to unravel the so-called puzzling nature of the real estate market, we first start with figures and facts on the importance of the property market. Then, secondly, we explore the specificity of the property market, and finally, we discuss the specificity of real estate as an asset class.

## **The characteristics of the real estate market**

### **The size of the property market:**

Real estate is viewed as one of the world's most important asset classes, with an estimated global property market value totaling \$136,047 billion at the end of 2016 (Hoesli 2018) and a residential real estate market estimated to be two times bigger than the commercial real estate market (Geltner, Miller, Clayton and Eichholtz 2007). Besides, to realize the importance of the property market, it is essential to consider the competing asset classes and compare the size of the property market with the size of the share and bonds asset classes market. In fact, property commercial real estate represents 46% of the wealth invested in the three asset classes, stressing the fact that commercial real estate is an important asset class.

To gain more insight into property investors' rationality, it is necessary to explore property investment characteristics and their specifics:

### **The specificity of the property market:**

A summary of the property market has been provided by Hoesli (2018). The author identifies and describes the specifics of the property market with six specific main dimensions:

These dimensions are the absence of a centralized market, the reduced transparency, the imbalance of the market, the strong presence of the state, the high transaction cost, and the low volume of transactions.

Likewise, eight dimensions are specific to real estate properties, namely: the fixed location, the indestructibility of the land, the heterogeneity of the properties, the key importance of the location, the fact that properties are considered as a long-term investment, the illiquidity of the asset, the common recourse to a high level of borrowing and finally the fact that housing is viewed as a fundamental need.

Additionally, the investors can be categorized into seven categories: the private investors, the institutional investors, sovereign funds, the listed and non-listed funds, the corporate investor, and the government.

Lastly, we can invest in property in four different ways: direct investment, non-direct investment through a listed fund, non-direct investment through a non-listed fund, and investment in a derivative product.

### **Real estate as an asset class:**

Real estate is classified as an alternative asset class, contrasting with the traditional asset class: stocks, bonds, and cash. The alternative asset class encompasses mainly real estate commodities, hedge funds, and private equity.

What makes real estate different is that it is a tangible asset that, like commodities, it is considered as an asset class that offers protection against inflation, contrasting with an asset that only exists in the form of a financial instrument such as derivatives.

But what distinguishes it even more, is its so-called "downward stiffness" (Shiller 1988). According to Shiller's theory, home values are fixed downward in the absence of a severe economic recession. When paired with upward fluctuation, the author claims that this inflexibility has resulted in a ramping impact in some boomtowns. With complicated redistributive repercussions, property owners benefit at the expense of non-owners at all income levels. In the same vein, Tsai and Chen (2009) demonstrate house price downward rigidity in the UK housing market. Their findings indicate that the volatilities between housing prices moving up and down are asymmetric.

## **State of the art**

### **A behavioralist framework**

A more recent stream of research to the dominant rationalist framework focuses on the psychological aspect of real estate decision-making and describes how the real estate investment decision.

Furthermore, behavioral economics has emerged as one of the most significant conceptual advances in the social sciences during the last 40 years. (Barberis 2018).

Confirming the importance of psychology in finance, the highly regarded CFA institute integrated the study of behavioral biases into the curriculum.

Specifically, in the real estate market, the seminal work of Case 1986, Case and Shiller (1989), and Shiller (2005) suggest that the irrational behavior of house market participants causes

house price inefficiency. This hypothesis is further confirmed by Dieci and Westerhoff's (2012) development of a speculative housing market model in which expectations about future housing prices influence houses' demand.

The model dynamics are governed by a two-dimensional nonlinear mapping, which may demonstrate unpredictable boom and bust home values cycles, as seen in many real-world markets. The study also indicates that market participants' adoption of heuristics is linked to bubbles and that real estate agents' anticipation can lead to bubbles and collapses.

A concept present in the literature is identified as the herding behavior in the real estate market, also referred to as mimetics or momentum; The thought rationalizing the herd behavior implying that not everybody can be wrong. Shiller (2005) argues that herd behavior is a source of mispricing and speculative bubbles. In the same vein, Lux (1995) develops a formal model to explain bubbles by linking momentum and herd Behavior.

It is important to mention that, according to the literature, herding is not necessarily irrational. We can distinguish between an information cascade and group behavior in this relation: People consciously ignore their knowledge in an information cascade instead of just replicating the decisions of those before them, whereas herd behavior is performed without people necessarily disregarding their personal details. Thus, it is not irrational when market participants abandon private information in favor of the herd when they believe that the market possesses superior collective information. The key idea here is whether the private information is being ignored or not. As Seiler (2010) explains, interpersonal learning can occur in a herd but not in a knowledge cascade because personal knowledge is disregarded in preference of the group's public choices.

An additional psychological dimension relevant to the field of property investment is the loss aversion and disposition effect. Considered as the most influential concept in the behavioralist paradigm, the prospect theory postulates that investors make investment decisions grounded on their instincts and prior investment experience rather than logical analysis with objective motives (Kahneman & Tversky, 1979).

In a paper aimed at financial advisors Kahneman & Riepe (1998), further expand by introducing common behavioral biases such as biases of judgment, errors of preference, false reference point, and the bias related to the well-documented difference between losses (which people feel acutely) and opportunity costs (failures to gain). This hypothesis is furthermore explored by Genesove and Mayer (2001) and confirms the presence of the "disposition effect" in the real estate markets. These findings are further supported by Engelhardt (2003), implying that loss aversion affects property investors and therefore is an important housing market phenomenon.

A further psychological dimension relevant to the property market is the over-optimism: Mainly characterized by high house prices that persist due to an enthusiastic market which is kept high as appraisers do not decrease the prices during a bubble period. The over-optimism can affect all participants of the market: Property investors, valuers, property agents, and even the media. Farlow (2004b) expands on this issue, arguing that the media favor optimists over pessimists, oblivious to the potentially detrimental repercussions of over-optimistic knowledge dissemination for regular investors.

Over-optimism can also affect the real estate agencies that make a living from the property sales commission. In a study of real estate agencies in France, Violand and Simon (2007) discovered that 830 out of 1070 violated the law. Infringements such as false advertising, the

omission of displayed commission prices, and real estate agents working without a directive from homeowners are only a few instances.

Another concept that belongs to the behavioralist framework is bounded rationality. Coined by Simon (1955), this concept casts doubt on the traditional economic theory that postulates an "economic man." The "economic man" is by essence a rational being, possessing knowledge of a relevant aspect of his environment, having a stable and well-organized system of preference as well as computational capabilities that enable him to decide the course of action that is at the highest attainable point of his preference scale.

According to Simon's seminal research, bounded rationality is "intendedly reasonable, but only to a limited extent." After recognizing such cognitive limits, Simon replaced the traditional notion of maximizing behavior with that of "satisficing" behavior. Simon uses the term satisficing to describe behavior that would result in favorable outcomes, not particularly in accordance with the perfect rationality model's maximum but further than the bare minimum (Bruin et al., 2001).

The concept of bounded rationality is further explored by the research of Glaeser (2013), which posits that the investors do not come out to be irrational but rather cognitively bounded and would rather work with ordinary heuristic frameworks rather than a comprehensive ordinary equilibrium model.

### **A knowledge gap**

In real estate, decision-making can be associated by many factors that can be normative, rational, social, and psychological.

These psychological dimensions depart from normative models, which the tenant of the rationalist paradigm considers as an ideal rational standard. These are seen as cognitive schemas that are away from normative frameworks and suggest poor judgments because they depart from a normative and rational standard.

Thus, in property investment decision-making, non-adherence to a normative framework is viewed as a sub-optimal decision and referred to as behavioral biases.

While both rationalist and behavioralist paradigms are explored in the literature, they appear to be studied independently, implying the absence of investigation of the connection between the two models.

This thesis aims to explore the relationship between one side of the rationalist paradigm which includes normative and investment rationales, and, on the other side, the behavioralist paradigm psychological dimensions in real estate investment decision making that are the herding behavior and the disposition effect. We believe that when connected, the two paradigms, rationalist and behavioralist, will gain significance.

## **The research question**

The present research explores decision-making in real estate investment in the light of the main hypothesized drivers found in the prior literature, namely investment rationales, normative behaviors, and psychological factors, to explore the property investors' decision-making.

Hence, this study's key research question is how a behavioralist approach can add value to our understanding of the property market? In other words, how can the behavioralist paradigm complete the classical framework, and how can the behavioralist paradigm enrich the classical vision to ultimately help us better understand the real estate markets?

In particular, this dissertation examines how property investment motivations for investment are associated with the investor's normative dimensions of decision-making and behavioral biases.

## **Relevance of the research**

From the standpoint of a private investor, this research provides a new perspective on real estate investment decision-making. This is the first research on the relation between the rationalist and behavioralist perspectives in real estate decision-making that we are aware of.

This investigation enhances our understanding of how psychological and normative dimensions are interrelated and sheds new light on how psychological dimensions are associated with rationale and normative behavior.

Understanding the link between the motivation for investing, the normative and psychological dimensions will help the private investor avoid making biased decisions and risking financial distress through negative equity. This understanding of the real estate market is particularly relevant for individual homebuyers.

The present research explores the association between the psychological and normative dimensions. The findings make an essential contribution to the field of real estate decision-making by using the normative behavior from the literature on investment professionals as a benchmark to test the adherence to normative behavior and the rationality of the private investor.

Additionally, this research proposes a bounded rationality conceptual framework, where normative dimension, psychological dimension, and investor's demographic traits are components and drivers of the rationale for investing and, ultimately, the motivation and individual intention to invest in a property.

In this thesis, we finally advocate that behavioral economics used in conjunction with the rational framework in real estate investment can be used to generate theoretical insights, make predictions of field phenomena, and ultimately suggest better policy in an attempt to mitigate the conditions that contribute to the build-up of real estate bubbles and market vulnerabilities more efficiently. This understanding of the real estate market is particularly relevant for REIT investors, economists, policy makers, and academics.

## Principal results

The study is conducted in the form of a survey administered to 150 full-time employed respondents from the UK. The dependent variables of this study are the measured motivation and rationales for investing in a property. The explanatory variables are operationalized using two main categories; normative behavior and the decision-making's psychological dimensions. Investor profiles such as demographics are conceptualized as the control variables in the model.

Ordered logistic regression allows us to see in a sample the relationship between rationales for investing, rationales of investing for financial return, investing for a capital gain, investing for hedging against inflation, normative behavior, and psychological dimensions that are referred to as behavioral biases in the literature; Disposition effect is tested as hypothesized by Kahneman & Tversky (1979) and by putting the survey respondents in a hypothetical situation, where they had purchased an investment property several years ago to measure their regret aversion (Seiler 2008).

As hypothesized by Shiller (2005), the psychological dimension of herding is measured both in its rational and irrational form. Additionally, we see which control variable is impacting the model from the social and demographic data collected from the survey respondents.

Our results reveal significant associations between social herding and each rationale for investing, namely, investing for financial return, investing for capital gain, and investing for hedging against inflation.

The results also show an association between the risk metric Loan-to-value measurement's normative behavior with the rationales of investing for financial return, investing for a capital gain, and investing for hedging against inflation. Therefore, the results suggest that the investors use the normative behavior that is the adherence to a risk metric measurement when investing for these three conceptualized rationales while at the same time exhibiting social herding.

This fundamental result suggests that social herding is present at the level of the private investor, even if they display an adherence to normative behavior. This result implies that social herding can be present in the sophisticated investor that exhibits an adherence to normative behavior. In the difference of informational herding, alarmingly, social herding is considered in the literature to be a behavioral bias and a source of mispricing and speculative bubbles.

Moreover, the level of education is negatively influencing the investment rationale of investing to hedge against inflation, which makes sense as, at the time of the survey, the inflation level was close to nil, implying that the more educated respondents don't invest in this rationale when the inflation is low.

Finally, age negatively influences the rationales for both investing for financial return and investing for capital gain rationales.

## **Structure of the thesis**

The overall structure of the study takes the form of nine chapters:

Chapter 1: Introduction introduces the topic of the thesis

Chapter 2: Literature review and hypothesis development is essentially composed of a Literature of the extant literature regarding real estate investment decision making.

The literature review identified thirty-three studies pertinent to the current research and revealed the following identified concepts:

- (A) Real estate investment decision making
- (B) Normative investor behavior
- (C) Investor Rationales and Motivation
- (D) Demographic and social factors
- (E) Psychological factors

The Literature review shows the above concepts' relationships to real estate investment decision making and demonstrates the importance of normative investor behavior, investor rationales, demographic and social factors, and psychological factors. This chapter also reveals limitations and gaps within the existing literature. Lastly, we review the type of data used, the methodology applied, and whether the research concerns professional or private investors.

The hypotheses tested in this research are developed in the relevant concept sub-section

Chapter 3: Methodology outlines the objectives of the research and the proposed methodology.

In this section, each concept is operationalized through the variables that are measured in a questionnaire. This chapter also presents the positivist and hypothetic-deductive epistemological posture of the present investigation.

Chapter 4: Discussion, Implications, Limitations and Contributions; provides observations and thoughts on the findings of the research. The chapter asserts that both psychological and normative dimensions are present in real estate decision-making and ultimately influence the rationale for investing.

Lastly, recommendations are made for future research opportunities based on the research findings and previous studies' results.

Chapter 5: Conclusion discusses the significant theoretical findings of the present research. The chapter calls for making the findings on the psychological dimension of real investment available to the private real estate investor to help them make optimal decisions.

# CHAPTER 2

## Literature Review and Hypothesis Development

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In finance, the field of investment decision-making is well-analyzed. However, in the context of real estate, it is somewhat restricted. According to Gallimore et al. (2000), the literature on investor decision-making conduct in property investment is limited and poorly connected.

This chapter provides an overview of our contextual research on real estate investment decision-making and the findings of a literature review of the existing literature on the subject. The study methodology used for the literature review is described in [Appendix A](#), with details of the protocol, training methods, synthesis steps, practical screening methods, search process, quality appraisal considerations, and data extraction techniques.

The literature review provides an analysis of the limits of the thirty-three research articles used in the study and theoretical and empirical inputs. The current study builds on the existing literature's investigation constraints to provide valuable insights into real estate investing decision-making.

The literature review in this study illustrates the significant impact that conventional investor behavior, investment reasoning, demographic and socioeconomic aspects, and psychological factors have on real estate investment decision-making.

However, we believe that current studies are limited in their investigation of the real estate investors' heuristics.

According to Roberts & Henneberry (2007), research into the property investment decision-making procedure has traditionally focused on the rules and strategies that decision-makers could employ instead of investigating the actuality of investors' market behavior. Apart from that, according to Farragher and California (2008), further research is needed to understand better the investing professional's reluctance to adopt more complex procedures and evaluate whether employing sophisticated approaches results in higher returns and/or lower risk.

Regarding private investors, **Error! Reference source not found.** (2008) suggest that future studies investigate whether or not psychological biases have a real impact on real estate markets.

Additionally, Tan (2018) proposes to further investigate the differences in the bounded rational behaviors between individual and institutional real estate investors.

All the articles in the literature review analyze concept that influences the decision-making in real estate investments; Two main limitations emerged from the literature review:

Firstly, from the perspective of the private investor, it appears that the two main research streams encountered in this literature review, namely Rationalist and Behavioralist, are studied independently. The aim of this thesis is to explore the relationship between on one side the rationalist paradigm that includes normative and investment rationales and, on the other side, the behavioralist paradigm psychological dimensions in real estate investment decision making. We believe that when connected, the two dimensions will gain significance.

Secondly, an additional shortcoming is that while the literature on adherence to normative process focuses on investment professionals, little investigation is made on private investors adherence to normative behavior.

To conclude this section, the present research focuses on decision-making in real estate investment and some of its important drivers found in the prior literature, namely normative behaviors, investment rationales, psychological and demographic factors at the level of the investment professional and at the level of the private investor.

## 2.1. Literature concept matrix on real estate investment decision making

A literature review of the published articles and literature on real estate investment decision-making was conducted. (See Figure 3)

Figure 3 - Literature concept matrix of real estate investment decision-making

Authors	Concepts						Relationships Impact Researched Concept Variable include both Positive and Negative impact	Methodology	Data type
	(A) Real estate investment decision making	(B) Normative investor-behavior	(C) Investment Rationales	(D) Demographic and social factors	(E) Psychological factors	Level* (P or C)			
Adair, A. S., Berry, J. N., & McGreal, W. S. (1994)	✓	✓			✓	C	(B) normative investor behavior & (E) Psychological factors impact*(A) Real estate investment decision making	30 interviews of managers of the major investment institutions in the City of London using questionnaire	Primary
Almenberg, J., & Karapetyan, A. (2009)	✓				✓	P	(E) Psychological factors impact*(A) Real estate investment decision making	100 individuals surveyed in stockholm train station 3 minutes with reward of 4 USD lottery ticket and then empirical test on past data on 3,000 apartment sales from Swedish association of real estate agents	Primary and secondary
Bispinck, H. (2012)	✓	✓				C	(B) normative investor behavior impact*(A) Real estate investment decision making	16 interviews on real estate investors from London based investment companie	Primary
Blasi (2018)	✓	✓	✓		✓	C	(E) Psychological factors impact*(A) Real estate investment decision making	29 semi-structured investors professional interview from Paris	Primary
Campbell, J. Y. (2006)	✓	✓		✓	✓	P	(B) Normative investor behavior & (E) Psychological factors impact & (D) Demographic and social factors impact*(A) Real estate investment decision making	A swedish dataset property and financial asst, income, wealth, demographic from 1983 to 1999. unique opportunity to tudy an entire country population.	Secondary
Case, K. E., & Shiller, R. J. (1988)	✓	✓			✓	P	(B) Normative investor behavior & (E) Psychological factors impact*(A) Real estate investment decision making	Controlled experiment on 486 MBA students	Primary
de Bruin, A., Flint-Hartle, S., & others. (2001)	✓	✓	✓	✓	✓	P	(B) Normative investor behavior & (C) Investment Rationales & (D) Demographic and social factors & (E) Psychological factors impact*(A) Real estate investment decision making	967 property investors surveyed and 35 in depth interviews	Primary
Engelhardt, G. V. (2003)	✓				✓	P	(E) Psychological factors impact*(A) Real estate investment decision making	data from 1985-1996 on household characteristics, mobility, and wealth from the National Longitudinal Survey of Youth (NLSY79) matched with house price data from 149 metropolitan areas	Secondary
Farlow, A. (2004)	✓				✓	P	(E) Psychological factors impact*(A) Real estate investment decision making	Review paper	Secondary
Farragher, E., & California, A. (2008)	✓	✓	✓			C	(B) normative investor behavior & (C) Investment Rationales & (E) Individual project Risk impact*(A) Real estate investment decision making	188 chief investment officer surveyed using questionnaire	Primary
Farragher, E., & Kleiman, R. (1996)	✓	✓	✓			C	(B) normative investor behavior & (C) Investment Rationales impact*(A) Real estate investment decision making	125 Chief investment officer surveyed using questionnaire	Primary
French, N. (2001)	✓	✓			✓	C	(B) normative investor behavior impact & (E) Psychological factors impact*(A) Real estate investment decision making	150 property investors surveyed using questionnaire	Primary
French, N., & French, S. (1997)	✓	✓			✓	C	(B) normative investor behavior impact & (E) Psychological factors impact*(A) Real estate investment decision making	Review paper	Secondary
Gallimore, P., Hansz, J. A., & Gray, A. (2000)	✓	✓	✓		✓	C	(B) normative investor behavior & (C) Investment Rationales & (E) Psychological factors impact*(A) Real estate investment decision making	From 200 identified property investment company, a random sample of 80 was chosen from which 13 companies agreed to be interviewed.	Primary

Figure 3 (continued) - Literature concept matrix of real estate investment decision making

Authors	Concepts						Relationships Impact Researched Concept Variable include both Positive and Negative impact	Methodology	Data type
	(A) Real estate investment decision making	(B) Normative investor behavior	(C) Investment Rationales	(D) Demographic and social factors	(E) Psychological factors	Level* (P or C)			
Genesove, D., & Mayer, C. (2001)	√				√	P	(E) Psychological factors impact*(A) Real estate investment decision making	individual property listing in the boston condominium market at weekly interval 1990-1997 supplemented with property characteristics, tax, sale and mortgage informations	Secondary
Gibler, K., & Nelson, S. (2003)	√				√	P	(D) Demographic and social factors & (E) Psychological factors impact*(A) Real estate investment decision making	Review paper	Secondary
Hartigay S and Yu S-M (1993)	√	√	√			C	(B) normative investor behavior & (C) Investment Rationales impact & (F) Perception of risk and return impact *(A) Real estate investment decision making	Review paper	Secondary
Koklic, M. K., Vida, I., & others. (2009).	√			√	√	P	(E) Psychological factors impact & (D) Demographic and social factors impact*(A) Real estate investment decision making	6 semi-structued in-depth interview 3 recent buyers and 3 potential buyer.	Primary
Levy, D., Murphy, L., & Lee, C. K. (2008)	√	√		√	√	P	(E) Psychological factors impact & (D) Demographic and social factors impact*(A) Real estate investment decision making	In-depth interviews with 9 experienced estate agents and the adult decision makers from 18 families.	Primary
Munro, M., & Smith, S. J. (2008)	√	√			√	P	(B) normative investor behavior & (E) Psychological factors impact*(A) Real estate investment decision making	90 qualitative interviews from a single compact city.	Primary
Northcraft, G. B., & Neale, M. A. (1987)	√				√	P and C	(E) Psychological factors impact*(A) Real estate investment decision making	experiment on 48 undergraduate business school students, T21 volunteer real estate agents	Primary
Obeidat, M. S., Qasim, T., & Khanfar, A. (2018)	√	√	√			P	(B) normative investor behavior & (C) Investment Rationales impact*(A) Real estate investment decision making	Data in this study were collected in Jordan from five real estate investors and 305 customers.	Primary
Parker, D. (2010)	√	√				C	(B) normative investor behavior impact*(A) Real estate investment decision making	review paper	Secondary
Roberts, C., & Henneberry, J. (2007)	√	√	√		√	C	(B) normative investor behavior & & (E) Psychological factors impact*(A) Real estate investment decision making	64 semi-structured interviews administred to investment managers	Primary
Sah, V. (2009)	√	√		√		P and C	(B) normative investor behavior & (D) Demographic and social factors impact*(A) Real estate investment decision making	Controlled experiment on 20 real estate expert and 20 students	Primary
Samuelson, W., & Zeckhauser, R. (1988)	√	√			√	P and C	(E) Psychological factors impact (B) normative investor behavior*(A) Real estate investment decision making	Controlled experiments using questionnaire on faculty members	Primary
Sean, S. L., & Hong, T. T. (2014).	√		√	√		P	(C) Investment Rationales *(A) Real estate investment decision making	200 self administred questionnaire	Primary
Seiler, M. J., & Seiler, V. L. (2010)	√			√	√	P	(E) Psychological factors impact & (D) Demographic and social factors*(A) Real estate investment decision making	Controlled experiment on 345 MBA students	Primary
Seiler, M. J., & Walden, E. (2016)	√				√	P	(E) Psychological factors impact*(A) Real estate investment decision making	Controlled experiment using fMRI on 20 home mortgage borrowers	Primary
Seiler, M. J., Lane, M. A., & Harrison, D. M. (2014).	√			√	√	P and C	(E) Psychological factors impact & (D) Demographic and social factors impact*(A) Real estate investment decision making	Controlled experiment on a sample reflecting the overall population of U.S. homeowners of 1,365 individuals	Primary
Seiler, M., Seiler, V., Traub, S., & Harrison, D. (2008)	√			√	√	P	(E) Psychological factors impact & (D) Demographic and social factors impact*(A) Real estate investment decision making	Controlled experiment on 345 MBA students	Primary
Tan, C., Entrek, L., & Butler, D. (2018)	√				√	P	(E) Psychological factors impact*(A) Real estate investment decision making	99 individual real estate investors surveyed using questionnaire	Primary
Wang, K., Zhou, Y., Chan, S. H., Chau, K. W., & others. (2000)	√				√	C	(E) Psychological factors impact*(A) Real estate investment decision making	review paper with pre-sale system being used as an information-gathering tool by developers	Secondary
Garboden (2021)	√			√	√	P	(E) Psychological factors impact*(A) Real estate investment decision making	in-depth interviews with 93 investors s in the US combined with participant observation of 22 real estate investment association meetings (REIAs)	Primary

\*P = Private investors and C = Corporate investors

Following Webster and (Watson 2002), The concept matrix is used to classify the articles according to the emerging concepts. The rows represent the articles, while concepts and relationships are reflected in the columns.

