

**KAROLINA KOBETS**

**BEHAVIORAL ECONOMICS AND REAL ESTATE BUBBLES:  
A SYSTEMATIC LITERATURE REVIEW**



**UNIVERSITY OF ALGARVE**

Faculty of Economics

2019

**KAROLINA KOBETS**

**BEHAVIORAL ECONOMICS AND REAL ESTATE BUBBLES:  
A SYSTEMATIC LITERATURE REVIEW**

**Master in Financial Economics**

**The final work is carried out under the supervision of:**

**Professor Doutor Jorge Miguel Lopo Gonçalves Andraz**

**Professor Doutor Luís Miguel Serra Coelho**



**UNIVERSITY OF ALGARVE**

Faculty of Economics

2019

**BEHAVIORAL ECONOMICS AND REAL ESTATE BUBBLES:  
A SYSTEMATIC LITERATURE REVIEW**

**Work Authorship Declaration**

I declare to be the author of this work, which is unique and unprecedented. Authors and works consulted are properly cited in the text and are in the listing of references included.

**Karolina Kobets**

-----  
(signature)

## Copyright

© **Copyright:** (*Karolina Kobets*)

The University of Algarve reserves the right, in accordance with the provisions of the Portuguese Copyright and Related Rights Code, to archive, reproduce and make public this work, regardless of means used, as well as to broadcast it through scientific repositories and allow its copy and distribution with merely educational or research purposes and non-commercial purposes, provided that credit is given to the respective author and Publisher.

## RESUMO

O fenómeno de bolhas especulativas possui uma longa história, documentado pela primeira vez em 1637, associado ao episódio histórico da Mania das Tulipas. Após esse evento, a nossa sociedade tem enfrentado inúmeras bolhas, surgindo maioritariamente no mercado de acções e mercado imobiliário. As bolhas imobiliárias mais famosas são: a bolha imobiliária Japonesa da década de 80 e a bolha imobiliária dos Estados Unidos, no início dos anos 2000. Estes fenómenos de preços tiveram um impacto devastador não só na economia dos países em questão, como também na economia de outros países.

Até agora, bolhas especulativas constituíam uma área de estudo carente de investigação, onde certos conceitos ainda se encontram por definir, e um relato claro dos factores que influenciam e aceleram o fenómeno de bolhas especulativas está em falta.

Observações empíricas provam que as teorias clássicas e conceitos fundamentais da literatura financeira ficam aquém de uma explicação da natureza de bolhas especulativas.

Diversos argumentos relacionados com estes fenómenos foram propostos, mas acordo entre especialistas ainda não foi aceite. Por exemplo, Rober Shiller (2004) acredita que irracionalidade exuberante foi proclamada como uma das principais forças por detrás do surgimento de uma bolha no mercado imobiliário Estadunidense, nos anos 2000. Por volta da mesma altura, Eugene Fama (2010) expressou cepticismo acerca da existência deste fenómeno, motivado pelo facto de que prever e evitar bolhas não é possível.

A teoria de economia comportamental emerge como uma estrutura teórica que possibilite o enquadramento do fenómeno de bolhas na literatura, melhorando assim os estudos efectuados nesta área.

O conceito básico da teoria comportamental é o de que participantes num mercado financeiro são por natureza irracionais e sofrem de preconceitos a nível psicológico, resultando em decisões monetárias que aparentam irracionais, especialmente quando as condições de risco e incerteza são tidas em conta. Economia comportamental baseia-se na Teoria da Perspectiva, desenvolvida por Kanheman e Tversky in 1979, e oferece uma alternativa à existente Teoria de Utilidade Expectável. A ideia principal é a de que os participantes do mercado são irracionais por natureza. Outros conceitos de teoria

comportamental são: os limites da arbitragem, como alternativa à Hipótese do Mercado Eficiente; os limites psicológicos e preconceitos cognitivos dos participantes do mercado.