The first column presents the author and the year of the publication of the article, this literature review identified a total of thirty-four studies pertinent to the current research. The following columns represent the identified concepts. Our research revealed that the following concepts associated with the real estate investment topic:

- (A) The process of real estate investment decision-making.
- (B) The adherence to normative investor behavior.
- (C) The rationales and motives behind a real estate investment.
- (D) Demographic and social factors associated with a real estate investment.
- (E) The psychological factors associated with a real estate investment.

The studies identified appear to be performed on two different main fields of studies; from the perspective of the private investor and the investment professional's perspective. Referred as (P) for the private investor and (C) from the professional on the seventh column of the matrix.

### **The Perspective of the Professional Investor (C):**

What we define as an investment professional in this research is a professional that is influencing the real estate investment decision-making at the firm level; this can be an individual working for a Real estate investment trust (REIT), an institutional investor, an unregulated investment fund, a developer, or a small property investment company.

This decision-maker is usually called the Chief investment officer, principal, or portfolio manager. For simplification's sake in this research, we will refer to this role as an investment professional (IP). The IP's goals are to select investment real estate properties based on parameters, such as their marginal contribution to the generation of a mean-variance efficient multi-asset portfolio while keeping in mind the investor's goals and capital rationing limits (French, 2001).

While a decision-maker may think that the required optimum levels of exposure are dictated by an asset allocation framework, circumstances outside the parameters of the mathematical parameter may/will impact the final decision. As a result, it is critical to comprehend the investor's practice from the perspective of the investment professional.

### **The Perspective of the Private Investor (P):**

Private persons are also investing in real estate; it can be for renting it or for their own dwelling; nevertheless, it is still considered a very significant investment. In fact, the purchase of a

property is considered the most significant transaction individuals will ever make, and the cognitive attachment when houses become homes is unavoidable (Salzman & Zwinkels, 2013). Even if a private person has invested in a property without renting it to generate revenues, the use of this house is perceived as an investment, thus considering capital profits rather than rental earnings as an incentive for investing in a house, regardless of whether they own only one home or many homes at one time (Case & Shiller, 1988).

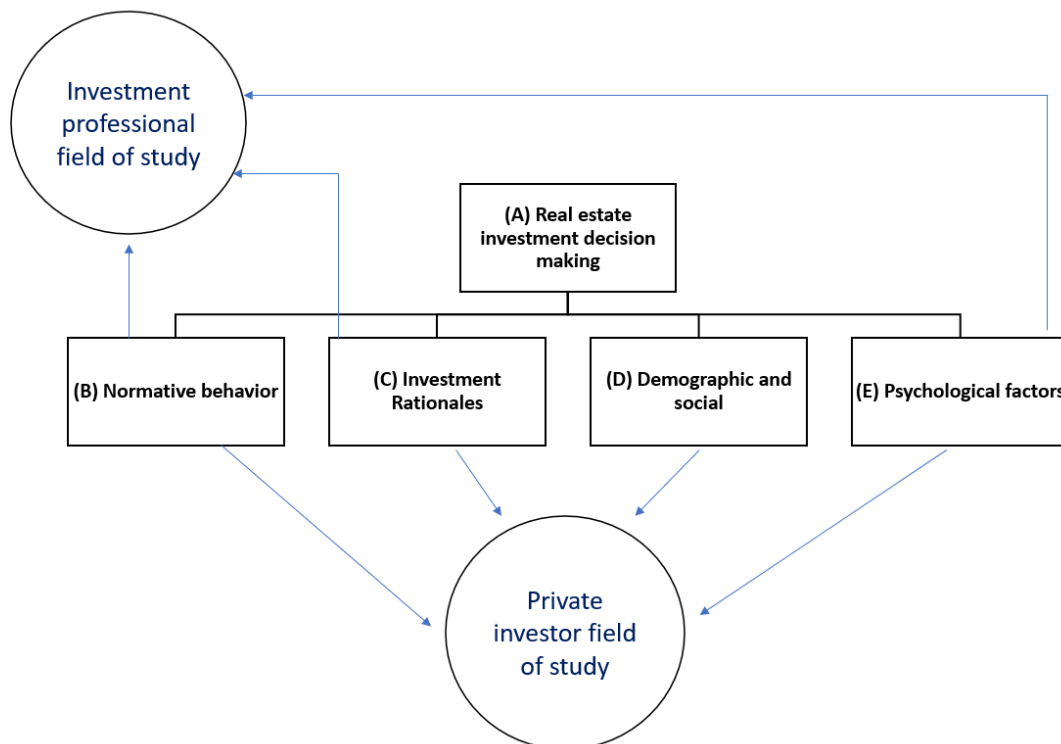
**Methodology and data type:**

Finally, the matrix presents the type of data being used (Primary or/and Secondary data source), as well as the methodology applied, such as controlled experiment, survey, and interviews.

A nomological network illustrates the concepts reviewed and our representation of the theoretical relationships proposed or found in the extant literature. (Figure 4)

In this figure, we can see that the concepts of adherence to a normative behavior, investment rationale, social and demographic factors, and psychological factor are linked in the literature to real estate investment making. This association appears in both professional and private investor field of study except for the social and demographic factor that occurs only in the private investor field of study.

Figure 4 - Nomological network of the systematic literature review concepts & theoretical relationships



## **2.2. Real estate investment decision making**

Gallimore et al. (2000) have challenged the focus of research on property decision making that has been concerned principally with normative models that appear in textbooks and descriptions of the decision process, such as the published influential textbook from Hargitay and Yu (1993) on property investment.

More recently, a literature has emerged that offers contradictory findings on the adherence to a normative model and instead challenges the dominant rationalist approaches. This literature is based on the seminal work of Tversky & Kahneman (1974) and the prospect theory according to which investors make investment decisions based on their intuitions and previous investment experience rather than rational analysis with objective reason.

Our review of the extant literature confirms that the recently published studies are focusing on the behavioralist the topic has seen strong interest in recent years, with over 72 percent (twenty-three studies) of the literature researched being conducted on these psychological dimensions, from which over 87 percent (twenty reviews) since 2000.

To investigate the distinction between social and informational herding in the perspective of the decision to strategically default on one's mortgage in the real estate context, Seiler and Walden (2016) used functional magnetic resonance imaging (fMRI). The model analyzes brain function during corporate strategy mortgage default decision-making to examine the distinction between social and informational herding in the perspective of strategic default on one's mortgage in the real estate context.

In contrast to earlier research, the current study claims that the psychological dimension of real estate investment decision-making is connected to investment rationale and normative conduct. This study aims to show how the psychological dimension is influenced by investment reasoning and normative conduct. This research also takes into consideration demographic and social factors as the control variables.

In the next section, we present the principal concept that emerged from the literature review: These concepts are the investment rationales, the adherence to a normative framework, the psychological factor, and the demographic and social factors.

## **2.3 Investment Rationales and the property investor goals**

### **2.3.1 Investment Professional: Investment rationales and goals**

The surge in real estate investment has been extraordinary, according to Adair et al. (1994), and it has been occurring since the 1970s especially at the level of the institutional investors. Following this real estate investment thesis, a multi-asset portfolio that includes property as a component can provide capital and income protection while also generating reasonably excellent returns in an uncertain economic situation. Institutional investors employ a conservative investment strategy, striving for the highest possible return while limiting the risk associated with their investments.

Specifically, Hargitay and Yu (1993) stress the importance of investment objectives, the strategic repercussions of investment decisions, and how they influence managerial and operational decisions.

In setting the investment objective, the institutional property investor objectives are constructed in terms of desired or tolerable minimum return rate, an acceptable risk, in terms of income, capital value, development requirements; and finally in preferences for liquidity.

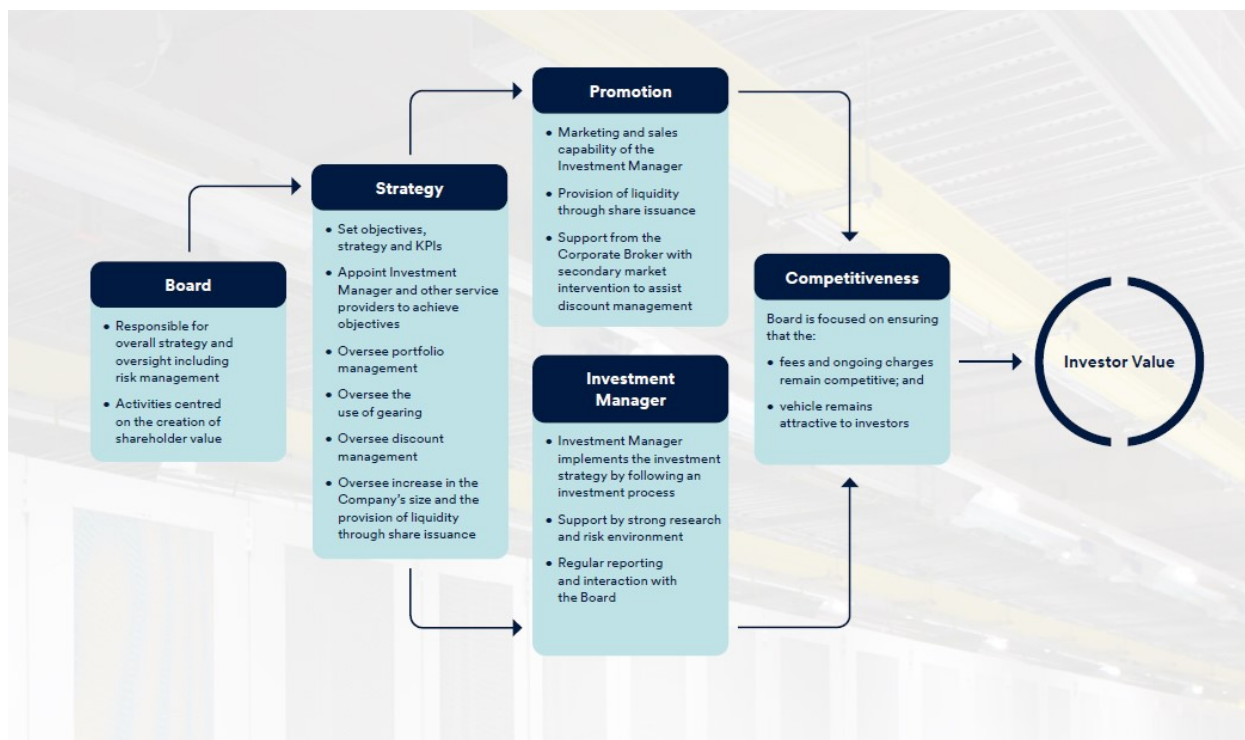
Farragher & Kleiman (1996), consider setting strategy with return/risk objectives as the primordial step in decision making. In the same vein, Roberts & Henneberry (2007), point out that the crucial phase of the decision-making is when the decision-maker is setting out what the fund (or the investor) is trying to achieve.

According to research findings, objectives must be quantified by a assertion regarding the availability of funds for an investment and an acceptable time frame for attaining those objectives.

Farragher & California (2008), emphasize the importance of the investment rationale in the decision-making process and found in a survey of 188 chief investment officers that 79% of the respondents have a quantified minimum required rate of return objective, while a smaller percentage, 44%, has a quantified maximum acceptable risk standard.

Investment management companies typically have robust process that includes sequentially, valuation and risk management. The Figure 5 below depicts a typical process.

Figure 5 - Investment management process published financial report from Schroders 2021



### **2.3.2 Private investor: Investment rationales and goals**

It is claimed by Hutchison (1994) that property investment, at the level of the individual investor, can result in either passive income through rental income or property value growth over time, depending on the circumstances.

In a similar vein, de Bruin et al. (2001) revealed in a research study of 967 property investors that net profit and wealth accumulation are the most significant aspects of the property investment decision. With 43 percent of respondents ranking it as their first and 17 percent as their second most important reason for engaging in rental investment.

These findings support Case and Shiller's (1988) premise that property buyers prioritize capital gains rather than rental income as a motive for investing in a property, irrespective of whether they own only one home or a large number of units at the same time.

The researchers also examined the justifications for investing in real estate in a low inflation environment. According to the literature, a property is a better inflation hedge than other types of assets (Fama & Schwert, 1977, Hutchison, 1994)). They found that despite knowing that low inflation was entrenched, over 60% of survey participants would still have invested in property. The researchers also stated that those with less education were more constrained by their cognitive capacity to comprehend that there could be an inversion of the historical pattern in high capital appreciation from the property.

Thirty-five investors were interviewed by de Bruin et al. (2001) in an attempt to better understand the private investor behavior in the context of property investment. The findings support a bounded rationality concept in which participants are conscious that low inflation has reduced the opportunity for capital gains but still think their investment decision was sound. Though they did not demonstrate that they are maximizing their gains, they did demonstrate an overriding comfort level with their investment, which the researcher interprets as satisficing conduct. Here, we see a clear opposition between the neo-classical concept of utility maximization and the bounded rationality concept of satisficing.

Sean & Hong (2014), had similar findings when they surveyed 200 real estate investors in Malaysia when it comes to assessing the investment rationales and found that investing in a property for an attractive financial return rationale has a higher factor loading followed by investing in a property as an instrument to hedge against inflation.

Locational, financial, and Structural factors proved to be significant rationales for investing. Interestingly the results also show that investors do not consider the neighborhood of the property they purchase as long as they do not intend to stay in these properties.

In order to finance the properties, mortgages are largely used; mortgage data from Freddie Mac suggest that since 1999, in the United States, mortgages for purchases of second homes have doubled as a percent of all mortgages. (Case & Shiller, 2003).

Additionally, according to the National Association of Realtors, 36% of all homes purchased in 2004 were second homes: investment properties or vacation homes.

### **2.3.3 The investment rationales of the private investor: the Endogenous variable measured in this research**

Based on these researches on the rationales for real estate investment, the present research seeks to capture the investment motivation for inflation hedging, the motivation of real estate investment for financial return, and finally, the investment motivation for capital gain. The rationales for investing are in essence, what motivates the investor to allocate resources to the investment property. This research is performed at the level of private investors and explores the possible association with normative and psychological dimensions.

### **2.4. A normative framework for real estate investment decision-making.**

French & French (1997) state that a significant portion of real estate research in the United Kingdom and the United States is devoted to quantitative asset allocation techniques, which recommend an optimal allocation between asset categories based on retroactive performance and risk evaluations.

Therefore, the focus of research on property decision-making has been concerned principally with normative models that appear in the textbook. Building on this rational paradigm, an essential body of knowledge prospered based on theories that reflect rational, normative models and treats investor behavior as highly structured and formalized. (Gallimore, Hansz, & Gray, 2000).

However, the normative framework based on a rationalist paradigm suffers from some serious shortcomings.

The most significant reasons for this are a lack of reliable data sources due to the asset's structure, a lack of proprietary information associated with real estate, and a lack of liquidity associated with real estate assets (Sah, 2009).

Consequently, little use is made of the sophisticated quantitative risk assessment tools by real estate professionals that derive from the rationalist paradigm.

Institutional investors' continued aversion to sophisticated quantitative risk methodologies such as sensitivity analysis, scenario analysis, and Monte Carlo simulation is supported by the findings of two studies conducted by Farragher and Kleiman (1996) and again ten years later by Farragher and Kleiman (2008).

According to the research, practitioners will instead rely on straightforward risk assessment tools such as debt coverage ratios, default ratios, and profitability analysis to assess risk.

In addition to traditional methods such as the cash-on-cash rate of return, discounted cash flow (DCF), and net present value (NPV) rather than using the more sophisticated methodology for the asset valuation.

#### **2.4.1. The adherence to a sequential process for real estate decision-making.**

The adherence to a sequential model can be considered a normative behavior followed by the investors. This is seen as the textbook approach to decision-making.

Under the assumption that the activity of investment itself is rational, Hargitay & Yu (1993) propose five steps, sequential normative model:

1. Definition of objectives and specific goals.
2. Search for a set of alternative investment projects which promise to achieve the objectives and goals set.
3. Evaluate, compare, and rank the alternatives in terms of the quantified expectations of risk and return.
4. Choose the most satisfactory alternative.
5. At a later date, evaluate the consequences of the decisions taken earlier, draw conclusions, and revise goals and criteria.

Similarly, Farragher & Kleiman (2008) propose a sequential process using the nine steps below

1. Setting a strategy;
2. Establishing risk/return goals;
3. Searching for investment opportunities;
4. Forecasting expected returns;
5. Evaluating forecast returns;
6. Assessing and adjusting for risk;
7. Decision making;
8. Implementing accepted proposals;
9. Auditing operating performance.

This proposition of a sequential process is based on a survey with data collected from 188 chief investment officers from both private and institutional investors.

Building on the previous research on the establishment of a normative process **Error! Reference source not found.**Roberts & Henneberry (2007), describe how the rationalist literature conceptualizes the investment decision as a multi-level procedure derived from the analysis and combination of the various normative models proposed in the rationalist and normative body of knowledge (such as Farragher & Kleiman (1996) and Hargitay & Yu (1993), research to reach a ten steps model as per below:

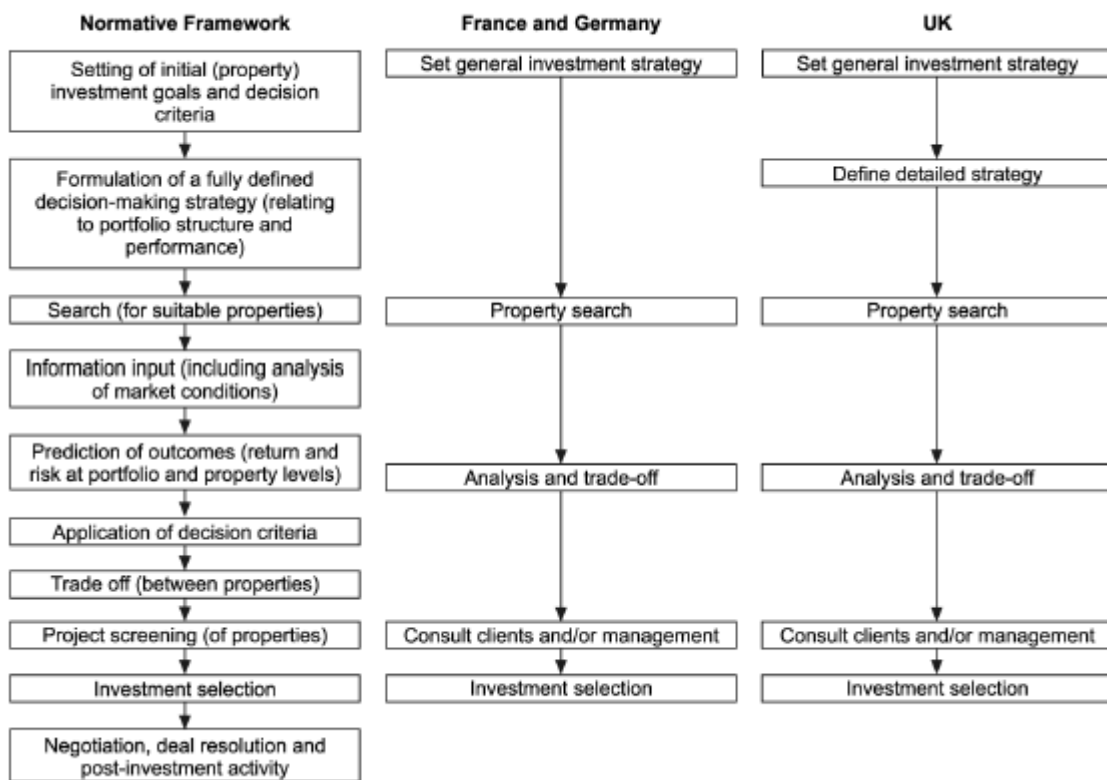
1. The setting of initial (property) investment goals and decision criteria.
2. Formulation of a fully defined decision-making strategy (relating to portfolio structure and performance).
3. Search (for suitable properties).
4. Information input (including analysis of market conditions).
5. Prediction of outcomes (return and risk at portfolio and property levels).
6. Application of decision criteria.
7. Trade-off (between properties).
8. Project screening (of properties).
9. Investment selection.
10. Negotiation, deal resolution, and post-investment activity.

An additional set of 64 semi-structured surveys with investment companies in France, Germany, and the United Kingdom are used to validate this sequence experimentally. They discovered that the tactics taken by investors in the United Kingdom, France, and Germany all

follow a predictable path, with investors formulating a plan, searching for properties, monitoring market circumstances, and purchasing properties that suit that strategy, respectively. The investigation into the recommended decision-making procedures of investment managers revealed a significant adjustment to the ten-stage normative model derived from the literature, which was previously used.

When applied to investment decision-making in France and Germany, Figure 6 shows how the ten-stage concept can be reduced to five steps in the investment decision-making framework and six phases when applied to investment decision-making in the United Kingdom.

Figure 6 - Sequential decision-making model adapted from Roberts & Henneberry (2007)



The research also revealed that real estate investment firms do less strategic planning than other businesses, reflecting their entrepreneurial orientation, which highly values gut instinct and experience over rigorous quantitative analysis and analysis.

The adherence to a sequential normative process can also be seen at the level of the private investor: In a research based on 18 interviews of private Levy, Murphy, & Lee, (2008), found that the decision-maker typically described a five-stage decision-making process when

purchasing a family home that is: problem recognition, product specification, information search and inspection of the property and contact with an estate agent.

We conclude this section by hypothesizing an association between the adherence to a sequential decision-making process and the rationales for investing: the investment motivation for inflation hedging, the motivation of real estate investment for financial return, and the investment motivation for capital gain. (Treated in section 2.3)

#### **2.4.2. The adherence to a valuation practice: The net present value (NPV) and Discounted cash flow (DCF)**

While the extant literature confirms that investment professionals use practical decision model criteria such as the net present value, the discounted cash flow, and the IRR, it is unclear whether the private investor uses these methods.

Therefore, it is essential to understand how individuals measure the concept of risk and returns at their level.

Additionally, the extant literature suggests that valuation is an essential dimension of decision-making. In fact, valuation appears to be one of the most researched topics in the real estate field; this is confirmed by Harrison (2008) and Hoesli (2016).

According to Hargitay and Yu (1993), most investment appraisal and decision models are cash flow dependent and employ the DCF valuation approach to account for the time value of money to account for inflation.

Based on the fundamental cash flow, which is one of the most essential features of a property, the discounted cash flow approach is used to value the property. It is possible to assess the current value of a property by valuing the cash flow over time and assuming that the market value is equal to the net present value (NPV) of future gains using this technique. As shown in the following formula, the net present value (NPV) formula: (Geltner, Miller, Clayton, & Eichholtz, 2001).

$$NPV(i, N) = \sum_{t=0}^N \frac{R_t}{(1+i)^t}$$

In this formula,  $R_t$  = net cash flows,  $i$  = discount rate, and  $t$  = time. Both the acquisition price and the asset selling price of the property must be incorporated into the cash flow.

The main characteristic of the NPV model is the incorporation of a discount rate, the required rate of return. This rate of return makes the NPV equal to zero and is referred to as the Internal rate of return (IRR).

Generalized net present value (NPV): If the DCF has a positive net present value (NPV), it can be deemed a profitable investment.

Using this criterion, when the investors consider different properties, it is the property with the highest NPV that is preferred.

This is evidenced by the result of successive surveys from Farragher & Kleiman (1996) and ten years after Farragher & Kleiman (2008), showing the use of these cash flow-based models when it comes to evaluating real estate investment real estate practitioners will

Relying also on similar practical techniques such as Cash on cash rate of return, Discounted cash flow (DCF), and net present value (NPV).

See below example of a publicly available valuation report using the NPV methodology to determine the fair value of a building in the Czech Republic from the valuation specialist JLL

Figure 7 - NPV methodology applied to real estate publicly available published JLL report

Cash Flows calculated		All figures shown are annuities									
monthly		1.N.2018	1.N.2019	1.N.2020	1.N.2021	1.N.2022	1.N.2023	1.N.2024	1.N.2025	1.N.2026	1.N.2027
		31.III.2019	31.III.2020	31.III.2021	31.III.2022	31.III.2023	31.III.2024	31.III.2025	31.III.2026	31.III.2027	31.III.2028
YEAR		1	2	3	4	5	6	7	8	9	10
TOTAL INCOME		12,329,054	10,568,888	21,486,974	22,048,635	21,568,550	21,046,797	17,983,655	20,885,478	23,671,742	24,121,595
<b>EXPENSES</b> % on income											
Service Charge Shortfall	0.00%	1,633,920	816,960	0	0	0	0	0	0	0	0
Vacancy rate	0.00%	0	0	0	0	0	0	0	0	0	0
Unpaid Rent	0.00%	0	0	0	0	0	0	0	0	0	0
Other Non-Recoverable Costs	1.00%	246,581	211,378	214,870	220,486	215,686	210,468	179,837	208,855	236,717	241,215
Other Costs (e.g. ground rent)	Amount	0	0	0	0	0	0	0	0	0	0
<b>TOTAL EXPENSES</b> 15.25%		<b>1,880,501</b>	<b>1,028,338</b>	<b>214,870</b>	<b>220,486</b>	<b>215,686</b>	<b>210,468</b>	<b>179,837</b>	<b>208,855</b>	<b>236,717</b>	<b>241,215</b>
NET OPERATING INCOME		10,448,553	9,540,550	21,272,104	21,828,149	21,352,865	20,836,329	17,803,819	20,676,623	23,435,025	23,880,290
RUNNING YIELD (After CAPEX)		4.35%	3.97%	8.85%	9.08%	8.88%	8.67%	7.41%	8.60%	9.75%	9.93%
DISCOUNT RATE		8.75%									
NPV NET INCOME		10,067,840	8,317,326	17,305,279	16,335,176	14,699,802	13,173,106	10,414,235	11,022,259	11,529,149	10,802,945
EXIT YIELD		8.00%									
CAPEX + Fit-out + Letting fees (nominal)		Amount	892,629	1,340,575	0	0	1,521,426	62,758	0	0	0
CAPEX + Fit-out + Letting fees (discounted)		Amount	859,213	1,186,565	0	0	1,047,041	39,715	0	0	0
FAIR VALUE as at (after capex)		240,400,000 CZK		20,049 / per sqm							

In this study, we are testing whether the private investor also exhibits the use of practical valuation techniques, the NPV, and DCF, and show some familiarity with these essential valuation concepts.

We conclude this section by hypothesizing an association between the use of practical valuation techniques and the rationales for investing: the investment motivation for inflation hedging, the motivation of real estate investment for financial return, and the investment motivation for capital gain. (Treated in section 2.3)

### **2.4.3. The adherence to risk assessment practice: The Loan-to-value ratio (LTV) of the property investments**

Referred as the “the lynchpin in the decision-making process” by French (2001), risk assessment and, more generally, the perception of risk play a critical role in the real estate investment decision-making.

Further supporting the idea of the critical role of risk assessment, Hargitay & Yu (1993) defined it as the most challenging aspect of investment decision-making to quantify and measure the effects of risk and uncertainty.

The definition of investment risk and the components of investment risk, on the other hand, are still up for debate. Per Hargitay and Yu (1993), it is now well recognized that the absence of certainty and unpredictability are identical and that unpredictability is often associated with variation. Therefore variance and standard deviation appear to be the most relevant risk indicators in this context. The real estate investment risk can be partitioned into two elements:

1 - The systematic risk: This is the market-related risk, a macroeconomic dimension of risk and relevant at the level of the government. As an example, the European Systemic Risk Board (ESRB), mentioned in our introduction, produce alerts and recommendation pertaining to this risk and what policy should be adopted by the European member state to mitigate this risk that

2- The unsystematic risk: This is a specific risk that affects only a particular investment. While the real estate investor has no control over the systematic risk, a limited control on the investor's exposure to this type of risk can be exerted.

As previously stated, the risk is integrally tied to the concept of return since it expresses the potential variability of future rates of return concerning their mean or projected values.

In fact, in the real world, the investor makes the selection after reviewing a range of projects that promise to meet a required financial return and an acceptable risk level (Gallimore, Hansz, & Gray, 2000).

One of the shortcomings of the asset allocation model, according to French & French (1997), is that it involves a study of risk/return patterns for each asset class across time and relies on past data to guide asset allocations in the prospective.

Adair et al. (1994) argue that distinctions in valuation methods, lease structures, taxation, and exchange rates are further deterrents for UK investors to invest in other European regions. At the same time, the overriding issue is the perceived risk of investing in markets where there is a lack of accountability, which confirms this proposition.

Moreover, sophisticated probabilistic approaches for portfolio maximization to assess risk are now available to real estate investors; nevertheless, as noted by Hargitay & Yu (1993), traditional approaches are still favored by many investors. This is furthermore demonstrated by the following example from French (2001): An asset allocation maximization framework may anticipate achieving a specific allocation to achieve optimal performance compared to investment risk. Still, the researcher argues that this may contradict business risk factors and investigation, such as competitor location (that is not included in an asset allocation maximization framework)

De Bruin et al. (2001) discovered that private investors did not conduct formal and comparative risk analyses.

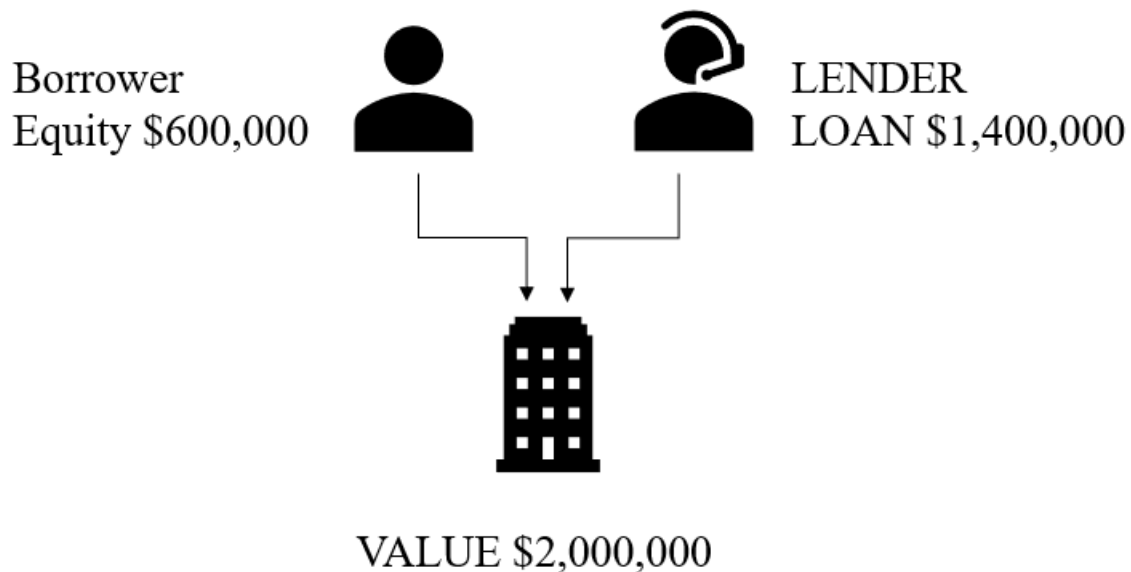
The investors did not analyze uncertainty and risk efficiently enough to reach optimum, reasonable judgments. They did not employ any risk assessment procedures or metrics. To conclude, they depend on instinctive risk evaluation of their investment, demonstrating constrained rationality (as hypothesized by Simon (1955)).

Farlow (2004), further describes a common belief among private investors “*one cannot lose in this market; houses are always a safe investment, so long as one holds out long enough.*” Calling it a myth, the author explains that this myth is happily promoted by the mortgage companies and a willing media and that, in fact, the timing matters, and that lifetime wealth can be dramatically lower when buying at a price peak.” Additionally, in the same vein, Case & Shiller (1988), suggest that the degree of risk perceived is clearly lowest in the boom, which casts doubt over the ability of the private investor to assess risk properly.

The importance of mortgages is, therefore, vital and could dramatically affect the economy. According to Federal in the United States is estimated to be \$9.14 trillion in the second quarter of 2017.

In this research, we use the Loan-to-Value ratio LTV as a proxy of the property investment risk. When investing in real estate, this common tool used to manage risk is the LTV ratio, or the Loan-to-Value ratio. It’s a very simple measure of the amount borrowed by an individual or a developer for a project divided by the value of the property or project – the lower the LTV, the lower the risk of the loan. (See figure 8)

Figure 8 - LTV Loan-to-Value in real estate source: the author



$$\text{LTV Ratio} = \text{LOAN/VALUE}$$

$$\text{LTV} = \frac{\$ 1,400,000}{\$ 2,000,000} = 70\%$$

The loan-to-value (LTV) ratio is obtained by calculating the loan amount as a percentage of the transaction price of the collateralized property. The loan-to-value (LTV) ratio is an assessment of lending risk that financial institutions and other lenders examine before approving a mortgage

In the United States and around the world, according to Bian (2018), it is most certainly the most widely used indicator for estimating financial leverage and assessing credit risk.

Conventional home loans in the United States can have a loan-to-value ratio (LTV) of up to 80 percent.

Such a range of ratios is verified by Hoesli (2017), taking the example of Switzerland, where banks usually request 20% of the asset's estimated value. And 1/3 of the revenue of the household. The 2007-2008 subprime crises illustrated how these measures could impact the entire economy.

In a 2018 study, Bian (2018) investigates the significance of underwriting and risk control approaches in mortgages and other collateralized liabilities. Property can be sold for significantly more than the amount of money owed on it. The loan amount on a 30-year mortgage with a 95 percent LTV may be 15 percent greater than the collateral value of the property at the time of origination, indicating that the mortgage is already "under water" at the time of origination. As an example of a similar approach, Min and Yang (2009) examine

historical loan-level default and recovery data from a large number of private mortgage insurance providers to investigate loss-given default. They discover that loss-given default is positively associated with the loan-to-value ratio.

In the same vein, Wong et al. (2015) argue that the implementation of loan-to-value (LTV) policy as a macroprudential tool improve financial stability. Empirical evidence suggests that LTV policy is effective in reducing the systemic risk associated with boom-and-bust cycles in property markets.

While the loan-to-value ratio is not the only risk assessment tool for a property, it appears to us as a simple and effective proxy for evaluating risk assessment practice among the private investor.

We conclude this section by hypothesizing an association between the use of risk assessment technique and the rationales for investing: the investment motivation for inflation hedging, the motivation of real estate investment for financial return, and the investment motivation for capital gain. (Treated under Investment rationale in section 2.3)

### **H1: The normative framework hypotheses: The adherence to a normative framework is associated with the investment rationales**

This led us to posit the H1 normative framework hypotheses described previously as the adherence to a sequential process, the use of a practical valuation, and the risk assessment methodology. The testable normative framework hypothesis is therefore expressed as follows:

*H1: The adherence to a normative framework is associated with the investment rationales.*

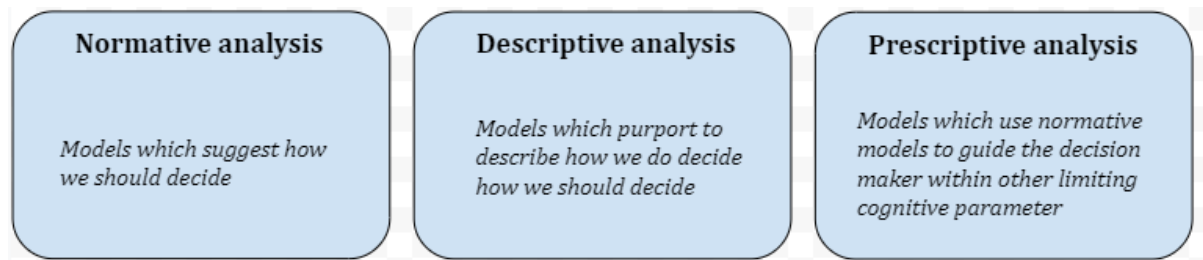
#### **2.4.4. The normative, the descriptive and the prescriptive analysis**

In the preceding section, we hypothesized that rationales and motivation for investing in real estate are associated with the normative practice. Nevertheless, the normative framework is not the only framework associated with the motivation of property investment. In fact, the psychological dimension of decision-making appears to play an essential role in property investment.

According to French and French (1997), the rationalist collective knowledge approach provides a prescriptive normative framework for real estate decision-making. However, what individuals should do in principle is frequently very different from the actual decision in a real estate investment set. This is possibly due to an inaccuracy in the original prediction model or a failure to consider the whole thought process that led to the final decision.

The author further categorizes the decision framework into three categories descriptive, normative, or prescriptive analysis:

Figure 9 - descriptive, normative, and prescriptive analysis adapted from French & French (1997).



The reality of decision-making "collapses down" the appropriate proportion, which entails using algorithms to deliver appropriate responses at a fraction of the cost in terms of cognitive effort.

This concept of using heuristics is tackled in the next section of this article and relates to the descriptive framework. A research stream that is developed by psychologists and behavioral scientists rather than neoclassical economists.

## **2.5 Psychological Dimension and the Behavioral Biases in the context of property investment**

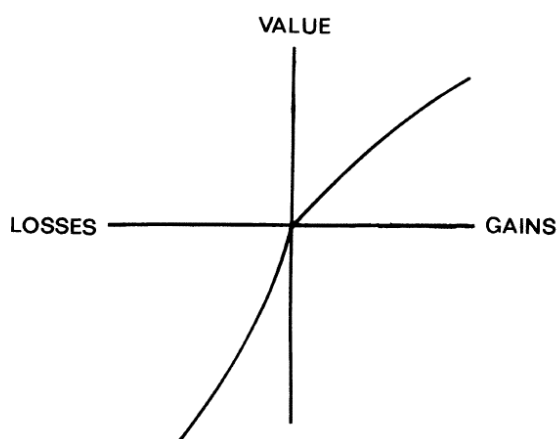
An essential contribution to the literature on the psychological dimension of investment is embodied in the prospect theory. According to Kahneman and Tversky (1979), the prospect theory posits that investors make investment decisions primarily based on their perceptions and prior investment experience rather than rational assessment. In this seminal publication, the authors present a critique of expected utility theory as a descriptive model of decision-making under risk and develop an alternative model entitled prospect theory.

In this publication, the authors describe the “certainty effect,” in which people underweight outcomes that are merely probable in comparison with outcomes that are obtained with certainty that contributes to risk aversion in choices involving sure gain and to risk seeking in choices involving sure loss. The “isolation effect” is furthermore described as a tendency to discard components that are shared by all prospects under consideration which leads to inconsistent preferences when the same choice is presented in different forms.

The authors develop an alternative theory of choice in which value is assigned to gains and losses rather than to final assets and in which probabilities are replaced by decisions weights.

To illustrate this theory, the figure 10 depicts a value function with a vertical axis representing an individual utility and on the horizontal axis the outcome that can correspond to an amount of reward, such as money, from loss on the left to gain on the right. The depicted value function is concave for gains (risk aversion) and convex for losses (risk seeking). It presents a discontinuity at the origin with a steeper slope for losses than for gains.

Figure 10 - A hypothetical value function. Source: Kahneman and Tversky (1979)



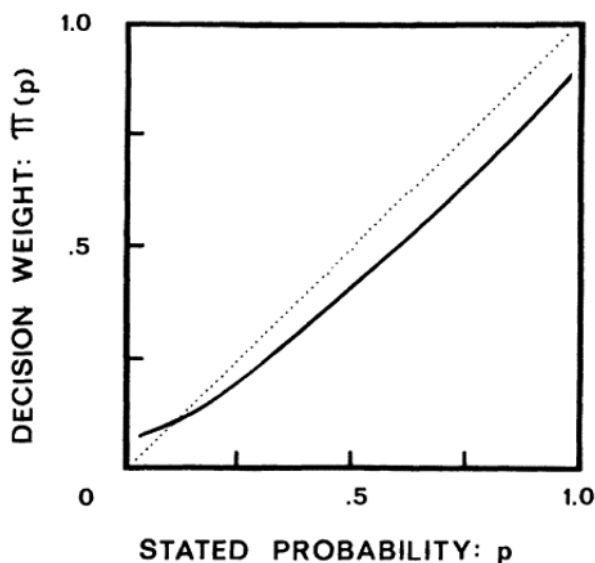
The authors further discuss the properties of the weighting function  $\pi$ , which relates decision weights to stated probabilities:  $\pi$  is defined as an increasing function of  $p$ , with  $\pi(0) = 0$  and  $\pi(1) = 1$ . That is, outcomes contingent on an impossible event are ignored,

and the scale is normalized so that  $\pi(p)$  is the ratio of the weight associated with the probability  $p$  to the weight associated with the certain event.

The Figure 11 presents a hypothetical weighting function that satisfies overweighting and subadditivity for small values of  $p$ , as well as subcertainty and subproportionality. These properties entail that  $\pi$  is relatively low in the open interval and changes abruptly near the end-points where  $\pi(0) = 0$  and  $\pi(1) = 1$ .

The sharp drops or apparent discontinuities of  $\pi$  at the endpoints are consistent with the notion that there is a limit to how small a decision weight can be attached to an event if it is given any weight at all. A similar quantum of doubt could impose an upper limit on any decision weight that is less than unity. According to the author, this quantal effect may reflect the categorical distinction between certainty and uncertainty. On the other hand, the simplification of prospects in the editing phase can lead the individual to discard events of extremely low probability and to treat events of extremely high probability as if they were certain. Because people are limited in their ability to comprehend and evaluate extreme probabilities, highly unlikely (improbable) events are either ignored or overweighted, and the difference between high probability and certainty is either neglected or exaggerated.

Figure 11 - A hypothetical weighting function. Source: Kahneman and Tversky (1979)



In order to illustrate this concept, the authors take an example in which we are compelled to play the “Russian roulette” but are given the opportunity to purchase the removal of one bullet from the loaded gun.

The authors ask us the following: “would you pay as much to reduce the number of bullets from four to three as you would to reduce the number of bullets from one to zero?” Most people feel that they would be willing to pay much more for a reduction of the probability of death from  $1/6$  to zero than for a reduction from  $4/6$  to  $3/6$ . Economic considerations would lead one to pay more in the latter case, where the value of money is presumably reduced by the considerable probability that one will not live to enjoy it.

The prospect theory, according to the authors, helps to understand why the same individual can be, at different situations, risk-avoiding or risk-seeking; Overweighting of low probabilities may contribute to the attractiveness of both insurance and gambling and explain why in real life why the same individual may buy both a lottery ticket and an insurance policy.

Kahneman & Riepe (1998), in a paper aimed at financial advisors, further expand by introducing common behavioral biases such as biases of judgment, errors of preference, false reference points, and disposition effect (difference between losses and opportunity costs).

Using a questionnaire to explain views regarding residential property as an investment, Case and Shiller (1988) found that the real estate market differed significantly from the questionnaire's predictions. Upon investigation, they observed that the real estate market varies considerably from the demands described and evaluated in the classical finance literature, with rigidly negative prices driven by prior price variations.