Apesar do campo das finanças comportamentais se encontrar bem estabelecido, prevalece ainda a abordagem de racionalidade perante um mercado e a dificuldade em quantificar fenómenos psicológicos e sociológicos, inerentes à noção de “exuberância irracional”, que contribuem para a escassez de estudos comportamentais. Quando aplicado ao mercado imobiliário, o número de estudos é cada vez mais restrito. A razão principal encontra-se nas características específicas do mercado, que dificultam a colecção de informação estatística suficiente para efectuar estudos empíricos.

Esta dissertação representa uma revisão sistemática da literatura pertinente à aplicação da teoria comportamental e conceitos associados de modo a compreender e explicar a natureza de bolhas imobiliárias. Os objectivos principais da revisão sistemática são:

1. Efectuar uma revisão da literatura existente acerca destes dois tópicos, bolhas imobiliárias e teoria comportamental, de modo a definir a questão de investigação e especificar as palavras-chave mais apropriadas para a selecção dos artigos;
2. Apresentar uma estratégia de selecção dos artigos mais relevantes relacionados com a questão de investigação, que é a aplicação de teoria comportamental ao estudo da natureza das bolhas imobiliárias;
3. Definir e discutir os resultados mais importantes da selecção de artigos relacionados com o tópico;
4. Definir as oportunidades e desafios para futura investigação empírica relacionada com o tópico.

A metodologia utilizada foi uma revisão sistemática da literatura, que procura minimizar as fraquezas presentes na revisão tradicional da literatura. Revisões sistemáticas são formas rigorosas e transparentes de rever a literatura. Envolvem identificar, sintetizar e avaliar todas as evidências disponíveis, quantitativas ou qualitativas, de modo a gerar uma resposta robusta e empiricamente derivada que responde à questão de investigação.

Cada passo do processo de selecção está presente de acordo com o protocolo padrão de uma revisão sistemática. Os critérios de inclusão e exclusão encontram-se igualmente presentes e são estritamente seguidos durante a selecção dos artigos.

A pesquisa actual começa no estudo da literatura existente relacionada com os dois tópicos do trabalho, que são: economia comportamental e bolhas no mercado imobiliário.

O objectivo principal é avaliar todo o conhecimento existente em ambas as áreas de modo a definir as possíveis lacunas neste conhecimento e como é que a aplicação de teoria económica comportamental pode auxiliar no entendimento da natureza das bolhas. A motivação principal para tal sinergia entre as duas áreas é o facto de que teorias económicas tradicionais não são suficientes para explicar bolhas especulativas como fenómenos.

A revisão sistemática da literatura foi possível utilizando como recurso a base de dados *Web of Science*. A extensão inicial de artigos encontrados com a aplicação das palavras-chave foi de 936 artigos. A aplicação de critérios de exclusão, parcialmente feita com o uso de filtros proporcionados pela própria base de dados (linguagem, tipo de documento, área científica), e através da leitura dos *abstracts* de cada artigo. O resultado da aplicação dos critérios de exclusão foi de 35 artigos. Os critérios de inclusão, aplicados ao ler cuidadosamente o texto de cada artigo na sua totalidade, levou à eliminação de 18 artigos. O conjunto final de artigos é composto por 17.

A síntese dos artigos seleccionados mostra que existem provas empíricas que corroboram a correlação entre factores comportamentais e variações de preços durante as bolhas imobiliárias. Encontrou-se provas de que a teoria comportamental pode se revelar eficiente em explicar a natureza da bolha e factores psicológicos devem ser incluídos nos modelos tradicionais de precificação de activos financeiros de modo a melhorar o conhecimento que se tem acerca das bolhas imobiliárias.

O desafio que surge da aplicação de conceitos comportamentais é o de que preconceitos psicológicos e seus efeitos são difíceis de medir e quantificar, e dados estatísticos difíceis de colectar. O mercado imobiliário, devido às suas particularidades, também apresenta algumas dificuldades em agregar dados estatísticos. Por exemplo, a baixa liquidez do mercado e certos limites nas transacções permitidas no mercado, restringem consideravelmente a quantidade de dados estatísticos necessários para uma investigação empírica.