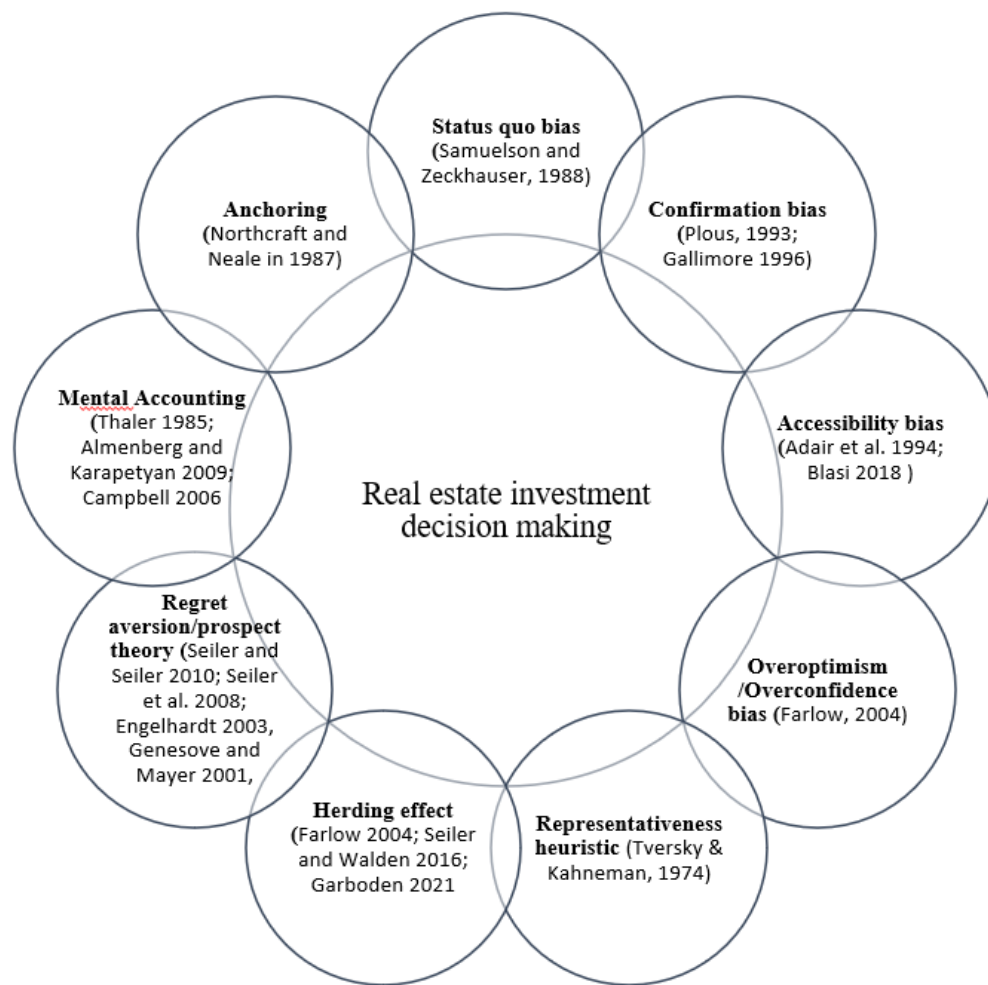
De Bruin and al. (2001) investigate the notion of limited rationality as applied to real estate investors, which represents a shift away from the neoclassical "homo economicus" concept, which demonstrates maximization and consistency based on perfect knowledge. The aim was to recognize imperfect knowledge and satisficing behavior.

In their paper, Tan et al. (2018) propose six limited rational behaviors that can be used to investigate the decision-making behavior of individual real estate investors. The bounded rational behaviors explored include (1) availability, (2) grounding, (3) the endowment impact and risk aversion, (4) herding, (5) overconfidence, and (6) status quo bias.

In their research, the authors look into a wide range of behavioral biases under limited rationality.

In the following section, we will enumerate the behavioral bias that applies to property investment that we encountered in the literature. The figure 12 depicts our findings, which are organized according to the type of bias under investigation.

Figure 12 - Behavioral bias encountered in the literature review; source: the author



A first psychological dimension we encountered in the literature is the Status quo bias; When faced with a decision regarding their investments, investors can actually do nothing at all and thus take the decision to do nothing. Samuelson and Zeckhauser, (1988), comprehensively analyze the heuristic of choosing to maintain the status quo, arguing that most real-world decisions, unlike those in textbooks, have a status quo alternative that is, doing nothing, in other words, maintaining one's current or previous decision. According to a series of decision-making tests conducted by the researchers, people appeared to be disproportionately devoted to the status quo. As evidence for their assertion, they cite the following historical example: "A strip-mining project was initiated by a west German administration, which necessitated the relocation of a tiny hamlet underlain by the lignite being mined, in accordance with the legislation."

The government agreed to relocate the hamlet to a nearby valley comparable in nature at its own expense. According to government specialists, the inhabitants chose a pattern that was "quite close to the serpentine arrangement of the ancient town a configuration that had evolved through time without any deliberate reasoning."

A second psychological dimension that we encountered is overconfidence and over-optimism bias. In research focusing on a semi-rational model, Wang et al., 2000 discovered that property investors are often overconfident when the developer's confidential information is validated, resulting in perpetual overbuilding and cycles in Asian property markets. According to Farlow (2004), the most documented psychological error is the tendency of over-optimism. This bias originates from the illusion of controls where the investor exaggerates their ability to control the situation, a situation where success in a housing price boom is attributed to an investor's wise investment decisions. But failure in a bust is blamed on someone else (the market).

A third psychological dimension that we encountered is the accessibility bias; The existence of an availability bias is described by Adair et al., (1994). They demonstrate that investors are more likely to invest in initiatives where information is easily accessible. This bias is also explored more recently by Blasi (2018) who interviewed 29 investors and sought to determine the prevalence of behavioral biases and examine how cognitive and emotional biases influence investor judgments when purchasing or selling office buildings. Similarly, the author also sought to determine whether a framing bias was present in decision-making. According to the findings of this study, the accessibility or familiarity bias influences decision-making in such a way that some investors opt to invest locally because they feel more comfortable operating in a recognized market or selling to a known buyer rather than a third party who is unknown. This "framing bias" also appeared in professional investment decisions where the information necessary for decision-making gathered from local agents is shaped by their data and their opinions about the situation. A "base-rate fallacy" manifested itself before purchase when investors evaluate the expected performance of a structure. When they make an investment decision based on the base/central scenario, they assume that market conditions will remain constant for the whole period in which they would own the building. Consequently, they are not allowing any unexpected outcomes or bizarre events to occur during their asset ownership, expecting that the market's conditions will remain unchanged.

A fourth psychological dimension that we encountered is the Confirmation bias; According to the literature, when a person searches for or recalls information, he or she is more likely to attach greater weight to material that validates pre-existing ideas. Because of this, the individual pays less attention to other pieces of information (Plous, 1993). Gallimore (1996) discovered evidence that a group of Royal Institution of Chartered Surveyors (RICS) valuers was subjected to confirmation bias while valuing a real estate property. Valuers look for recent transaction prices that support their assumptions and limit their search for comparables to those that are similar to the assumptions they are making. Valuers "fail to evaluate the information available to them properly, and as a result, they are less likely to arrive at accurate representations of market judgments" (Gallimore, 1996).

A fifth psychological dimension that we encountered is the concept of anchoring; Anchoring is a bias in assessments that causes them to be biased in favor of a starting estimate that can be for example, too low. This bias was initially demonstrated in a real estate environment by Northcraft and Neale in 1987, who claimed that listing prices anchored pricing judgments for

both students and real estate professionals. Interestingly, this research includes both amateur and experts and is made in a real-world setting as the experiment subject were touring real properties.

A sixth psychological dimension we encountered is the representativeness heuristic, Tversky and Kahneman first described the representativeness heuristic in 1974 (Tversky & Kahneman, 1974) to explain how investors utilize short datasets from the past few years as a foundation for forecasting the outcome. Thus, the affected investor relies on the immediate information that comes to the mind believing that if it can be recalled, then it must be important.

A seventh psychological dimension that we encountered is the concept of Mental Accounting Thaler (1985) coined the expression "mental accounting" to characterize a bias in one's judgment. It refers to the process through which investors categorize and divide their investments in various portfolios on the basis of a number of mental categories they have. Then they separate investment policies for each mental account in a way that each of them has a specific purpose to be attained; aiming for the maximization of returns with the minimization of risk" According to Almenberg and Karapetyan (2009), mental accounting is abundant in the real estate market, and it contributes to the unsustainable nature of capital structures. This lead according to the authors that households use sub-optimal debt structures to finance their houses. A similar line of thinking is expressed by Campbell (2006), who asserts that a significant fraction of households commit severe financial errors. The costliest mistakes people make are participating in risky asset markets, under-diversifying risky portfolios, and failing to take advantage of opportunities to refinance mortgages. Individuals who are underprivileged and have less education are more likely to make these mistakes than those who are wealthy and have a higher level of educational achievement.

While not directly attributable to the regret aversion and herding paradigms, which serve as the foundation of the current investigation and are hypothesized to be associated with real estate bubble, the above-discussed psychological bias appears to be relevant to the real estate decision-making and can enrich our understanding of real estate investment decision making. Additionally, this review of the application of real estate investment bias can be useful for private investor to avoid making biased decisions and risk of financial distress.

### **2.5.1 Herding behavior, a bias associated with the real estate bubble. Rational versus Irrational Herding**

When it comes to real estate, Farlow (2004) illustrates the momentum effect: When property price rise dramatically, which can happen for various reasonable reasons, such as a decrease in the long-term real interest rate, buyers expect the price to increase further. Consequently, investors have constructed what we can refer to as a self-fulfilling prophecy without the use of any arbitrage opportunities.

This Momentum argument is also applicable when the price is declining. Initial price declines deter some investors; demand declines, further price declines; feed momentum traders while preventing even more investors from entering the market.

Agents are extrapolating recent price spikes to draw inferences about economic fundamentals, entirely neglecting the fact that the series was produced by the market's momentum behavior. A similar bias present in real estate is the herding effect, which defines a situation in which individuals mimic others without any rational reason. A study conducted by Seiler and Walden (2016) examines this behavior in the real estate scenario to see if strategic mortgage defaulters follow a herd for social reasons or emulate others' behavior for informational benefit. The experimental design of this study is quite innovative as it uses fMRI. The authors found that when defaulters learn of the peer default behavior, they acknowledge the social component of the decision but feel freer to make their own decisions. When observing the behavior of a real estate expert, the borrowers still consider the social aspect of the decision but follow the expert who presumably possesses a greater information set. The author also found that the borrowers only significantly follow the herd when the expert advocates strategic default, not when they recommend against it. This study also shows how research in real estate can be performed in a controlled experimental setting using the latest technology available (fMRI).

It is further investigated by Garboden (2021), that considers the cultural factors that motivate amateurs to purchase real estate, an investment that the author considers with high risks and relatively poor returns.

The author used in-depth interviews with 93 investors in three heterogeneous real estate markets in the US combined with participant observation of 22 real estate investment association meetings (REIAs) and found that amateurs who decide to become investors often do so during periods when their professional identities are insecure or they perceive their retirement portfolios to be insufficient.

Interestingly, the author stated the influence of third-party actors that propagate this so-called investor culture to profit for their own benefit, which is comparable to the so-called expert role in the previously discussed Seiler and Walden (2016) publication.

The behavior of the amateur investor is therefore influenced by an external source and translate into abandoning rational thinking and instead follow blindly the external source, which is comparable to social herding. The resulting investments are therefore done regardless of whether or not those decisions are financially prudent.

It is important to note that there is a distinction between herding for social reasons (that is considered as irrational behavior and thus a behavioral bias) and herding for informational gains (That is rather viewed as a rational behavior).

Therefore, in this study, we specifically distinguish rational and irrational herding

We conclude this section by hypothesizing an association between herding behavior and the rationales for investing: the investment motivation for inflation hedging, the motivation of real

estate investment for financial return, and the investment motivation for capital gain. (Treated in section 2.3)

### **2.5.2 Regret aversion (prospect theory) is a bias associated with real estate bubble.**

Homeowners strongly prefer limiting their losses over maximizing their earnings, and they are wary of taking a slight loss while selling their property. Seiler and Seiler (2010) present a defective reference point extension of the prospect theory by examining the behavior of real estate investors after they have suffered a financial loss. According to the findings, the information was acquired as part of a study in which 345 MBA participants were asked to examine various investing circumstances. According to the findings, investors attempt to avoid the sting of regret by altering their perspective on the loss they have suffered. The result is that they are more likely to hold on to an unprofitable financial investment. As a result of their refusal to sell unprofitable assets in the short term, investors are more likely to suffer from unavoidable regret in the long run than other investors. Seiler et al. (2008) conducted considerable research into the interaction of regret aversion and inaccurate points of interest, both of which have been identified as behavioral biases in previous studies. The conclusion was obtained from original data acquired from survey respondents, who were asked to complete a questionnaire assessing their level of regret following the purchase of an investment property some years prior.

It was possible to have ex-post knowledge of the extraordinarily high valuation of the investment property. Specifically, the researchers found that "the participants expressed greater regret on average if they had consciously failed to sell at the all-time high (commission scenario) rather than if they had just been unaware of the projected advantage (omission scenario)."

This commission scenario which translates as the concept of failing to sell at the all-time and, as a result experiencing the sting of regret, is furthermore analyzed recently on a sample of 102 business school students in an experiment by Gajewski & Ohadi (2021).

Although not specific to real estate, in this research the authors tested the consequences of regret in risky decisions by revealing the outcome of a foregone lottery, then investigating whether the experience of regret and the elicited anticipation of regret can explain participants' initial choices or changes in their subsequent decisions about risky and skewed lotteries.

The results show that elicited anticipation of regret can explain people's initial choice when a distinction is made in the lotteries by skewness rather than riskiness. The anticipation of regret instead explains the changes in people's subsequent decisions when lotteries have risky attributes more than when lotteries feature skewness.

Participants with higher regret coefficients are more likely to change their decision

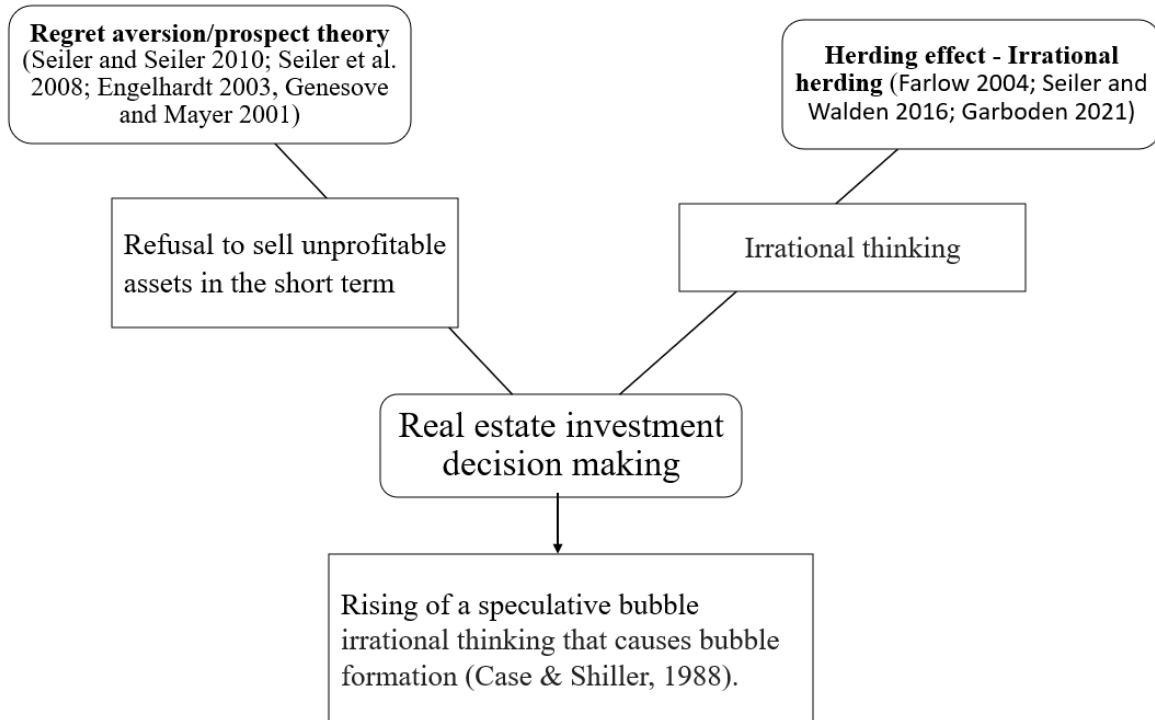
when they have no feedback than when provided with feedback about the foregone outcome.

Another factor that influences household real estate investment, according to Engelhardt (2003), is loss aversion. The researcher asserts that nominal loss aversion in the housing market significantly impacts household mobility.

Loss aversion bias was also explored by Genesove and Mayer (2001). They discovered a 'disposition effect' in the housing market, indicating that consumers despise incurring losses far more than they enjoy earning benefits. When negative equity was prevalent in the 1990s downtown Boston housing market, owners tended to set prices between 25 percent and 35 percent higher than the property's fair market value to avoid the misery of regret, as illustrated in the chart below. As a result, their properties languished on the market for significantly more extended periods than sellers who had purchased more recently and set more realistic selling prices. As a result, the loss becomes even more significant.

Given that both regret aversion and herding paradigms appear to be associated the literature associated to the real estate bubble, we posit that it is through irrational thinking that these bias impact the real estate investment making and contribute to the formation of real estate bubble, as shown in figure 13. We, therefore, decide to focus this study on these two important psychological dimensions.

Figure 13 - Herding and regret aversion are associated to real estate bubble; source: the author.



## **H2 The behavioral framework hypothesis: The behavioral framework hypothesis is associated with the investment rationales**

We conclude this section by hypothesizing an association between herding, the regret aversion behavior and the rationales for investing: the investment motivation for inflation hedging, the motivation of real estate investment for financial return, and the investment motivation for capital gain. (Treated in section 2.3)

This led us to posit the H2 behavioral framework hypotheses of herding for social reasons, the testable hypotheses are expressed as follows:

### ***H2 The behavioral framework hypothesis is associated with the investment rationales***

In other words, how can a behavioral approach add value to our understanding of the property market?

## 2.6 Demographic and social factors

According to the extant literature review, the demographic and social factors are relevant to the private investor field of study and associated with the psychological dimensions.

A first demographic and social factor we encountered is the subject experience of an individual is a trait that could play a role in the decision-making process in the context of property investment. In order to confirm this hypothesis, Sah (2009) considers the influence of experience on real estate investors' decision-making. This is done in a process-tracing supervised experiment environment by contrasting the decision-making behavior of novices (represented by students) and knowledgeable individuals (experts represented by real estate professionals). The experiment yielded mixed findings regarding the difference in conduct between beginners and experts. As a result, more research is suggested by the author to answer this question, such as further research into the influence of task complexity owing to increased property alternatives.

This led us to consider the variable experience as a control variable in our model.

A second demographic and social factor we encountered is the individual's gender. The literature suggests that the gender of an individual is a trait that could play a role in decision making process in the context of property investment. Seiler et al. (2008) show that in the setting of property investment, regret aversion is the most common and most severe emotion experienced by unmarried women.

According to Levy et al. (2008), the adult male member of the family tends to have a more significant influence than the adult female member of the family in identifying the general location and price range of a property. When it comes to resale value and prestige, the male partner is often more concerned with these factors than the female partner. According to the study's findings, men were found to be more troubled than women by the physical and structural components of property and maintenance challenges. This led us to consider the variable gender as a control variable in our model.

A third demographic and social factor we encountered is the individual's age. The literature suggests that the age of an individual is a trait that could play a role in the decision-making process in the context of property investment. Lutfi (2011), using a sample of 84 investors, found that investors' demographic characteristics positively correlate with investors' behavior and type of investment chosen. Highlighting a relationship between age and risk behavior and type of investment. Where relatively young investors, those whose ages are not older than forty years old, are more active in their investment than the old investors. These young investors want to accumulate wealth for their long future lives, and therefore they choose riskier assets with higher expected returns. On the contrary, elderly investors, especially those who are in retirement want to have more comfortable lives, and therefore they prefer to invest in assets with more stable returns. This is supported by evidence that relatively young investor put most

of their funds in capital market assets, while elderly investors put most of their money in bank accounts. Health factors may also affect this phenomenon.

We, therefore, expect a negative relationship between age and motivation for investing in property, given the property's investment are a risky investment compared to bonds or cash deposit. This led us to consider the variable age as a control variable in our model.

A fourth demographic and social factor we encountered is the individual's education. The literature suggests that the education of an individual could play a role in the decision-making process in the context of property investment. The literature suggests that individuals with less education were more confined by their cognitive capacity to realize that the past trend of sizeable financial gain from the property could be reversed (de Bruin et al. 200). In simpler words they are convinced that real estate price will never go down. This led us to consider the variable education as a control variable in our model.

A fifth demographic and social factor we encountered is the individual's income level. The literature suggests that the level of income is a factor that could play a role in the decision-making process in the context of property investment. A study conducted by Campbell (2006) revealed that poorer and less educated people are more prone to make financial mistakes than wealthy and well-educated people. This led us to consider the variable level of income as a control variable in our model.

A sixth demographic and social factor we encountered is the individual's risk profile. The literature suggests that the risk profile of an individual could play a role in the decision-making process in the context of property investment. In an experiment on 225 students, Seiler (2008) examined the relationship between risk aversion, cultural background, and regret aversion in a property investment setting for North American and Asian respondents. While loss aversion can be confused with risk aversion, we consider that the risk profile is a demographic element in real estate investment decision-making linked to investment rationale and normative behavior.

Based on the above discussions, the present research includes experience, gender, age, education, income level, and risk profile as control variables to assess whether these variables impact real estate investment decision-making.

We conclude this section by hypothesizing an association between the demographic and social factors as a control variable and the rationales for investing: the investment motivation for inflation hedging, the motivation of real estate investment for financial return, and the investment motivation for capital gain. (Treated in section 2.3)

## **2.7 Extant Literature Limitations**

The below section of the literature review highlights limitations and gaps within the extant literature.

### **2.7.1 Two research streams: Rationalist and behavioralist**

We first came across two distinct study streams, one belonging to a normative framework and the other to a descriptive paradigm. There appears to be a shortage of studies on the interaction between the rationalist and behavioralist paradigms in real estate investment.

In fact, the extant literature didn't explore the relationship between the four main concepts that emerged from our literature review: Investment rationales, adherence to normative behavior, demographic and social factor, and finally, the psychological dimension of real estate decision making.

We also identified that in most behavioral research, the presence of an apparent antagonism and rejection of the normative and "rational expectation" school of thought.

This antagonism likely originates from the rejection of neo-classical models by the behavioral literature the behavioralists. As well as a reciprocal rejection of the psychological dimensions of analysis by the neo-classical economists on the other side.

26 articles out of the 34 total articles of the literature incorporate the psychological dimensions, which show that the behavioralist paradigm is gaining ground and can be considered mainstream. Nevertheless, these articles pursue a similar goal that is to prove that the rationalist theory is failing, but as pointed out by Camerer (2004), "A list of theories failing is not an alternative theory." And so far, a parsimonious alternative theory has not emerged to deal with all of these challenges to utility maximization.

An additional shortcoming is that while the literature on adherence to the normative process focuses on investment professionals, little investigation is made on private investors' adherence to normative behavior; only two articles explore this dimension at the investor level.

The present research addresses these limitations by including both rationalist and behavioralist paradigms and assessing the adherence to normative behavior at the investor level.

This research constitutes a value add to the body of knowledge by understanding how the judgment will be biased to ultimately generate prescriptions for real estate investment decision-making that protects us from our behavioral biases.

## 2.7.2 Investment professional and normative behavior

The extant literature review shows that 40 percent of the studies on professional investors demonstrate that normative processes are not being followed for more intuitive decision-making.

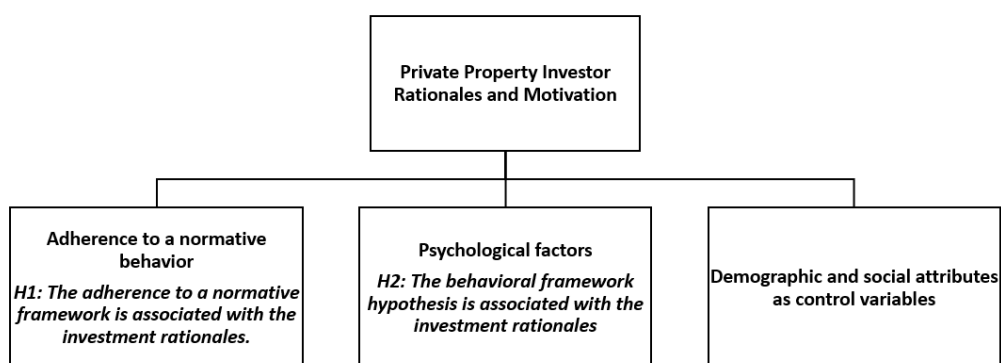
Investment professionals, especially those working for the institutional funds, are required to show a significant amount of transparency, including how a decision is made, and justify that each decision is performed according to the goal set by the fund.

In fact, a deviation is recognized from the prescribed normative model (Adair et al., 1994, French, 2001, Gallimore et al., 2000, Roberts & Henneberry, 2007). Additionally, while extant literature pertaining to professional real estate investment highlight the importance of the risk dimension, only three articles explore whether the modern quantitative risk assessment methods are being used and suggest a reluctance to use these models, although failing to define “why”. The present research contributes to the literature by offering a complementary investigation based on a questionnaire on the private investor on their behavior when it came to investment.

With the goal to assess whether private investors follow the textbook approach, which is in our model, conceptualized as an adherence to a normative behavior and hypothesized as H1: *The adherence to a normative framework is associated with the investment rationales* or rather that the investment decision is associated with psychological factors which rather relate to a behavioral framework and hypothesized as H2: *The behavioral framework hypothesis is associated with the investment rationales*.

This research seeks to understand to which extent the private investor relies on psychological factors, which could be referred as intuition or “gut feeling,” and the reason behind such a deviation from normative models.

Figure 14 - Conceptual framework with the materialization of the hypotheses.



# CHAPTER 3

## Methodology

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The aim of this research is to develop a framework and understanding of the determinants of investment in the property market, in other words, what affects the real estate investment decision-making process. To achieve this goal, a research survey was employed to better understand the behavior of individual real estate investors and test the hypothesis developed in the prior section.

### 3.1 Data

Our sample is constituted by 150 UK residents. These individuals are part of the country's workforce (work on a full-time basis). The sample is constituted by 52% women and 48 % men. A self-administered questionnaire was used to collect the data from the respondents.

The questionnaire was administered to the respondent using prolific academic and google form. To ensure full compliance of the respondents, an incentive fee upon completion of all questions was awarded (approximately 1.18 euros). While attention checks were placed in the questionnaire to ensure the candidate appropriately answered, an incentive fee was provided only when all questions were adequately answered and data reviewed. SPSS 24 was used for data analysis and statistics.

### 3.2 The outcome variables

The outcome variable of interest is the private investor rationale for investing measured in an ordinal categorical variable with 1= strongly disagree, 2 = disagree, 3 =undecided, 4= agree 5= strongly disagree. (each variable being cross-referenced to the questionnaire in annex 2).

In this study, three rationales for investing are measured with the specific survey question, a rationale for capital gain, a rationale for hedging, and a rationale for financial return (as hypothesized by the literature see 2.3 of this thesis)

Table 1 - The outcome variable

<b>Abbreviation</b>	<b>Research Variables</b>	<b>Measurement</b>	<b>Survey question (refer to annex 2)</b>
RCG	A1_REI_CA_S	Rational for investing in real estate for capital gain	8
RHI	A2_REI_HAI_S	Rational for investing in real estate for hedging against inflation	7
RFR	A3_REI_AFR_S	Rational for investing in real estate for financial returns	6

### 3.3 The explanatory variables

The explanatory variables are measured using the survey question (each variable being cross-referenced to the questionnaire in annex 2) and presented under table 2 with a total of 13 variables, from which seven are assumed to belong to the control variable category as these present social and demographic factors.

Table 2 - The explanatory variables

Abbreviation	Research Variables	Measures	Survey question (refer to annex 2)
BO	B1_RI_Omission_S	heuristic measure of the omission bias through regret	12,14
BHS	B3_Herding_social_D	heuristic measure of the social herding heuristic	19
BHI	B4_Herding_informati_D	heuristic measure of the informational herding heuristic	20
NSEQ	A5_REI_Seq_D	analytical rational for investing in real estate by using a sequential	35,36,37,38,39

		step by step process	
NVAL	A6_Val_fin_S	analytical rational for investing in real estate by using financial valuation tools	24
NLTV	A7_LTV_S	analytical rational for investing in real estate by using loan to value ratio (LTV)	40
DAGE	C1_AGE_S	age of the respondent	25
DXP	C2_XP_RE_S	self-assessed experience in real estate of the respondent	18
DIG	C3_Income_group_S	income group of the respondent	30
DE	C4_education_S	education level of the respondent	31
DG	C5_gender_D	gender of the respondent	32
DRLOSS	C6_Risk_profile1_sureloss_D	measure of the risk aversion of the respondent in presence of a sure loss vs gamble	40
DRGAIN	C7_Risk_profile2_suregain_D	measure of the risk aversion of the respondent in presence of a sure gain vs gamble	44

## **3.2 The selection of the model**

The Likert-type data is an ordinal type of data, and the dependent variable has more than two categories, with the value of each category having a meaningful sequential order with the value being higher than the previous one.

For this analysis, we are therefore evaluating potential discrete choice models available to us. The models are mainly adapted from an introduction to categorical data analysis statistic textbook (Agresti, 2018)

## **3.3 Ordered logit model**

Ordered logistic regression allows us to see in a sample the relationship between rationales for investing, rationales of investing for financial return, investing for a capital gain, investing for hedging against inflation, normative behavior, and psychological dimensions that are referred to as behavioral biases in the literature disposition effect is tested as hypothesized by Kahneman & Tversky(1979) and by putting the survey respondents in a hypothetical situation, where they had purchased an investment property several years ago to measure their regret aversion Seiler (2008).

The psychological dimension of herding, as hypothesized by Shiller (2005), is measured both in its rational and irrational form. Additionally, we see which control variable is impacting the model from the social and demographic data collected from the survey respondents.

The logistic ordinal regression model, also known as the proportional odds, was introduced by McCullagh (1980) and is a generalized linear model specially tailored for the case of predicting ordinal variables, that is, variables that are discrete (as in classification) but which can be ordered (as in regression). It can be seen as an extension of the logistic regression model to the ordinal setting.

The ordered logit model is based on a continuous latent variable. In this study, the outcome variable is ordered and has more than two levels with a response scale of the survey instrument ordered from 1 (strongly disagree) to 5 (strongly agree), which makes the use of the logistic ordinal regression model adequate.

This study uses the ordered logit model to investigate and determine the effect of descriptive variables of:

- The sequentially of the process (NSEQ)
- The use of a valuation method (NVAL)
- The use of a risk assessment technique (NLTV)
- The psychological dimension of informational herding (BHI)
- The psychological dimension of social herding (BHS)
- The psychological dimension of disposition effect (BO)

The rationale for investing for financial return (RFR), investing for a capital gain (RCG), and investing for hedging against inflation (RHI) measured 1 to 5 using a Likert scale questionnaire. The demographic and social variables are also included in the model in order to test their influence and possible association as control variables.

The ordinal logistic regression model can be expressed as a latent variable model (Agresti, 2002).

The model assumes that a latent variable\* exists

$$Y_i = \beta_{xi} + \varepsilon \quad (1)$$

with  $y_i$  the variable measuring the rationales for investing

with  $\beta_{xi}$  a vector of parameters that should be estimated

with  $x$  is an observed vector of non-random explanatory variable which shows the characteristic of  $i^{th}$  individual.

$\varepsilon$  Residual error which is logistically distributed.

Since  $y_i$  is a latent variable, standard regression techniques are not applicable to estimate the sample size.

$y$  is divided in thresholds  $\alpha_1, \alpha_2, \alpha_3, \dots, \alpha_j$  and  $\alpha_1 < \alpha_2 < \alpha_3, \dots < \alpha_j$ .

If  $y_i$  is considered as a discrete and observable variable which shows different levels rationales for investing, the relation between latent variable  $y_i$  and observable variable  $y_i$  is obtained from ordered logit model as follows:

$$\begin{aligned}
 y_i = 1 \text{ if } & -\infty \leq y_i \leq \alpha_1, & i = 1, \dots, n, \\
 y_i = 2 \text{ if } & \alpha_1 \leq y_i \leq \alpha_2, & i = 1, \dots, n, \\
 y_i = 3 \text{ if } & \alpha_3 \leq y_i \leq \alpha_4, & i = 1, \dots, n, \\
 \dots & \dots & \dots \\
 y_i = J \text{ if } & \alpha_{J-1} \leq y_i \leq +\infty, & i = 1, \dots, n,
 \end{aligned} \tag{2}$$

In which  $n$  is the value for the sample size.  $\alpha$  ,,

The probability of  $y_i=j$  is calculated by the following equation

$$\Pr ( y_1=J ) = \Pr ( y_1 \geq \alpha_{J-1} ) = \Pr ( \varepsilon \geq \alpha_{n-1} - \beta x_1 ) = F ( \beta x_1 - \alpha_{J-1} ) \tag{3}$$

Let  $\pi_i$  be the probability of a the rational for investing

$$\text{Log} [\pi_j(x)/(1 - \pi_j(x))] = \alpha_j + (-\beta_1 X_{11} - \beta_2 X_{21} - \dots - \beta_p X_p) \tag{4}$$

with  $\pi_j(x) = \pi_j(Y \leq j | x_1, x_2, \dots, x_p)$ , which is the probability of being at or below category  $j$ , given a set of predictors.  $j = 1, 2, \dots, J-1$ .  $\alpha_j$  are the cut points, and  $\beta_1 \beta_2 \dots \beta_p$  are logit coefficients.

SPSS PLUM (Polytomous Universal Model) is an extension of the generalized linear model for ordinal response data. It can provide five types of link functions including logit, probit, complementary log-log, cauchit and negative log-log (Liu 2009).

The ordinal logit model is based on a latent continuous outcome variable for SPSS PLUM

$$\begin{aligned}
 \text{logit} [\pi(Y \leq j | x_1, x_2, \dots, x_p)] &= \ln \left( \frac{\pi_j(Y \leq j | x_1, x_2, \dots, x_p)}{\pi_j(Y > j | x_1, x_2, \dots, x_p)} \right) \\
 &= \alpha_j + (-\beta_1 X_{11} - \beta_2 X_{21} - \dots - \beta_p X_p)
 \end{aligned} \tag{5}$$

Where  $\alpha_j$ 's are the thresholds and  $\beta_1, \beta_2 \dots \beta_{1p}$  are logit coefficients;  $j= 1,2 \dots J-1$ .

### 3.4 Descriptive statistics

#### 3.4.1 Demographic of people answering the questionnaire

The table 3 present the characteristics of the sample in term of demographics and social traits.

Table 3 - Demographic of people answering the questionnaire

<b>Profile of respondents</b>	<b>Total count</b>	<b>Total %</b>
<b>Gender</b>		
Female	72	48%
Male	78	52%
<b>Total</b>	150	100%
<b>Age</b>		
18-25	31	21%
26-40	74	49%
41-55	32	21%
56-70	13	9%
<b>Total</b>	150	100%
<b>Education</b>		
High school	51	34%
Bachelor	83	55%
Master	13	9%
Doctorate	3	2%
<b>Total</b>	150	100%
<b>Annual income in GBP</b>		
below 10k	5	3%
between 10k and 15k	7	5%
between 15k and 25k	39	26%
between 25k and 40k	63	42%
between 40k and 55k	26	17%
between 55k and 65k	3	2%
between 65k and 75k	2	1%
between 75k and 85k	1	1%
between 85k and 100	3	2%
above 100k	1	1%
<b>Total</b>	150	100%

### 3.4.2 Minimum, Maximum, Mean and standard deviation

Table 4 - Minimum, Maximum, Mean and standard deviation

	N	Minimum	Maximum	Mean	Std. Deviation
BHS	150	1	2	1,45	,499
BHI	150	1	2	1,73	,444
BO	150	1,00	3,00	1,1133	,33851
AGE	150	1	4	2,18	,860
DXP	150	1,00	5,00	1,8467	,90292
DIG	150	2	12	5,63	1,755
DE	150	1	4	1,96	1,117
DG	150	1	2	1,52	,501
DLOSS	150	1	2	1,62	,487
DGAIN	150	1	2	1,08	,272
RCG	150	1,00	5,00	4,1067	,89852
RFR	150	1,00	5,00	3,9800	,90835
RHI	150	1,00	5,00	3,1867	1,12558
NSEQ	150	0	1	,11	,318
NLTV	150	1,00	5,00	3,4000	1,14692
NVAL	150	1,00	5,00	2,2467	1,17546
Valid N (listwise)	150				

#### Legend

*BO* measure of the omission bias through regret

*BHS* measure of the social herding heuristic

*BHI* measure of the informational herding heuristic

*NSEQ* measure adherence to normative behavior for investing in real estate by using a sequential step by step process

*NVAL* measure adherence to normative behavior for investing in real estate by using financial valuation tools

*NLTV* measure adherence to normative behavior for investing in real estate by using loan to value ratio

*DAGE* age of the respondent

*DXP* self-assessed experience in real estate of the respondent

*DIG* income group of the respondent

*DE* education level of the respondent

*DG* gender of the respondent

*DRLOSS* measure of the risk aversion of the respondent in presence of a sure loss vs gamble

*DRGAIN* measure of the risk aversion of the respondent in presence of a sure gain vs gamble

### 3.5 Result and interpretation

#### 3.5.1 RHI Regression results of the ordered model estimation Rational for investing in real estate for hedging against inflation (RHI)

The following data results are output from SPSS program and interpret using Bruin (2011) statistic article on SPSS interpretation as well as the University of California statistical consulting interpretation SPSS (<https://stats.oarc.ucla.edu/>).

##### 3.5.1.1 Case Processing Summary

Table 5 - RHI Case Processing Summary

Case Processing Summary			Marginal Percentage
		N	
RHI	1,00	13	8,7%
	2,00	27	18,0%
	3,00	46	30,7%

	4,00	47	31,3%
	5,00	17	11,3%
Valid		150	100,0%
Missing		0	
Total		150	

### *Legend*

**N** provides the number of observations that fits the description from the first column (RHI). In our case, the five values from 1 to 5 provide the number of observations for students that report an RHI which measure the Rationale for investing in real estate for hedging against inflation.

**The marginal percentage** provides the proportion of valid observations found in each of the outcome variable's groups. This is derived by dividing the N for each group by the N for "Valid".

Of the 150 subjects with valid data, 46 were categorized as undecided RHI. Thus, the marginal percentage for this group is  $(46/150) * 100 = 30.7 \%$ .

**RHI:** In this regression, the outcome variable is RHI which contains a numeric code for the subject's rationales for investing for hedging against inflation status. The data includes five levels of RHI and is measured using Likert scale with value of 1= strongly disagree, 2 = disagree, 3 =undecided, 4= agree, 5= strongly disagree.

**Valid** – This indicates the number of observations in the dataset where the outcome variable and all predictor variables are non-missing.

**Missing** – This indicates the number of observations in the dataset where data are missing from the outcome variable or any of the predictor variables.

**Total** – This indicates the total number of observations in the dataset the sum of the number of observations in which data are missing and the number of observations with valid data.

This table shows us that all 150-respondent data is analyzed with no missing value.

### 3.5.1.2 Model Fitting Information

Table 6 - RHI Model Fitting Information

Model Fitting Information				
Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	448,049			
Final	411,344	36,704	13	,000

Link function: Logit.

**Model** – This reflects the parameters of the model for which the model fit is calculated. “Intercept Only” designates a model that does not control for any predictor variables and simply fits an intercept to predict the outcome variable. “Final” designates a model that includes the specified predictor variables whose coefficients have been estimated using an iterative process that maximizes the log likelihood of the outcome. By including the predictor variables and maximizing the log likelihood of the outcome, the “Final” model should improve upon the “Intercept Only” model. This can be seen in the differences in the -2(Log Likelihood) values associated with the models.

-2(Log Likelihood): This is the product of -2 and the log likelihoods of the null model and fitted “final” model. The likelihood of the model is used to test whether all of the estimated regression coefficients in the model are simultaneously zero.

Chi-Square – This is the Likelihood Ratio (LR) Chi-Square test. It tests whether at least one of the predictors’ regression coefficients is not equal to zero in the model.

In our case, the LR Chi-Square statistic can be calculated by  $-2 \times L(\text{null model}) - (-2 \times L(\text{fitted model})) = 448,049 - 411,344 = 36,704$ , where  $L(\text{null model})$  is from the log likelihood with just the response variable in the model (Iteration 0) and  $L(\text{fitted model})$  is the log likelihood from the final iteration (assuming the model converged) with all the parameters.

df – This indicates the degrees of freedom of the Chi-Square distribution used to test the LR Chi-Square statistic and is defined by the number of predictors in the model.

Sig. – This is the probability of getting a Likelihood Ratio (LR) test statistic as extreme as, or more so, than the observed under the null hypothesis; the null hypothesis is that all of the regression coefficients in the model are equal to zero. In other words, this is the probability of obtaining this chi-square statistic (36,704) if there is in fact no effect of the predictor variables. This p-value is compared to a specified alpha level, our willingness to accept a type I error, which is typically set at 0.05.

The small p-value from the LR test, <0.00001, would lead us to conclude that at least one of the regression coefficients in the model is not equal to zero. The parameter of the Chi-Square distribution used to test the null hypothesis is defined by the degrees of freedom in the prior column. The statistically significant chi-square statistic ( $p < .0005$ ) indicates that the model gives a significant improvement over the baseline intercept-only model. This means that the model gives better predictions than if we just estimated based on the marginal probabilities for the outcome categories. This can be summarized as whether our model improve the ability to predict the outcome so we are looking at -2 log likelihood which measure the error in the model. Significance needs to be less than 0.05 which appears to be the case.

### 3.5.1.3 Goodness-of-Fit

Table 7 - RHI Goodness-of-Fit

<b>Goodness-of-Fit</b>			
	Chi-Square	df	Sig.
Pearson	610,366	559	,065
Deviance	411,344	559	1,000

Link function: Logit.

This table contains Pearson's chi-square statistic for the model. These statistics are intended to test whether the observed data are consistent with the fitted model. We start from the null hypothesis that the fit is good. If we do not reject this hypothesis (i.e. if the p value is large), In this case Pearson appears to be non-significant which indicates that the model fits the data well.

### 3.5.1.4 Pseudo R-Square

Table 8 - RHI Pseudo R-Square

<b>Pseudo R-Square</b>	
Cox and Snell	,217
Nagelkerke	,229
McFadden	,082

Link function: Logit.

Nagelkerke R-square is 0.229 which suggest that 22.9 percent of the variance in our outcome is explained by our explanatory variables while this amount is not high, there is a substantial amount of variance explained which suggest that there is some value to our model.

### 3.5.1.5 Test of Parallel Lines

Table 9 - RHI Test of Parallel Lines

<b>Test of Parallel Lines<sup>a</sup></b>				
Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	411,344			
General	364,424 <sup>b</sup>	46,920 <sup>c</sup>	39	,180

The null hypothesis states that the location parameters (slope coefficients) are the same across response categories.

- a. Link function: Logit.
- b. The log-likelihood value cannot be further increased after maximum number of step-halving.
- c. The Chi-Square statistic is computed based on the log-likelihood value of the last iteration of the general model. Validity of the test is uncertain.

In this table, SPSS tests the proportional odds assumption which in fact test the null hypothesis that the odds for each explanatory variable are consistent across different threshold of the output variable.

This is commonly referred to as the test of parallel lines because the null hypothesis states that the slope coefficients in the model are the same across response categories (and lines of the same slope are parallel).

Since the ordered logit model estimates one equation over all levels of the response variable, the test for proportional odds tests whether our one-equation model is valid. If we were to reject the null hypothesis based on the significance of the Chi-Square statistic, we would conclude that ordered logit coefficients are not equal across the levels of the outcome, and we would fit a less restrictive model (i.e., multinomial logit model). If we fail to reject the null hypothesis, we conclude that the assumption holds.

In our case, the proportional odds assumption appears to have held because the significance of our Chi-Square statistic is  $.18 > .05$ . We obtain a non-significant result which suggests that the odds are different between these different thresholds.

### 3.5.1.6 Parameter estimates

Table 10 - RHI Parameter estimates

Parameter Estimates								
		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[RHI = 1,00]	2,032	1,405	2,092	1	,148	-,722	4,786
	[RHI = 2,00]	3,543	1,405	6,358	1	,012	,789	6,297
	[RHI = 3,00]	5,092	1,433	12,623	1	,000	2,283	7,902
	[RHI = 4,00]	7,150	1,498	22,787	1	,000	4,215	10,086
Location	BHS	1,081	,336	10,373	1	,001	,423	1,738
	BHI	-,146	,377	,149	1	,699	-,886	,594
	BO	,000	,479	,000	1	1,000	-,938	,938
	AGE	,241	,194	1,536	1	,215	-,140	,621
	DXP	,344	,184	3,468	1	,063	-,018	,705
	DIG	,060	,097	,375	1	,540	-,131	,250
	DE	-,317	,144	4,857	1	,028	-,599	-,035
	DG	,055	,310	,031	1	,860	-,553	,662
	DLOSS	,174	,316	,303	1	,582	-,446	,794
	DGAIN	,390	,560	,484	1	,487	-,709	1,488
	NSEQ	-,597	,506	1,391	1	,238	-1,590	,395
	NLTV	,361	,148	5,929	1	,015	,070	,652
	NVAL	,260	,141	3,403	1	,065	-,016	,535

Link function: Logit

### **3.5.1.6.1 Definition of the Parameter estimates**

Estimate: These are the ordered log-odds (logit) regression coefficients. Standard interpretation of the ordered logit coefficient is that for a one unit increase in the predictor, the response variable level is expected to change by its respective regression coefficient in the ordered log-odds scale while the other variables in the model are held constant.

95% Confidence Interval – This represents the Confidence Interval (CI) for an individual regression coefficient given the other predictors are in the model. It is calculated as the Coef.  $(z_{\alpha/2}) * (\text{Std.Err.})$ , where  $z_{\alpha/2}$  is a critical value on the standard normal distribution.

The CI is equivalent to the z test statistic: if the CI includes zero, we would fail to reject the null hypothesis that a particular regression coefficient is zero given the other predictors are in the model.

Std. Error: These are the standard errors of the individual regression coefficients. They are used in both the calculation of the Wald test statistic, superscript p, and the confidence interval of the regression coefficient, superscript r.

Wald: This is the Wald chi-square test that tests the null hypothesis that the estimate equals 0.

DF These are the degrees of freedom for each of the tests of the coefficients. For each Estimate (parameter) estimated in the model, one DF is required, and the DF defines the Chi-Square distribution to test whether the individual regression coefficient is zero given the other variables are in the model.