*Palavras-chave:* bolhas especulativas; mercado imobiliário; economia comportamental; revisão sistemática da literatura.

## ABSTRACT

*Background:* The behavioral economics theory relies on the concept, that market participants are irrational by their nature and suffer from psychological limitations and cognitive biases. As a result, the money related decisions might be irrational and errored, especially if done under risk and uncertainty. According to the behavioral concept, the real estate market is partially represented by the unsophisticated households and speculative agents. The irrational behavior of such participants might cause sharp deviations of the house prices from the fundamental value and even cause the bubble. The traditional theories and fundamentals are not sufficient enough for studying the nature of the house bubbles. So, behavioral theory is seen as the useful framework for better understanding of the factors, that stand behind the bubble formation.

*Objective:* The goal of this dissertation is to assess the application of the behavioral economics theory to the explanation of the real estate bubbles nature.

*Method:* A systematic literature review was performed in order to identify and assess the application of behavioral economics theory.

*Results:* The initial search, based on the key words, showed 936 papers, that potentially referred to the studied topic. Among these papers, only 17 met our inclusion criteria. The analysis of the selected papers shows that the behavioral factors are correlated with the price deviations during the recent house bubbles and are able to improve the explanation of the nature of the phenomena.

*Conclusion:* After conducting the systematic literature review, we can sum up that behavioral factors should be implemented in the traditional asset price models to improve better understanding of the house bubbles' nature. The result of our literature review shows what has been done and what can be done in this field. In general, the narrow volume of the final set of the papers means the paucity of the existing studies on application of behavioral approach to the real estate bubbles. The reasons for that are: the prevalence of the traditional theories; complications related to measuring and quantifying the behavioral factors; the relatively low liquidity of the real estate market, that make it difficult to collect the sufficient set of statistical data.

*Keywords:* bubbles; real estate market; behavioural economics; systematic literature review

## GENERAL INDEX

INDEX OF FIGURES.....	xi
TABLE INDEX.....	xii
CHAPTER 1. INTRODUCTION.....	1
CHAPTER 2. BUBBLE AS THE PHENOMENA.....	3
2.1. The history of bubbles.....	3
2.1.1. Japanese housing bubble 1980s.....	4
2.1.2. USA housing bubble 2000s.....	5
2.2. What we know about bubbles.....	7
2.2.1. The history of the term.....	7
2.2.2. Defining bubble.....	10
2.2.3. Reasons behind the formation of the bubbles.....	11
CHAPTER 3. BEHAVIORAL ECONOMICS.....	12
3.1. Early contributions.....	13
3.2. Basic concepts.....	14
3.3. Behavioral real estate.....	18
CHAPTER 4. METHODOLOGY.....	20
4.1. About the systematic literature review.....	20
4.2. Systematic literature review: step by step.....	21
4.2.1. The strategy.....	21
4.2.2. The database.....	21
4.2.3. The keywords.....	22
4.2.4. The searching strings.....	24
4.2.5. The exclusion and inclusion criteria.....	25
4.2.6. Literature synthesis process.....	26
4.3. Results and findings.....	26
4.3.1. The searching strings.....	27
4.3.2. Exclusion criteria.....	27
4.3.3. Inclusion criteria.....	27
4.3.4. Papers included in the final review.....	28
4.3.5. Publication frequency.....	28
4.3.6. The science area and the ranking of the sources of publications.....	29
CHAPTER 5. DISCUSSION.....	32
5.1. Consumer Optimism and Confidence.....	32
5.2. Extrapolative expectations.....	35
5.3. Biased expectations.....	37

5.4. Money illusion.....	38
5.5. Discussion on results.....	39
CHAPTER 6. CONCLUSION.....	42
BIBLIOGRAPHY.....	47
Annex 1.....	50

**INDEX OF FIGURES**

Figure 4.1. Searching frames.....23  
Figure 4.2. Publications by year.....29

**TABLE INDEX**

Table 4.1. Keywords.....23  
Table 4.2. Final scope of publications.....28  
Table 4.3. Journal ranking.....31

## CHAPTER 1. INTRODUCTION

Throughout the history of our society, many times we could observe periods of a specific asset price behavior - first a sudden dramatic increase in the asset price and then almost immediately a crash back to a level close to the one observed before the increase. These periods are so dramatic that it is rational to have a specific term that refers to them. Such term appeared in the 18th century and is known as «bubble».