Sig.– These are the p-values of the coefficients or the probability that, within a given model, the null hypothesis that a particular predictor's regression coefficient is zero given that the rest of the predictors are in the model. They are based on the Wald test statistics of the predictors, which can be calculated by dividing the square of the predictor's estimate by the square of its standard error. The probability that a particular Wald test statistic is as extreme as, or more so, than what has been observed under the null hypothesis is defined by the p-value and presented here.

### **3.5.1.6.2 Interpretation of the Parameter estimates for RHI**

## **H1: The normative framework hypotheses: The adherence to a normative framework is associated with the investment rationales**

### **An association between LTV and RHI**

The Wald test statistic for the predictor NLTV is 5.929, with an associated p-value of 0.015. If we set our alpha level to 0.05, we would reject the null hypothesis and conclude that the regression coefficient for NLTV has been found to be statistically different from zero in estimating RHI, given that BHI, BHS, BO, AGE, DXP, DE, DIG, DG, DLOSS, DGAIN, NSEQ and NVAL are in the model.

NLTV: This is the ordered log-odds estimate for a one-unit increase in science score on the expected RHI level, given the other variables are held constant in the model. If a subject were to increase his BHS score by one point, his ordered log-odds of being in a higher RHI category would increase by 0,361 while the other variables in the model are held constant

These results also suggest that the respondent that invest in order to hedge against inflation are familiar with risk metrics such as the use of LTV loan to value. This result suggests that we, therefore, reject the null hypothesis H The behavioral framework hypothesis is associated with the investment rationales

## **H2 The behavioral framework hypothesis: The behavioral framework hypothesis is associated with the investment rationales**

### **An association between BHS and RHI**

The Wald test statistic for the predictor BHS is 10.373 with an associated p-value of 0.01. If we set our alpha level to 0.05, we would reject the null hypothesis and conclude that the regression coefficient for BHS has been found to be statistically different from zero in estimating RHI given that BHI, BO, AGE, DXP, DIG, DE, DG, DLOSS, DGAIN, NSEQ, NLTV and NVAL are in the model.

BHS: This is the ordered log-odds estimate for a one unit increase in science score on the expected RHI level given the other variables are held constant in the model. If a subject were to increase his BHS score by one point, his ordered log-odds of being in a higher RHI category would increase by 1,081 while the other variables in the model are held constant.

This result suggests that we therefore reject the null hypothesis H 2 The behavioral framework hypothesis is associated with the investment rationales

### **An association between the control variable DE and RHI**

The Wald test statistic for the predictor DE is 4857 with an associated p-value of 0.028. If we set our alpha level to 0.05, we would reject the null hypothesis and conclude that the regression coefficient for DE has been found to be statistically different from zero in estimating RHI given that BHI, BHS, BO, AGE, DXP, DIG, DG, DLOSS, DGAIN, NSEQ, NLTV and NVAL are in the model.

DE: This is the ordered log-odds estimate for a one unit increase in degree of education score on the expected RHI level given the other variables are held constant in the model. If a subject were to increase his DE score by one point, his ordered log-odds of being in a higher RHI category would decrease by -0.317 while the other variables in the model are held constant.

Interestingly we have a negative association which is in line with the literature as at the time when this survey was performed the inflation was very low and (Bruin, 2011)

Finally, If we set our alpha level to 0.05, we would fail to reject the null hypothesis and conclude that the regression coefficient for the predictor BHI, BO, AGE, DXP, DE, DIG, DLOSS, DGAIN, NSEQ and NVAL. Have not been found to be statistically different from zero in estimating RHI given the respective predictor in the model.

These results suggest that respondent with higher education will less invest in a property for the hedging against inflation motive in time when the inflation is low which imply a level of financial literacy. These results also suggest that the respondent that invest in order to hedge against inflation are familiar with risk metrics such as the use LTV loan to value.

These results suggest the respondent are subject to a form of social herding when it comes to invest with an inflation hedging rational.

### 3.5.2 RCG regression results of the ordered model estimation Rationale for investing in real estate for capital gain (RCG)

#### 3.5.2.1 Case Processing Summary

Table 11 - RCG Case Processing Summary

Case Processing Summary			Marginal Percentage
		N	
RCG	1,00	4	2,7%
	2,00	4	2,7%
	3,00	17	11,3%
	4,00	72	48,0%
	5,00	53	35,3%
Valid		150	100,0%
Missing		0	
Total		150	

N provides the number of observations fitting the description from the first column. In our case, the five values from 1 to 5 give the number of observations for students that report an RCG which measure the Rationale for investing in real estate for capital gain

**The marginal percentage** lists the proportion of valid observations found in each of the outcome variable's groups. This can be calculated by dividing the N for each group by the N for "Valid".

Of the 150 subjects with valid data, 46 were categorized as undecided Rationale for investing in real estate for capital gain. Thus, the marginal percentage for this group is  $(46/150) * 100 = 11.3\%$ .

**RCG:** In this regression, the outcome variable is RCG which contains a numeric code for the subject's Rationale for investing in real estate for capital gain. The data includes five levels of

RCG and is measured using Likert scale with value of 1= strongly disagree, 2 = disagree, 3 =undecided, 4= agree, 5= strongly disagree.

**Valid** – This indicates the number of observations in the dataset where the outcome variable and all predictor variables are non-missing.

**Missing** – This indicates the number of observations in the dataset where data are missing from the outcome variable or any of the predictor variables.

**Total** – This indicates the total number of observations in the dataset the sum of the number of observations in which data are missing and the number of observations with valid data.

This table shows us that all 150-respondent data is analyzed with no missing value.

### 3.5.2.2 Model Fitting Information

Table 12 - RCG Model Fitting Information

Model Fitting Information				
Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	347,990			
Final	308,869	39,121	13	,000

Link function: Logit.

Chi-Square – This is the Likelihood Ratio (LR) Chi-Square test. It tests whether at least one of the predictors’ regression coefficients is not equal to zero in the model.

In our case, the LR Chi-Square statistic can be calculated by  $-2 * L(\text{null model}) - (-2 * L(\text{fitted model})) = 347,990 - 308,869 = 39,121$ , where  $L(\text{null model})$  is from the log likelihood with just the response variable in the model (Iteration 0) and  $L(\text{fitted model})$  is the log likelihood from the final iteration (assuming the model converged) with all the parameters.

Sig. – This is the probability of getting a Likelihood Ratio (LR) test statistic as extreme as, or more so, than the observed under the null hypothesis; the null hypothesis is that all of the regression coefficients in the model are equal to zero. In other words, this is the probability of obtaining this chi-square statistic (39,121) if there is in fact no effect of the predictor variables.

### 3.5.2.3 Goodness-of-Fit

Table 13 - RCG Goodness-of-Fit

<b>Goodness-of-Fit</b>			
	Chi-Square	df	Sig.
Pearson	475,886	559	,995
Deviance	308,869	559	1,000

Link function: Logit.

This table contains Pearson's chi-square statistic for the model. These statistics are intended to test whether the observed data are consistent with the fitted model. We start from the null hypothesis that the fit is good. If we do not reject this hypothesis (i.e. if the p value is large), In this case Pearson appears to be non-significant which indicates that the model fits the data well.

### 3.5.2.4 Pseudo R-Square

Table 14 - RCG Pseudo R-Square

<b>Pseudo R-Square</b>	
Cox and Snell	,230
Nagelkerke	,255
McFadden	,112

Link function: Logit.

Nagelkerke R-square is 0.255 which suggest that 25.5 percent of the variance in our outcome is explained by our explanatory variables while this amount is not high, there is a substantial amount of variance explained which suggest that there is some value to our model.

### 3.5.2.5 Test of Parallel Lines

Table 15 - RCG Test of Parallel Lines

#### **Test of Parallel Lines<sup>a</sup>**

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	308,869			
General	271,313 <sup>b</sup>	37,556 <sup>c</sup>	39	,536

The null hypothesis states that the location parameters (slope coefficients) are the same across response categories.

- a. Link function: Logit.
- b. The log-likelihood value cannot be further increased after maximum number of step-halving.
- c. The Chi-Square statistic is computed based on the log-likelihood value of the last iteration of the general model. Validity of the test is uncertain.

In this table SPSS tests the proportional odds assumption which in fact test the null hypothesis that the odds for each explanatory variable are consistent across different threshold of the output variable.

This is commonly referred to as the test of parallel lines because the null hypothesis states that the slope coefficients in the model are the same across response categories (and lines of the same slope are parallel).

Since the ordered logit model estimates one equation over all levels of the response variable. The test for proportional odds tests whether our one-equation model is valid. If we were to reject the null hypothesis based on the significance of the Chi-Square statistic, we would conclude that ordered logit coefficients are not equal across the levels of the outcome, and we would fit a less restrictive model (i.e., multinomial logit model). If we fail to reject the null hypothesis, we conclude that the assumption holds.

In our case, the proportional odds assumption appears to have held because the significance of our Chi-Square statistic is  $.536 > .05$ .

We obtain a non-significant result which suggest that the odds are different between these different thresholds.

### 3.5.2.6 Parameter estimates

Table 16 - RCG Parameter estimates

Parameter Estimates								
		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[RCG = 1,00]	-2,462	1,544	2,542	1	,111	-5,489	,565
	[RCG = 2,00]	-1,675	1,500	1,247	1	,264	-4,615	1,265
	[RCG = 3,00]	-,218	1,473	,022	1	,883	-3,105	2,670
	[RCG = 4,00]	2,494	1,490	2,802	1	,094	-,426	5,415
Location	BHS	1,553	,374	17,255	1	,000	,820	2,286
	BHI	-,175	,403	,189	1	,664	-,966	,615
	BO	-,947	,512	3,422	1	,064	-1,950	,056
	AGE	-,465	,210	4,897	1	,027	-,876	-,053
	DXP	,375	,206	3,323	1	,068	-,028	,779
	DIG	,015	,105	,019	1	,890	-,191	,220
	DE	-,143	,154	,863	1	,353	-,446	,159
	DG	-,296	,336	,779	1	,378	-,955	,362
	DLOSS	,318	,341	,871	1	,351	-,350	,987
	DGAIN	-,470	,596	,624	1	,430	-1,638	,697
	NSEQ	-,202	,546	,137	1	,711	-1,272	,868
	NLTV	,440	,161	7,451	1	,006	,124	,756
	NVAL	,135	,152	,792	1	,373	-,162	,432

Link function: Logit.

#### 3.5.2.6.1 Definition of the Parameter estimates

**Estimate:** These are the ordered log-odds (logit) regression coefficients. Standard interpretation of the ordered logit coefficient is that for a one-unit increase in the predictor, the response variable level is expected to change by its respective regression coefficient in the ordered log-odds scale while the other variables in the model are held constant.

**95% Confidence Interval –** This is the Confidence Interval (CI) for an individual regression coefficient, given the other predictors are in the model. It is calculated as the Coef.  $(z_{\alpha/2}) \cdot (\text{Std.Err.})$ , where  $z_{\alpha/2}$  is a critical value on the standard normal distribution. The CI is equivalent to the z test statistic: if the CI includes zero, we'd fail to reject the null hypothesis that a particular regression coefficient is zero, given the other predictors are in the model.

**Std. Error:** These are the standard errors of the individual regression coefficients. They are used in both the calculation of the Wald test statistic, superscript p, and the confidence interval of the regression coefficient, superscript r.

Wald: This is the Wald chi-square test that tests the null hypothesis that the estimate equals 0.

DF These are the degrees of freedom for each of the tests of the coefficients. For each Estimate (parameter) estimated in the model, one DF is required, and the DF defines the Chi-Square distribution to test whether the individual regression coefficient is zero given the other variables are in the model.

Sig.– These are the p-values of the coefficients or the probability that, within a given model, the null hypothesis that a particular predictor's regression coefficient is zero given that the rest of the predictors are in the model. They are based on the Wald test statistics of the predictors, which can be calculated by dividing the square of the predictor's estimate by the square of its standard error. The probability that a particular Wald test statistic is as extreme as, or more so, than what has been observed under the null hypothesis is defined by the p-value and presented here.

#### **3.5.2.6.2 Interpretation of the Parameter estimates for RCG**

**H1: The normative framework hypotheses: The adherence to a normative framework is associated with the investment rationales**

#### **An association between NLTV and RCG**

The Wald test statistic for the predictor NLTV is 7.451, with an associated p-value of 0.006. If we set our alpha level to 0.05, we would reject the null hypothesis and conclude that the regression coefficient for NLTV has been found to be statistically different from zero in estimating RCG given that BHI, BHS, BO, AGE, DXP, DE, DIG, DG, DLOSS, DGAIN, NSEQ, and NVAL are in the model.

NLTV: This is the ordered log-odds estimate for a one unit increase in NLTV score on the expected RCG level given the other variables are held constant in the model. If a subject were to increase his NLTV score by one point, his ordered log-odds of being in a higher RCG category would increase by 0.440 while the other variables in the model are held constant.

This result suggests that we therefore reject the null hypothesis H1 The adherence to a normative framework is associated with the investment rationales.

## **H2 The behavioral framework hypothesis: The behavioral framework hypothesis is associated with the investment rationales**

### **An association between BHS and RCG**

The Wald test statistic for the predictor BHS is 17.255 with an associated p-value of 0.01. If we set our alpha level to 0.05, we would reject the null hypothesis and conclude that the regression coefficient for BHS has been found to be statistically different from zero in estimating RCG given that BHI, BO, AGE, DXP, DIG, DE, DG, DLOSS, DGAIN, NSEQ, NLTV, and NVAL are in the model.

BHS: This is the ordered log-odds estimate for a one unit increase in science score on the expected RCG level given the other variables are held constant in the model. If a subject were to increase his BHS score by one point, his ordered log-odds of being in a higher RCG category would increase by 1,553 while the other variables in the model are held constant.

This result suggests that we therefore reject the null hypothesis H 2 The behavioral framework hypothesis is associated with the investment rationales

### **An association between the control variable AGE and RCG**

The Wald test statistic for the predictor AGE is 4,897, with an associated p-value of 0.027. If we set our alpha level to 0.05, we would reject the null hypothesis and conclude that the regression coefficient for AGE has been found to be statistically different from zero in estimating RCG, given that BHI, BHS, BO, DE, DXP, DIG, DG, DLOSS, DGAIN, NSEQ, NLTV, and NVAL are in the model.

AGE: This is the ordered log-odds estimate for a one-unit increase in AGE score on the expected RCG level, given the other variables are held constant in the model. If a subject were to increase his AGE score by one point, his ordered log-odds of being in a higher RCG category would decrease by -0.317 while the other variables in the model are held constant.

This negative association makes sense as we would expect that as more the subject age the less the subject will be motivated in investing for capital gain given the time horizon of the subject is reduced. These significant associations between age and rationale for investing for financial

return and for capital gain also confirm Lutfi (2011) relationship between age and type of investment.

Finally, if we set our alpha level to 0.05, we would fail to reject the null hypothesis and conclude that the regression coefficient for the predictor BHI, BO, DXP, DE, DG, DIG, DLOSS, DGAIN, NSEQ, and NVAL. Have not been found to be statistically different from zero in estimating RCG given the respective predictor in the model.

### 3.5.3 RFR regression results of the ordered model estimation Rationale for investing in real estate for financial returns (RFR)

#### 3.5.3.1 Case Processing Summary

Table 17 - RFR Case Processing Summary

Case Processing Summary			Marginal Percentage
		N	
RFR	1,00	4	2,7%
	2,00	5	3,3%
	3,00	24	16,0%
	4,00	74	49,3%
	5,00	43	28,7%
Valid		150	100,0%
Missing		0	
Total		150	

The proportion of cases within each category. we can see that half 49.3% of the respondent have rated RFR at 4 which mean they strongly agree on the fact that the motivation from property investment comes from a desire for financial return. With 16% being neutral and 28.7% strongly agreeing.

**N** provides the number of observations fitting the description from the first column. In our case, the five values from 1 to 5 give the number of observations for students that report an RFR which measure the Rational for investing in real estate for financial return.

**The marginal percentage** lists the proportion of valid observations found in each of the outcome variable's groups. This can be calculated by dividing the N for each group by the N for "Valid".

Of the 150 subjects with valid data, 46 were categorized as undecided RFR. Thus, the marginal percentage for this group is  $(24/150) * 100 = 16 \%$ .

**RFR:** In this regression, the outcome variable is RFR which contains a numeric code for the subject's rationales for investing for hedging against inflation status. The data includes five levels of RHI and is measured using Likert scale with value of 1= strongly disagree, 2 = disagree, 3 =undecided, 4= agree, 5= strongly disagree.

**Valid** – This indicates the number of observations in the dataset where the outcome variable and all predictor variables are non-missing.

**Missing** – This indicates the number of observations in the dataset where data are missing from the outcome variable or any of the predictor variables.

**Total** – This indicates the total number of observations in the dataset the sum of the number of observations in which data are missing and the number of observations with valid data.

This table shows us that all 150-respondent data is analyzed with no missing value.

### 3.5.3.2 Model Fitting Information

Table 18 - RFR Model Fitting Information

<b>Model Fitting Information</b>				
Model	-2 Log Likelihood	Chi-Square	df	Sig.
Intercept Only	362,994			
Final	333,440	29,554	13	,005

Link function: Logit.

The statistically significant chi-square statistic ( $p < .0005$ ) indicates that the model gives a significant improvement over the baseline intercept-only model. This tells us that the model gives better predictions than if you just guessed based on the marginal probabilities for the outcome categories. The question here is whether our model improve the ability to predict the outcome so we are looking at -2 log likelihood which measure the error in the model. Significance needs to be less than 0.05 which appears to be the case.

**Chi-Square** : This is the Likelihood Ratio (LR) Chi-Square test. It tests whether at least one of the predictors' regression coefficients is not equal to zero in the model.

In our case, the LR Chi-Square statistic can be calculated by  $-2 * L(\text{null model}) - (-2 * L(\text{fitted model})) = 362,994 - 333,440 = 29,554$ , where  $L(\text{null model})$  is from the log likelihood with just the response variable in the model (Iteration 0) and  $L(\text{fitted model})$  is the log likelihood from the final iteration (assuming the model converged) with all the parameters.

df – This indicates the degrees of freedom of the Chi-Square distribution used to test the LR Chi-Square statistic and is defined by the number of predictors in the model.

Sig. – This is the probability of getting a Likelihood Ratio (LR) test statistic as extreme as, or more so, than the observed under the null hypothesis; the null hypothesis is that all of the regression coefficients in the model are equal to zero. In other words, this is the probability of obtaining this chi-square statistic (36,704) if there is in fact no effect of the predictor variables. This p-value is compared to a specified alpha level, our willingness to accept a type I error, which is typically set at 0.05.

The small p-value from the LR test,  $< 0.00001$ , would lead us to conclude that at least one of the regression coefficients in the model is not equal to zero. The parameter of the Chi-Square distribution used to test the null hypothesis is defined by the degrees of freedom in the prior column. The statistically significant chi-square statistic ( $p < .0005$ ) indicates that the model gives a significant improvement over the baseline intercept-only model.

### 3.5.3.3 Goodness-of-Fit

Table 19 - RFR Goodness-of-Fit

<b>Goodness-of-Fit</b>			
	Chi-Square	df	Sig.
Pearson	536,982	559	,741
Deviance	333,440	559	1,000

Link function: Logit.

This table contains Pearson's chi-square statistic for the model. These statistics are intended to test whether the observed data are consistent with the fitted model. We start from the null hypothesis that the fit is good. If we do not reject this hypothesis (i.e. if the p value is large), In this case Pearson appears to be non-significant which indicates that the model fits the data well. This table contains Pearson's chi-square statistic for the model. These statistics are intended to test whether the observed data are consistent with the fitted model. We start from the null hypothesis that the fit is good. If we do not reject this hypothesis (i.e. if the p value is large),

In this case Pearson appears to be non-significant which indicates that the model fits the data well.

### 3.5.3.4 Pseudo R-Square

Table 20 - RFR Pseudo R-Square

<b>Pseudo R-Square</b>	
Cox and Snell	,179
Nagelkerke	,196
McFadden	,081

Link function: Logit.

Nagelkerke R-square is 0.196 which suggest that 19.6 of the variances in our outcome is explained by our explanatory variables while this amount is not high, there is a substantial amount of variance explained which suggest that there is some value to our model.

### 3.5.3.5 Test of Parallel Lines

Table 21 - RFR Test of Parallel Lines

**Test of Parallel Lines<sup>a</sup>**

Model	-2 Log Likelihood	Chi-Square	df	Sig.
Null Hypothesis	333,440			
General	230,806 <sup>b</sup>	102,634 <sup>c</sup>	39	,000

The null hypothesis states that the location parameters (slope coefficients) are the same across response categories.

- a. Link function: Logit.
- b. The log-likelihood value cannot be further increased after maximum number of step-halving.
- c. The Chi-Square statistic is computed based on the log-likelihood value of the last iteration of the general model. Validity of the test is uncertain.

This table SPSS tests the proportional odds assumption which in fact test the null hypothesis that the odds for each explanatory variable are consistent across the different threshold of the output variable.

This is commonly referred to as the test of parallel lines because the null hypothesis states that the slope coefficients in the model are the same across response categories (and lines of the same slope are parallel).

Since the ordered logit model estimates one equation over all levels of the response variable. The test for proportional odds tests whether our one-equation model is valid. If we were to reject the null hypothesis based on the significance of the Chi-Square statistic, we would conclude that ordered logit coefficients are not equal across the levels of the outcome, and we would fit a less restrictive model (i.e., multinomial logit model). If we fail to reject the null hypothesis, we conclude that the assumption holds.

In our case, the proportional odds assumption appears to have held because the significance of our Chi-Square statistic is  $.18 > .05$ .

we obtain a non-significant result which suggest that the odds are different between these different thresholds.

Test the null hypothesis that the odds for each explanatory variable are consistent across different threshold of the output variable. In our case we obtain a significant result which suggest that the odds are different between these different thresholds.

If this chi-square value is significant (which is the case here) then the use of Plum is unjustified

However, the test of the proportional odds assumption has been described as anti-conservative, that is it nearly always results in rejection of the proportional odds assumption (O’Connell, 2006, p.29) particularly when the number of explanatory variables is large (Brant, 1990), the sample size is large (Allison, 1999; Clogg & Shihadeh, 1994) or there is a continuous explanatory variable in the model (Allison, 1999).

### 3.5.3.6 Parameter estimates

Table 22 - RFR Parameter estimates

Parameter Estimates								
		Estimate	Std. Error	Wald	df	Sig.	95% Confidence Interval	
							Lower Bound	Upper Bound
Threshold	[RFR = 1,00]	-2,369	1,511	2,460	1	,117	-5,330	,592
	[RFR = 2,00]	-1,482	1,465	1,024	1	,312	-4,354	1,389
	[RFR = 3,00]	,137	1,445	,009	1	,925	-2,696	2,970
	[RFR = 4,00]	2,667	1,464	3,319	1	,068	-,202	5,536
Location	BHS	,994	,353	7,910	1	,005	,301	1,686
	BHI	-,382	,398	,921	1	,337	-1,163	,398
	BO	-,342	,506	,455	1	,500	-1,334	,651
	AGE	-,473	,206	5,275	1	,022	-,877	-,069
	DXP	,250	,197	1,612	1	,204	-,136	,636
	DIG	,051	,103	,250	1	,617	-,150	,252
	DE	-,131	,150	,766	1	,382	-,425	,163
	DG	-,265	,328	,653	1	,419	-,907	,377
	DLOSS	,587	,335	3,066	1	,080	-,070	1,245
	DGAIN	-,459	,584	,616	1	,433	-1,604	,687
	NSEQ	-,468	,533	,772	1	,379	-1,513	,576
	NLTV	,500	,159	9,874	1	,002	,188	,812
	NVAL	,014	,147	,009	1	,926	-,274	,302

Link function: Logit.

### 3.5.3.6.1 Definition of the Parameter estimates

**Estimate:** These are the ordered log-odds (logit) regression coefficients. Standard interpretation of the ordered logit coefficient is that for a one unit increase in the predictor, the response variable level is expected to change by its respective regression coefficient in the ordered log-odds scale while the other variables in the model are held constant.

**95% Confidence Interval –** This is the Confidence Interval (CI) for an individual regression coefficient given the other predictors are in the model. It is calculated as the Coef.  $(z_{\alpha/2}) * (\text{Std.Err.})$ , where  $z_{\alpha/2}$  is a critical value on the standard normal distribution. The CI is equivalent to the z test statistic: if the CI includes zero, we'd fail to reject the null hypothesis that a particular regression coefficient is zero given the other predictors are in the model.

**Std. Error:** These are the standard errors of the individual regression coefficients. They are used in both the calculation of the Wald test statistic, superscript p, and the confidence interval of the regression coefficient, superscript r.

**Wald:** This is the Wald chi-square test that tests the null hypothesis that the estimate equals 0.

**DF** These are the degrees of freedom for each of the tests of the coefficients. For each Estimate (parameter) estimated in the model, one DF is required, and the DF defines the Chi-Square distribution to test whether the individual regression coefficient is zero given the other variables are in the model.

**Sig.–** These are the p-values of the coefficients or the probability that, within a given model, the null hypothesis that a particular predictor's regression coefficient is zero given that the rest of the predictors are in the model. They are based on the Wald test statistics of the predictors, which can be calculated by dividing the square of the predictor's estimate by the square of its standard error. The probability that a particular Wald test statistic is as extreme as, or more so, than what has been observed under the null hypothesis is defined by the p-value and presented here.

### 3.5.3.6.2 Interpretation of the Parameter estimates for RFR

## **H1: The normative framework hypotheses: The adherence to a normative framework is associated with the investment rationales**

### **An Association between NLTV and RFR**

The Wald test statistic for the predictor NLTV is 9.874, with an associated p-value of 0.002. If we set our alpha level to 0.05, we would reject the null hypothesis and conclude that the regression coefficient for NLTV has been found to be statistically different from zero in estimating RFR, given that BHI, BHS, BO, AGE, DXP, DE, DIG, DG, DLOSS, DGAIN, NSEQ and NVAL are in the model.

NLTV: This is the ordered log-odds estimate for a one-unit increase in NLTV score on the expected RFR level, given the other variables are held constant in the model. If a subject were to increase his NLTV score by one point, his ordered log-odds of being in a higher RFR category would increase by 0,500 while the other variables in the model are held constant.

This result suggests that we therefore reject the null hypothesis H 1 The adherence to a normative framework is associated with the investment rationales.

## **H2 The behavioral framework hypothesis: The behavioral framework hypothesis is associated with the investment rationales**

### **An association between BHS and RFR**

The Wald test statistic for the predictor BHS is 7,910 with an associated p-value of 0.005. If we set our alpha level to 0.05, we would reject the null hypothesis and conclude that the regression coefficient for BHS has been found to be statistically different from zero in estimating RFR given that BHI, BO, AGE, DXP, DIG, DE, DG, DLOSS, DGAIN, NSEQ, NLTV and NVAL are in the model.

BHS: This is the ordered log-odds estimate for a one unit increase in BHS score on the expected RHI level given the other variables are held constant in the model. If a subject were to increase his BHS score by one point, his ordered log-odds of being in a higher RHI category would increase by 0.994 while the other variables in the model are held constant.

This result suggests that we therefore reject the null hypothesis H<sub>2</sub> The behavioral framework hypothesis is associated with the investment rationales

### **An association between the control variable AGE and RFR**

The Wald test statistic for the predictor AGE is 5,275, with an associated p-value of 0.022. If we set our alpha level to 0.05, we would reject the null hypothesis and conclude that the regression coefficient for AGE has been found to be statistically different from zero in estimating RFR, given that BHI, BHS, BO, DE, DXP, DIG, DG, DLOSS, DGAIN, NSEQ, NLTV, and NVAL are in the model.

AGE: This is the ordered log-odds estimate for a one-unit increase in AGE score on the expected RFR level, given the other variables are held constant in the model. If a subject were to increase his AGE score by one point, his ordered log-odds of being in a higher RFR category would decrease by -0.473 while the other variables in the model are held constant.

This negative association makes sense as we would expect that as more the subject age the less the subject will be motivated in investing for financial return given the time horizon of the subject is reduced. which is in line with the literature as at the time when this survey was taken.

This significant associations between age and rationale for investing for financial return and for capital gain also confirm Lutfi (2011) relationship between age and type of investment.

Finally, If we set our alpha level to 0.05, we would fail to reject the null hypothesis and conclude that the regression coefficient for the predictor BHI, BO, AGE, DXP, DE, DIG, DLOSS, DGAIN, NSEQ and NVAL. Have not been found to be statistically different from zero in estimating RHI given the respective predictor in the model.

# CHAPTER 4

## Discussion, Implications, Limitations and Contributions

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### 4.1 Discussion and Implication

The major theoretical findings of the present research are discussed in this chapter.

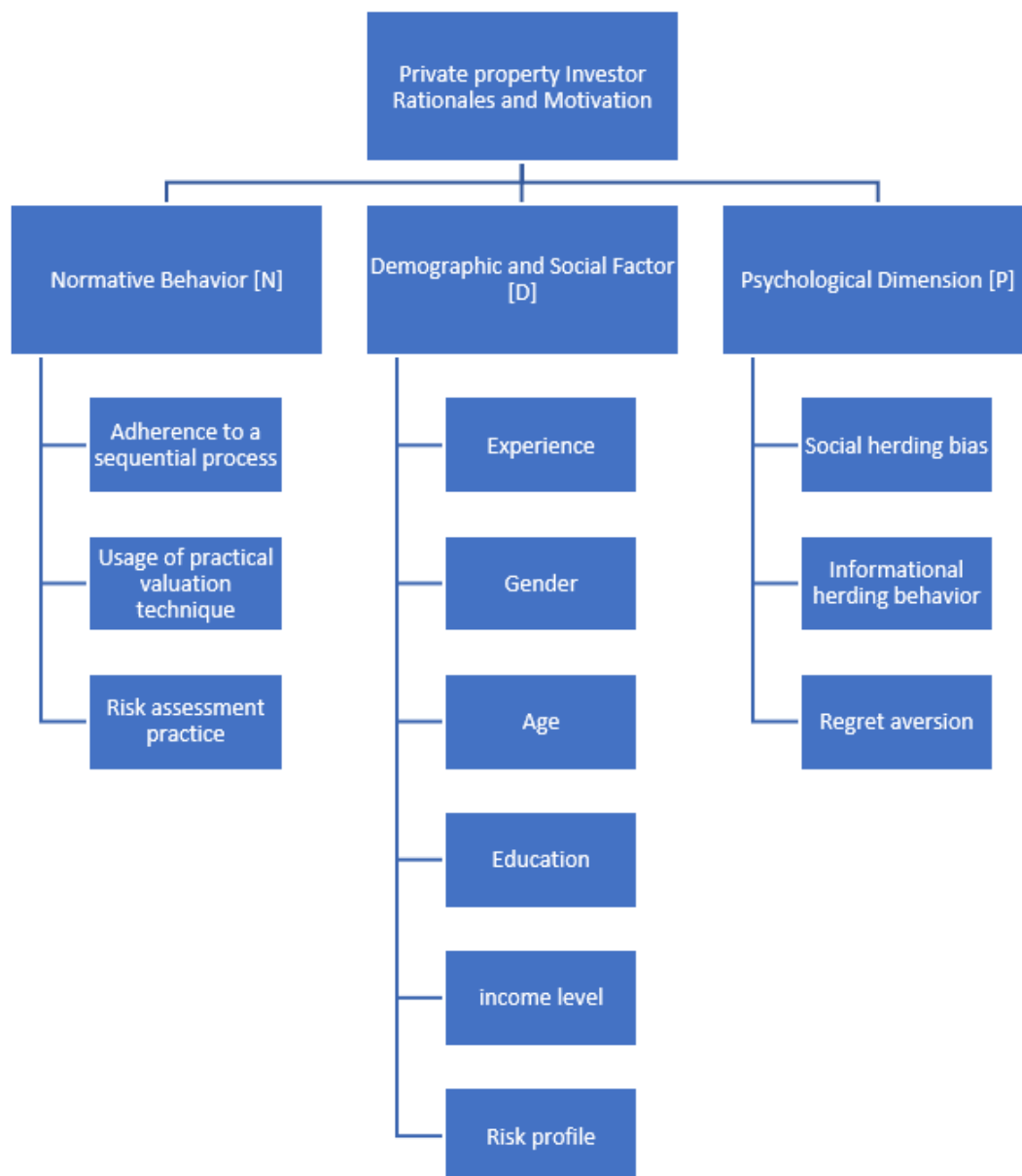
First, the discussion synthesizes the present quantitative findings by putting forth the NDP conceptual framework reflecting the identified association between the behavioral framework psychological dimension and the rationale for property investing, including how the social herding concept is associated with the motivation for investing for capital gain, for financial return and for hedging against inflation, and how social and demographic investor dimensions impact the motivation for investing.

Based on the study findings, the research proposes a NDP bounded rationality conceptual framework, where the Normative dimension (N), investors demographic traits (D) and psychological dimension (P) are components and drivers of the rationales for investing and ultimately the motivation and individual intention to investing in a property.

Then, further research opportunities are presented for the concepts discussed in the Behavioral framework.

#### 4.1.1 The NDP, a bounded rationality conceptual framework

Figure 15 - The NDP, a bounded rationality conceptual framework



The NDP” bounded rationality conceptual framework contends that Normative dimension (N), Investors demographic traits (D) and the investor psychological dimension (P) are components and drivers of rationales for investing in a property for an individual investor.

The framework is in line with the research on bounded rationality by Tan et al. (2018) which imply that the investors are affected by bounded rational behaviors such as herding

Likewise, to Tan et al. (2018) our proposed framework argues that the psychological dimension affects the rationale for investment in a property. Our research empirically identifies a positive association between social herding and the rationales of investing for financial return, investing for a capital gain, investing for hedging against inflation.

Ordered logistic regression allows us to see in a sample the relationship between rationales for investing, rationales of investing for financial return, investing for a capital gain, investing for hedging against inflation, normative behavior, and psychological dimensions that are referred to as behavioral biases in the literature

Our results reveal significant associations between social herding and each rationale for investing, namely, investing for financial return, investing for capital gain, and investing for hedging against inflation.

The results also show an association between the risk metric Loan-to-value measurement's normative behavior with the rationales of investing for financial return, investing for a capital gain, and investing for hedging against inflation. Therefore, the results suggest that the investors use the normative behavior that is the adherence to a risk metric measurement when investing for these three conceptualized rationales while at the same time exhibiting social herding.

The proposed framework also proposes that the adherence to a normative behavior such as the risk metric Loan-to-value measurement's is a component of the motivation to invest in a property.

On the control variable side our results reveal significant associations between age and rationale for investing for financial return and for capital gain which confirm Lutfi (2011) identified relationship between age and type of investment. where relatively young investors, those whose age are not older than forty years old, are more active in their investment than the old investors. These young investors want to accumulate wealth for their long future lives, and therefore they choose riskier assets with higher expected returns than less risky asset such as cash on bank accounts.

As well as a negative association between education and rational for investing when inflation is high which is in line with the literature as at the time when this survey was performed the inflation was very low and (Bruin, 2011)

De Bruin and al. (2001) investigate the notion of limited rationality as applied to real estate investors, which represents a shift away from the neoclassical "homo economicus" concept, which demonstrates maximization and consistency based on perfect knowledge. The aim was to recognize imperfect knowledge and satisficing behavior.

In their paper, Tan et al. (2018) propose six limited rational behaviors that can be used to investigate the decision-making behavior of individual real estate investors. The bounded rational behaviors explored include (1) availability, (2) grounding, (3) the endowment impact and risk aversion, (4) herding, (5) overconfidence, and (6) status quo bias.

In their research, the authors look into a wide range of behavioral biases under limited rationality.

#### **4.1.2 Future research opportunity:**

Due to the limited amount of extant research on private investor property investment behavior, a future research opportunity exists for analyzing the adherence to normative valuation practice capacity as a driver of rationales for property investment.

In fact, this type of research would integrate the concept of financial literacy.

Future research may also benefit from an exploration of regret aversion bias and the multiple Bias encountered in the behaviorist framework literature at the level of the individual property investor

## **4.2 Limitations and Contributions**

### **4.2.1 Limitation of the present research**

The present research has limitations in the quantitative components. First, quantitative research is based on self-assessment surveys, and as such, bias might exist in the measurement instrument used as the basis for the research.

As the survey tool is self-reporting, bias is present in the way respondents answer questions. This question has implications for the validity of the research.

To mitigate this bias and to ensure full compliance of the respondents an incentive fee upon completion of all questions was awarded. Incentive fee was provided only when all questions were properly answered and data reviewed. Nevertheless, a bias may remain in question the validity of the answer.

Second, quantitative research is limited to a snapshot taken at a particular point in time. Our survey was taken in 2017 in a low inflation context.

While the research data is current, it is suggested that longitudinal research is needed to confirm possible limitations due to the static nature of the quantitative data.

For example, new research could be conducted in a high inflation context and see whether we obtain contradictory result to the verified hypothesis that the higher educated will less invest in a property for the hedging against inflation motive in time when the inflation is low which imply a level of financial literacy likely obtained from education.

Third, NDP bounded rationality conceptual framework used for quantitative research is based upon a predefined set of normative and psychological behavior, as well as social and demographic traits subject to bias. Based on the extant literature review, we selected three normative behaviors: The use of a measure of risk metric, the use of a financial return metric, and the sequentiality in the decision-making process.

While these measures allow us to measure the adherence to normative behavior, they are not exhaustive and only reflect the main theme found in the extant literature review.

Similarly, the three rationales for investing are investing for financial returns, investing for a capital gain, and investing for hedging against inflation does not constitute an exhaustive list of all the motivations of the property investors to invest in real estate but rather a reflection of the important rationales for investing found in the extant literature review.

While these behaviors have been found in the literature to be present in the decision-making process of a property investor, the questions arise, whether other relevant behavior should be included as variables to accurately the determinant of the property investment.

A limit of this thesis is therefore that we do not measure all the behavioral biases identified in the extant literature but rather focus on herding and loss aversion bias. The reason why we specifically focus on these two behavioral biases is that they appear to have, according to the extant literature, an important impact on the property market especially when it comes to real estate bubble.

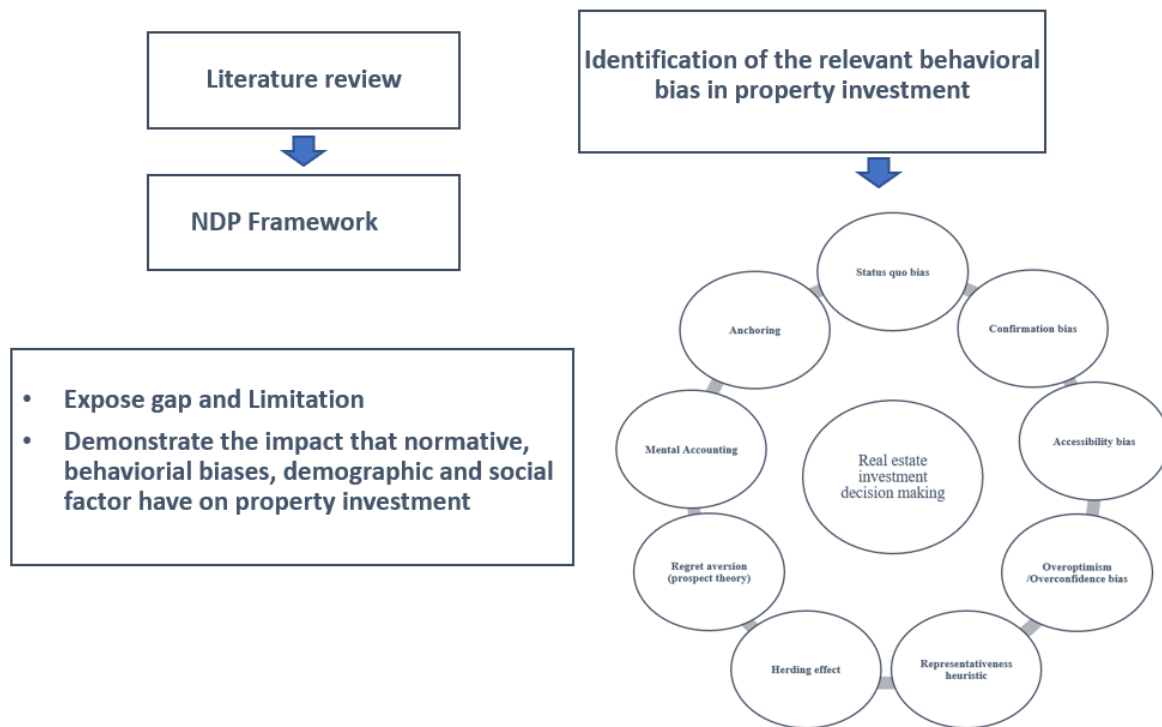
Lastly, potential bias exists in the quantitative data due to the size of the sample  $n=150$  of individual analyzed. Surveying a more important population might lead to relevant result and more research is required to address the issue and confirm the extendibility of the findings.

## 4.2.2 Contribution of this research

The present study offers theoretical, empirical, and practical contributions.

### 4.2.2.1 Theoretical Contributions:

Figure 16 - Theoretical importance of present research

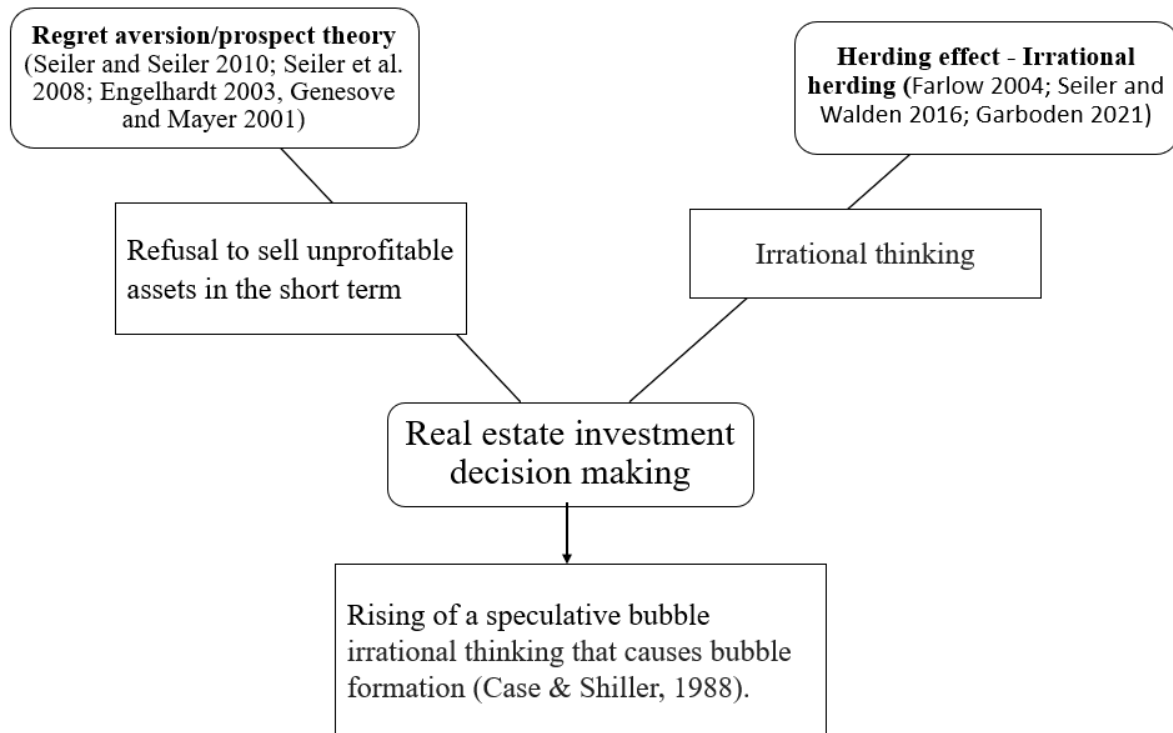


The results of the literature review included in Chapter 2, the proposed NDP conceptual framework, and the identification of bias relative to property investment are of theoretical importance.

The literature review completed in the present research is of theoretical importance because it identifies thirty-four relevant research in the field of property investment

Concerning psychological bias, the present research proposes that once the bias that applies to property investment are identified, they can be mitigated for better judgment and decision-making at the level of the private investor. It also highlights how biases such as irrational

herding and regret aversion can affect real estate decision making and cause the rising of a speculative bubble.



#### 4.2.2.2 Empirical and practical Contributions:

The chapter calls for making the findings on the psychological dimension of real investment available to the private real estate investor to help them make optimal decisions and lists the theoretical, empirical, and practical contributions of the current study

Figure 17 Empirical Contributions



As depicted in figure 17, the current study provides empirical contributions, including its demonstration of an association between social herding and rationales for investing that can ultimately lead to a bubble in real estate, as advocated by Case & Shiller (1988)

Our results reveal significant associations between social herding and each rationale for investing, namely, investing for financial return, investing for capital gain, and investing for hedging against inflation. Therefore, the private investor needs to be careful not to be affected by these biases. Additionally, the negative association between age and investment motivation should be taken by the investor into consideration as the more they age the more likely they will avoid investing in real estate.

These significant associations between age and rationale for investing for financial return and for capital gain also confirm Lutfi (2011) relationship between age and type of investment.

The results also show an association between the risk metric Loan-to-value measurement's normative behavior with the rationales of investing for financial return, investing for a capital gain, and investing for hedging against inflation. Therefore, the results suggest that the investors use the normative behavior that is the adherence to a risk metric measurement when investing for these three conceptualized rationales while at the same time exhibiting social herding. The proposed framework also proposes that the adherence to a normative behavior such as the risk metric Loan-to-value measurement is a component of the motivation to invest in a property.