The term bubble brings a lot of discussion and certain disagreements. The main concerns around it are: a) the main characteristics of the phenomena (how much and how fast the prices should depart from the fundamental value during the increase and how fast should come the stage of decrease, as well as, the size of the decrease); b) the rationality of this phenomena; c) the factors and drivers for the bubble formation; d) the effective existence of bubbles as a phenomena.

For instance, Fama (2010) expresses his skepticism about the existence of such a phenomena and motivates his view by the fact, that we can not predict and avoid bubbles. Krainer (2003) in his research on the US house prices during the period 1982-2002, argues against the existence of the house bubble. He documents that the prices were not extremely out of line with their historical relationship with rental values, and relative balance in the housing market could be restored. At the same time, Case and Shiller (2003) and Shiller (2007a and b) argue that there were clear indicators of a bubble in the USA. Garber (1990) expresses his opinion about the rationality of the bubbles and argues, that even in the classical bubbles - the Dutch Tulipmania (1634-37), the Mississippi Bubble (1719-20), and the South Sea Bubble (1720) – the reasons for asset price increase were only the changes in fundamentals. The opposite opinion is represented by Stiglitz (1990): «if the reason that the price is high today is only because investors believe that the selling price will be high tomorrow-when "fundamental" factors do not seem to justify such a price-then a bubble exists».

The core issue in studying the price bubble is around the reasons and drivers, that cause its formation. The existing knowledge proves, that the traditional theories and the fundamentals are not sufficient in explanation of the phenomena. For instance, Shiller (2000 and 2005) in his famous book “Irrational exuberance” argues, that people have

irrational expectations and beliefs, that lead to the irrational money related decisions. Such irrational behavior, developed in the group of people, might cause bubbles. Farlow (2004) in the empirical research on the UK house market during 1990s-early 2000s presents the evidence, that fundamental factors were incapable of explaining the house bubble in the UK and that buyers themselves, suffering from psychological errors, may drive markets away from fundamentals. Brzezicka and Wisniewski (2014) state, that behavioral factors is one of the conditions that must be met for the formation of the price bubble. Assuming rational expectations and the rational behavior of market participants, any asset should be priced based on its fundamental value, which is normally defined as the summation of the discounted future cash inflows. In an efficient market, where the current asset price has fully, instantaneously and correctly reflected all relevant information, there are no bubbles. But the bubble by itself appears to be the proof, that strong price deviations appear. The most outstanding examples of market inefficiency are the US house bubble of early 2000s and the Japanese house bubble of 1990s.

Since the financial system is created and run by people, it becomes obvious, that the behavior of the participants in the system has the strong impact. If we assume, that those participants are rational, the decision on investing in an asset, that is much overvalued can be excluded. But, the history of the bubbles shows the example, when groups of people, who might even be sophisticated investors, and are aware of market principals, still invest in overvalued assets with no support from the fundamentals.

The human nature suggests that we have certain psychological and cognitive limitations that influence our decision-making process and push us to the irrational behavior, specially under the risk and uncertainty.

The application of the psychological study for understanding the economical processes was first done by Daniel Kahneman and Amos Tversky in 1979, when they developed the Prospect Theory as the alternative for the existing Expected Utility Theory. The Prospect Theory can be seen as the starting point of Behavioral Finance.

Although the field of behavioral finance is well established, the prevalence of the rational market approach and the difficulty of quantifying psychological and sociological phenomena inherent to the notion of ‘irrational exuberance’ contribute to the paucity of behavioral studies. Specifically, such situation can be observed in the area of housing

market bubbles. Due to the frequency of occurrence and availability of reliable data, the stock market bubbles are much widely studied than those on the real estate. The other special features of the housing market also bring some challenges for the researchers. They are: extreme heterogeneity of housing; durability of housing; low liquidity of the house market; the fact that most buyers are also sellers etc.

The objective of the current work is to conduct a systematic literature review in order to find the theoretical and empirical studies that apply the behavioral theory to investigate the reasons for the bubble formation. The core interest is the impact of the behavioral biases on the market participants and the contribution of the irrational behavior to the house bubble formation.

The remainder of this dissertation is organized as follows. Section 2 discusses the bubble as the phenomena, putting light on the history of the bubbles, the definition of the term and the reasons of the bubble formation. Section 3 discusses the basic concepts of the behavioral economics theory. Section 4 discusses the methodology of the systematic literature review, describing each step of the process. It also covers the results and findings of the systematic review. Section 5 is the discussion on the findings, and the results, represented in selected papers. Section 6 presents the overall conclusion of the current systematic literature review.

## **CHAPTER 2. BUBBLE AS THE PHENOMENA**

Current part discovers bubble as a price phenomena. The objective is to shed light on the history of the bubbles, present a definition of bubble, investigate the core factors and the drivers of the bubble formation and clarify the challenges and gaps in studying bubbles.

### **2.1. The history of bubbles**

The history of economic bubbles brings us back to the seventeenth century, when the first known asset bubble occurred. It was 1630s, when the “Tulip Mania” happened in the Netherlands. The flower (seen here as an asset) was in a very high demand and with speculative traders entering the market, the price of Tulip increased enormously. Tulip

mania had reached its peak and by the end of 1630s, the prices crashed as there were no more buyers. Such a scenario is a good example of the classical asset price bubble.

After that, the society passed through many other economic bubbles.

### **2.1.1. Japanese housing bubble 1980s**

One of the most significant housing bubbles is the Japan's Real Estate Bubble, that happened during 1986-1991. Japan entered 1980s as a successful country with strong and stable economy. As we know, for that times the Japan's recover after the World War II was called as «economic miracle».

Between 1950 and 1980s Japan showed the sharp growth in Automobile Industry and then from 1970s in electronics industry. The creation of Giants like Sony, Hitachi swept the whole market towards them. Hence, Japan got the title of King of Electronics. Tokyo became a major financial center, home of some of the world's major banks, financial firms, insurance companies, and the world's largest stock exchange of its time, the Tokyo Securities and Stock Exchange (Goel and Gupta, 2017).

The GDP annual growth (%) of Japan during the 1960-1980 was one of the highest in the world, even comparing to such countries like the USA and the UK. Purchasing Power Parity was also growing rapidly, reaching and even exceeding that of the developed countries of best, making it the second largest economy after USA. As the result, the overheating of an economy occurred.

Rise in house prices soon followed. Large domestic savings, economic liberalization, increasingly accessible credits and lack of financial regulation, the increasing power of Yen as a currency, monetary easing policy all gathered to fuel the phenomenon. Overconfidence and excessive optimism of investors did the rest. Extreme speculative growth of the real estate prices soon occurred, peaking in 1989 when the price for 1 sq. meter of commercial real estate in Tokyo (business block of city) was \$1 million.

Overconfidence and euphoria of the Japanese people played a critical role here. Japan was very confident in itself because it had done well even when the world had suffered a financial crisis. Japanese firms were leading the world in manufacturing technology, including semiconductors, and the success of Japanese-style management was also one of the factors which Japan thought that it could sustain such high growth without very

high risk (Goel and Gupta, 2017). In 1990 the bubble exploded. Prices had visibly collapsed, the economy's decline continued for more than a decade (1990s and 2000s). Those decades are known in Japan's history as «Lost decade». By 1992 commercial, residential and industrial land prices dropped 15.2%, 17.9%, and 13%, respectively. The entire crisis also badly affected direct consumption and investment within Japan. The sharp decline of the real estate prices resulted in a huge accumulation of non-performing assets loans (NPL), causing difficulties for many financial institutions.