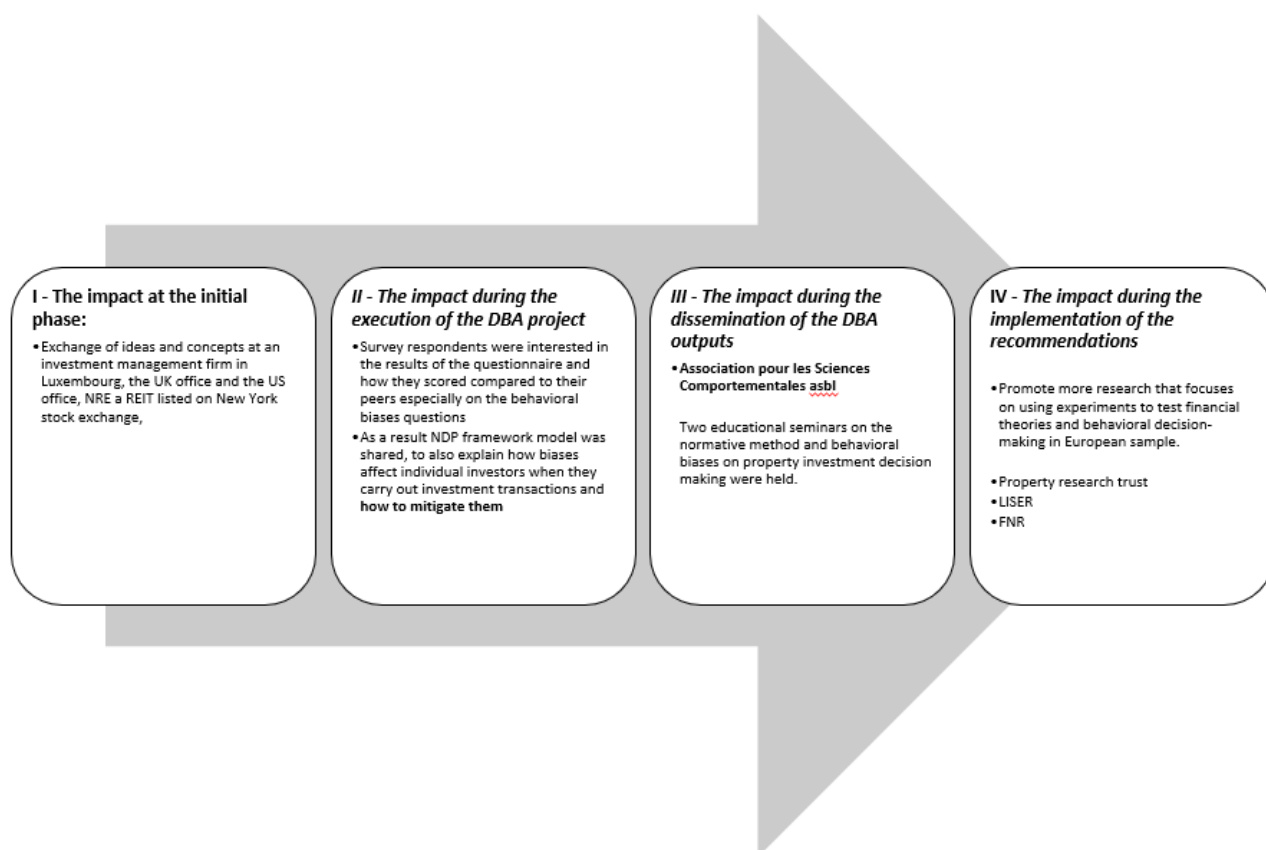
Our research represents a contribution for the private investor that is not aware of the implication of potential behavioral biases that can affect the investment decision; these biases are summarized in the below figure and described in chapter 2.

While practical contributions are an essential aspect of research, the impact of the research is an important aspect and is developed on the next section.

### 4.2.2.3 An evaluation of the impact of this research

The impact of a DBA project can be measured during four different phases the initial phase, the execution phase, the dissemination phase, and the implementation of the recommendation phase Kalika (Beaulieu & Kalika, 2017)

Figure 18 - Evaluation of the impact of this research



#### ***I - The impact at the initial phase:***

Firstly, during the initial phase where the research was undertaken, an important amount of interrogation took place within my organization, mainly with my colleagues in Luxembourg, the UK office, and the US office of our investment management firm.

The main interrogation was why investment firm, when it comes to property investment, do not follow the so-called “textbook approach” and sometimes makes decision based on intuition the so-called “gut feeling”.

This deviation from a normative and rational decision-making process made me research various publications on property investment decision-making and share my ideas with my firm NorthStar realty group, back in 2018.

My colleagues from the portfolio management desk shared their methods for analyzing a property investment and there were reciprocally quite interested in my research and more importantly, on how a behavioral framework could be a determinant of the decision-making process.

## ***II - The impact during the execution of the DBA project***

The execution phase of the research was characterized by the administration of a questionnaire.

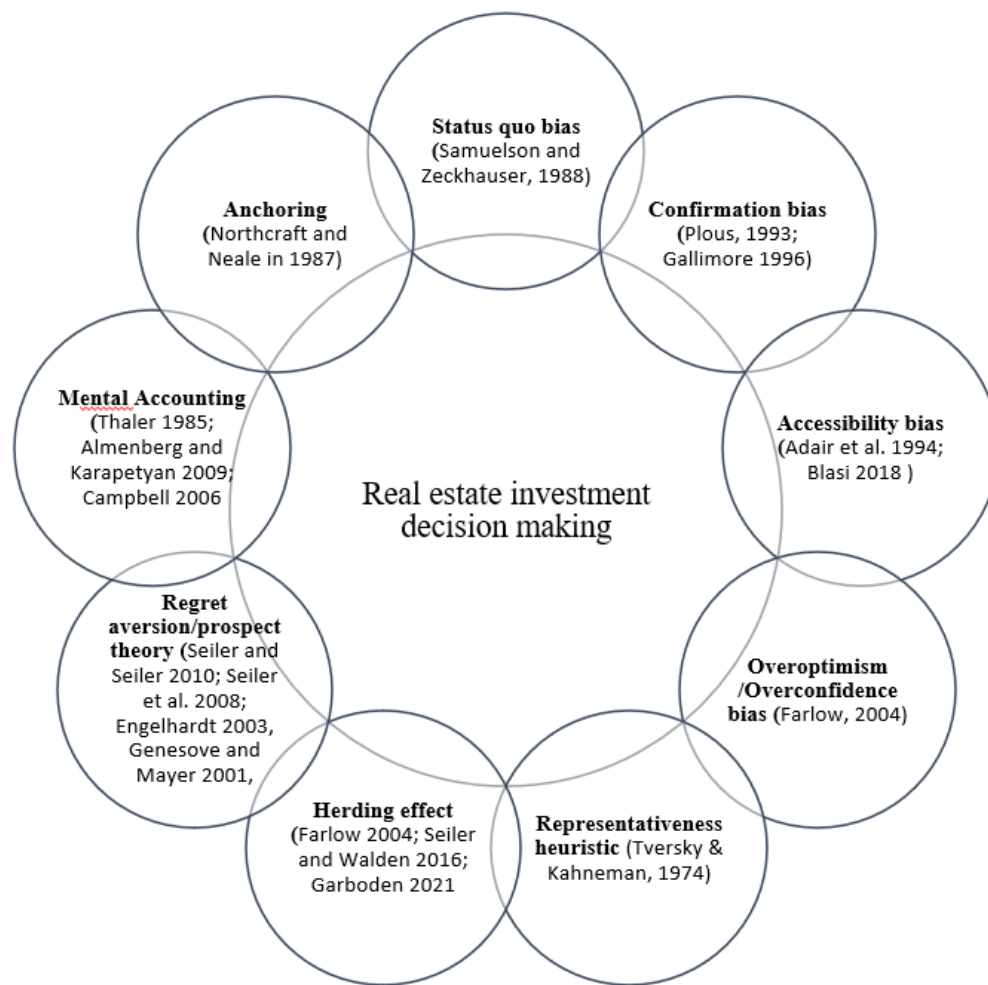
This collection of empirical field data was administered to fully employed UK resident individuals.

Interestingly few of these individuals were quite interested in the results of the questionnaire and how they scored compared to their peers. The reason why is that the survey contained questions that measures behavioral bias as well as question that measure the level of adherence to normative process when it comes to property investment.

An important number of respondents requested more information on the behavioral biases that, according to the literature, can affect property investment decision-makers.

In order to answer the request from the interested respondents both the results and the figure 12 “Behavioral bias encountered in the literature review, “were shared:

Figure 19 - Behavioral bias encountered in the literature review; source: the author



Knowing how one score in these questions can help to self-assess the determinant of decision-making in the context of property investment and can be pretty valuable in real life.

### ***III - The impact during the dissemination of the DBA outputs***

The dissemination of the research outputs is likely to influence managers in their managerial practices.

In this case, a Luxembourgish society “Association pour les Sciences Comportementales” was created in 2018 with few practitioners of the fund industry in Luxembourg.

This society disseminate the idea developed in this thesis such as the behavioral biases in real estate investment for example.

#### ***Association pour les Sciences Comportementales asbl***

The association held two educational seminars in Luxembourg city with a very diverse attendance constituted of lawyers, accountants, and public servants.

The first seminar in July 2020, an educational seminar on the normative and rational framework on property investment decision-making. The second seminar in February 2021 on the behavioral biases on property investment decision-making. This association has also used the social network as an online communication channel since 2018.

#### ***IV - The impact during the implementation of the recommendations***

Following the result obtained on the UK sample, we contacted the property research trust to receive funding in the UK and propose research on a more important sample. Partnership with the property research trust would also lead to more visibility and recognition of the NDP framework as well as alerting individuals on the behavioral biases and ultimately explaining how biases affect investors when they carry out investment transactions and how to mitigate them.

Likewise, the LISER in Luxembourg is an organization that studies socio-economic pattern in Luxembourg the person in charge of the real estate study was contacted to participate to an upcoming seminar on an individual investor with the Association pour les Sciences Comportementales asbl where the NDP framework would be presented. The goal is to replicate this type of study on the Luxembourg property market.

Finally, an application for funding by the FNR a national organization that promote research in Luxembourg, was made in order to finance more research on research focuses on using experiments to test financial theories and behavioral decision-making in a European sample. The figure 20 summarize the main recommendation by players

Figure 20 - Recommendations and players

Recommendations	Players
Education on the determinants of the investment when investing in a property by introducing the NDP framework and explain how biases affect individuals investors when they carry out investment transactions and how to mitigate them	Individuals investing on the property market
Education on the influence of behavioral biases that can affect decision making	Managers in investment management firms
Focuses research on using experiments to test financial theories and behavioral decision-making in European sample	National research organisation: - LISER Luxembourg Institute of Socio-Economic Research - FNR Luxembourg National Research Fund
Promote further research the Empirical link between social herding and each rationale for investing in the UK	International organizations such as the Property research trust in the UK

# CHAPTER 5

## Conclusion

---

This research specifically focuses on two major themes, the investment decision and the property investment theme. This research posits that the investment decision at the individual level impacts the property and property market bubble formation, which ultimately is relevant to government planning and policies.

Even if the option to invest in real estate appears as a secure investment it is less secure than other asset class such as government bonds that are typically used to determine the risk-free rate in the valuation process and net present value determination.

This mean that investing in real estate is riskier than it seems and the private investor should be using hedging instrument to protect the value invested in case of a bubble burst or a brutal decline of real estate price such as the 2008 subprime crisis.

Based on the study findings, the research proposes a “NDP” bounded rationality conceptual framework, where Normative dimension (N), psychological dimension (P) and investors demographic traits (D) are components and drivers of rational for investing and ultimately the motivation and individual intention to investing a property.

This research gives credence to the concept of bounded rationality which posits that the investors do not come out to be irrational but rather cognitively bounded and would rather work with ordinary heuristic frameworks rather than a comprehensive ordinary equilibrium model.

Our research confirms the epidemy hypothesis from Shiller 2005. arguing that the current home price boom is best thought of as a social epidemic: “a fad of sorts”. And yet social epidemics are not even mentioned by most of those who say reassuringly that there is no reason to worry about the property price. The Social epidemics can unwind sharply as the psychology changes, suggesting the worrisome possibility of a rather hard landing. When speculative bubbles begin to emerge, it is important for policymakers to understand the loss aversion bias as well as the social herding component, whether it originates from peers, from real estate expert or from third party actors that in one way or another would benefit from such behavior.

Understanding the link between the motivation for investing, the normative and psychological dimensions will help the private investor avoid making biased decisions and risking financial distress through negative equity.

The present research explores the association between the psychological and normative dimensions. The findings make an important contribution to the field of real estate decision-making by using the normative behavior from the literature on investment professionals as a benchmark to test the adherence to normative behavior and the rationality of the private investor.

In this thesis, we finally advocate that behavioral economics used in conjunction with the rational framework in real estate investment can be used to generate theoretical insights, make predictions of field phenomena, and ultimately suggest better policy in an attempt to mitigate the conditions that contribute to the build-up of real estate bubbles and market vulnerabilities more efficiently.

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# APPENDICES

## Annex 1 - Literature Review Methodology

### Protocol and training

The team conducting this lit review and their qualifications to review this topic is constituted by Zahreddine Bouslama experienced finance and investment professional. The skills needed for the review are familiarity with the investment framework as well as management science theories.

### Practical screen

The research articles are evaluated by scanning available published journals, conference papers, working papers, and other published literature for terms linked to property investment analysis within the perspective of rationality and behavioral economics. These articles were gathered over the years, beginning with the most introductory paper published in 1952, which laid the groundwork for this field and ending with the most recent studies (2021). These publications are divided into three categories: concept-wise, year-wise, and author-wise, using an excel sheet. In addition, we have included all research instruments that writers have utilized for primary and secondary data in our table.

This study aims to look over the real estate investment literature to see what factors influence the investing decision-making procedure. Publications that provide rational and normative models in the investment decision-making process and articles that describe biases in investment decision-making are the types of articles to seek for.

Journal rankings were not restricted (see II.2), and the publications databases used were EBSCOhost, JStor, Emerald Insight, Elsevier, and Google Scholar.

"Real estate investment decision making" and "Behavioral biases," "Real estate investment choice-making," and "Descriptive model," "Real estate investment decision making," and "Normative model" were the keywords used to find the publications.

### 1. Data extraction

Data extraction was performed using a three-step process: First, the title of the article and abstract are screened. Then, if the articles are relevant to the topic, the research questions are analyzed. Finally, the findings are analyzed.

The data collected from these articles are then captured in the Docear software database to allow navigation between articles. Each article is also accordingly classified using the mindmap software Docear to allow concept visualizations.

### 2 Quality appraisal

Following **Bandara (2015)** recommendation on quality appraisal. It was formerly thought that the best way to assess the quality of scientific research was to utilize journal ranking lists and only select papers with sources above a specific relevance factor level.

After collecting all the impact factors, it quickly appeared that this methodology is impracticable, given that real estate investment is a multidisciplinary field. In fact, the real

estate investment literature can be found in finance, accounting, valuation, decision theory, property, and psychology journals. It confirms the findings of **Gallimore (2000)**, showing that the literature on investor decision-making behavior in property investment is sparse and loosely integrated.

The methodology used was, therefore, to research and appraise how the authors built the arguments. This is done using a 4 steps approach following **Toulmin (1958)**, the method of argumentation. Each paper is screened for claims, evidence, warrant, and evidence provided.

Additionally, the epistemology of each article is analyzed, although it appeared that all the articles surveyed have a positivist approach confirming the findings of **O'Donnell (2011)** on the dominance of positivism epistemology in investment literature.

Finally, each article's future work recommendation is analyzed and recorded.

### **3. Synthesis approach**

In our case of theory reviews, the principle is to accumulate the existing theories related to prior initial theories. Summative theory-building is, therefore, the approach taken. Following **Webster and (Watson 2002)**, A concept matrix is used to classify the articles according to the emerging concepts. The rows represent the articles, while concepts and relationships will be reflected in the columns.

### **4. The leading real estate outlets and their specific topic**

Real estate as a field of research is studied through different topics depending on various variables such as the journal editorial line, the university affiliation, the authors' affiliations, and other monetary considerations such as fundings.

Real Estate Economics, Journal of Real Estate Finance and Economics, and Journal of Real Estate Research are the main journals in real estate studies. These three publications are regarded as the "core" publications in the area because they are entirely focused on real estate issues (Dombrow and Turnbull, 2002).

Winson-Geideman and Evangelopoulos (2013) analyzed and compared the body of research in real estate from 1973 to 2010 by comparing the three leading real estate publications. The authors identified that the leading journals do focus on specific fields within real estate:

The Journal of Real Estate Finance and Economics focuses on finance, preferring topics such as mortgage termination options, market integration/co-integration, default and foreclosure, lending, and adjustable-rate mortgages.

Some of these topics are also preferred by Real Estate Economics. However, it emphasizes those directly related to the homeownership decision (homeownership, mortgage termination options, default and foreclosure, lending, adjustable-rate mortgages, and inflation).

Finally, the Journal of Real Estate Research follows a distinct set of topics, including corporate real estate, brokerage, retail, office, and real estate portfolios.

The author also discovered that 11 subjects are common among publications, forming the core of real estate research. Research methodology, REITs, brokerage, urban land, rent, appraisal, taxes, capital and leverage, real estate journals, auctions, and leases are some of the issues covered.

The authors finally observe that the amount of publication on REITs is disproportionate compared to other research fields. According to the author, this is likely due to the easiness of acquiring data on REITS, as these are listed on the stock exchange.

Furthermore, Harrison (2006) investigates the most researched topic in real estate. Between 2000 and 2006, the authors examined the most researched subject and patterns in three leading publications, Real Estate Economics, Journal of Real Estate Finance and Economics, and Journal of Real Estate Research. They discovered that the most commonly occurring concepts for assessment were related to investment and appraisal actions, housing, and government policy/planning. Whereas the current popularity of specific issue fields appears to have remained consistent over time, there seems to be an indication of considerable involvement in academic real estate studies by both practitioners and international (i.e., non-US) academic institutes. Property valuation and housing as the principal theme are further confirmed by Hoesli (2016), that found that the three most important themes explored appear to be property valuation, housing, investment, and portfolio management.

This research specifically focuses on two major themes, the investment decision, and the housing theme. This research posits that the investment decision at the individual level impacts the property and housing market bubble formation, which ultimately is relevant to government planning and policies.

Decision-making in property investment is typically explored in the extant literature using a rationalist and a behavioralist framework.

## Annex 2 - Questionnaire administered on 2.5.2020

<b>Annex 2 - questionnaire administered on the 2.5.2020</b>
<i>1- Timestamp</i>
<i>2- The data will be used for research on investors' behavior. It will be stored digitally for an undefined period of time the anonymity of responses will be maintained. The participant can withdraw their consent and their data by sending a simple email via prolific.</i>
<i>3- Please state your prolific ID</i>
<i>4- What is your employment status?</i>
<i>5- I would invest in a property because the property value increase over time</i>
<i>6- I would invest in a property because it gives an attractive financial return.</i>
<i>7- I would invest in properties as an investment instrument to hedge against inflation.</i>
<i>8- I would invest in a property for my own dwelling without thinking about the property appreciation over time</i>
<i>9- I am aware of the risk-free rate for investing my money available to me in the UK. Please state the rate in % (if no idea about the rate just state "0")</i>
<i>10- For investing in real estate property, I first establish my required risk level (for example from Low risk, Medium Risk and High Risky investments)</i>
<i>11- I believe it makes sense to borrow money to invest in real estate when the borrowing interest rate is low</i>
<i>12- You purchased an investment property five years ago for GBP 400,000. Today, the home was sold for GBP 600,000. You just learned that two years ago, you could have sold the home for GBP 700,000 and made even more money. You were completely unaware of the potential additional gain before - Assess your regret on a scale from 1 to 5</i>
<i>13- You learned two years ago that you can sell at GBP700,000 but you did not sell two years ago because you thought the home's price would continue to increase - Assess you regret on a scale from 1 to 5</i>
<i>14- In an XXXX form please write what is the current time (eg. 1409 means it is 14h and 9min).</i>
<i>15- What is your estimate of the future price of 1g of gold in GBP on 15 February 2020</i>
<i>16- Pick a high value, such that you are 99% sure (but not absolutely sure) that the Gold price will be on 15 February 2020 will be lower than that value</i>

17- Now pick a low value, such that you are 99% sure (but no more) that the gold price will be on 15 February 2020 will be higher than that value
18- Rate your expertise in real estate
19- You have been considering investing some of your savings on the stock market. Before you have not had any experience investing due to a lack of knowledge. While talking to your colleagues you have seen that most of them have invested their money in the stocks of an XY company. How would this notion affect your decision whether to invest as well or not?
20- You have been considering investing some of your savings on the stock market. Before you have not had any experience investing due to a lack of knowledge. While talking to your colleagues you have seen that most of them have invested their money in the stocks of an XY company and that they possessed a very good grasp of the financial information published by the company. How would this notion affect your decision whether to invest as well or not?
21- I like to use a valuation method to evaluate the price of a property (please state the method name or "0" if none)
22- I use my "gut feeling" to evaluate a property
23- I use the value of a comparable asset that was recently sold as a benchmark to evaluate a property
24- I use a financial indicator such as IRR (Internal Rate of Return) and Discounted Cash Flow) to evaluate a property
25- Please state your age
26- With numbers, 1 to 4 please rank your preferences when it comes to the investment or saving options (1 shows your most favorite option and 4 your least favorite) [Real estate]
27- With numbers, 1 to 4 please rank your preferences when it comes to the investment or saving options (1 shows your most favorite option and 4 your least favorite) [Cash deposit]
28- With numbers, 1 to 4 please rank your preferences when it comes to the investment or saving options (1 shows your most favorite option and 4 your least favorite) [Shares]
29- With numbers, 1 to 4 please rank your preferences when it comes to the investment or saving options (1 shows your most favorite option and 4 your least favorite) [Bonds]
30- Which income group do you belong to in (GBP per year)?
31- Please state your level of education
32- Please state your gender
33- When I think about a property investment decision
34- With numbers, 1 to 4 please rank how you would consider a real estate investment (1 shows your first step and 4 your last step). Answering is not required if you rather rely on your instincts [first step]

<i>35- I establish my purpose and rationale for the investment by setting my property investment goal and decision criteria</i>
<i>36- I evaluate the consequences of the decisions taken earlier, draw conclusions, revise goals and criteria</i>
<i>37- I collect information from various sources on real estate investments to Search for investment opportunities</i>
<i>38- I evaluate, compare and rank the alternatives in terms of the quantified expectations of risk and return and I choose the most satisfactory alternative;</i>
<i>39- I would consider the importance of Mortgage Loan to Value Ratio (LTV) before making a decision to invest in a residential property.</i>
<i>40- Choose between: 100% chance of losing 1,000 GBP/Gamble with 50% chance of no loss and 50 % of 2,500 GBP loss</i>
<i>41- Please provide detailed feedback on this survey. Any difficulties? Which questions were difficult to understand and why? Is 10min enough to complete the study?</i>
<i>42- I would like to invest in a real estate property</i>
<i>43- Please state your postcode</i>
<i>44- Choose between A 100% chance gain of 1,000 GBP/Gamble with 50% chance of getting 2,500 GBP and 50% chance of getting nothing</i>