### **2.1.2. USA housing bubble 2000s**

The other significant price bubble in the real estate market was the US Housing Bubble, that occurred in early 2000 and reached its peak in 2006.

Dean Baker, who identified the bubble in August 2002, described the circumstances under which the bubble began to grow: *“The housing bubble in the United States grew up alongside the stock bubble in the mid-90s. The logic of the growth of the bubble is very simple. People who had increased their wealth substantially with the extraordinary run-up of stock prices were spending based on this increased wealth. This led to the consumption boom of the late 90s, with the savings rate out of disposable income falling from close to 5.0 percent in the middle of the decade to just over 2 percent by 2000”*.

The stock bubble in the mid-90s is also known as the dot-com bubble, which roughly coincides with the real estate bubbles of the United Kingdom (2001/2-2007), Hong Kong (2004), Spain (1996–2008), Poland (2002 to 2008) and South Korea (1997). The collapse of the stock market pushed people to find alternative assets to invest. The real estate market became such an option.

Dean Baker explains that in USA the stock wealth pushed people to buy more new houses or to improve their homes since they sought to spend some of their new stock wealth on housing. So, the demand increased in a short period of time, comparing to the supply, which remained relatively fixed in short run. That situation triggered what is termed “irrational exuberance”, i.e. a situation when the rise in prices drive up expectations. The expectation that prices would continue to rise led homebuyers to pay far more for homes than they would have otherwise, making the expectations self-fulfilling.

*“But these (ongoing economic crisis) aren’t just a series of unrelated accidents. Instead, what we’re seeing is what happens when too much money is chasing too few investment opportunities.” (Paul Krugman)*

At the same time, the government data was showing the long history of stable house prices. Robert Shiller constructed a data series going back to 1895, which showed that real house prices had been essentially unchanged for 100 years prior to 1995. So, it should have been evident that house prices were being driven by a speculative bubble rather than the fundamentals of the housing market. Moreover, the rents had risen only by less than 10 percent. If there were fundamental factors driving the run-up in house sale prices, they should be having a comparable effect on rents. However, the increase in rents was far more modest and was trailing off already by 2002.

If the USA bubble was following the same scenario as it had happened in Japan, the housing bubble would have collapsed along with the collapse of the stock bubble in the years 2000-2002. Instead, the collapse of the stock bubble helped to feed the housing bubble. The loss of faith in the stock market caused millions of people to turn to investments in housing as a safe alternative to the stock market.

In fact, the year 2001 was a period of recession in the USA, which was recovering from it very slow. This led the Federal Reserve Board to continue cutting interest rates, eventually pushing the federal funds rate to 1% in the summer of 2003, a 50-year low. Mortgage interest rates followed suit. The average interest rate on 30-year fixed rate mortgages fell to 5.25 percent in the summer of 2003, also a 50-year low. Furthermore, Federal Reserve Board Chairman Alan Greenspan suggested that homebuyers were wasting money by buying fixed rate mortgages instead of adjustable rate mortgages (ARMs). Adjustable rate mortgages became a growing share of mortgages issued during the boom, peaking at close to 35 percent in 2004-06. Not only did these mortgages not provide the security of fixed rate mortgages, they were often issued with below market “teaser rates” that would reset to higher levels after two-years, even if interest rates did not rise. These ARMs were especially common in the subprime segment of the mortgage market. Subprime mortgages were loans issued to people with poor credit histories. The subprime share of the mortgage market went from less than 9 percent in 2003 to more than 20 percent in 2005

As a result, the extraordinarily low interest rates accelerated the run-up in house prices. From the fourth quarter of 2002 to the fourth quarter of 2006, real house prices rose by an additional 31.6 percent, an annual rate of 7.1 percent. This fueled construction even more.

The run-up in house prices also had the predictable effect on savings and consumption. Consumption boomed over this period with the savings rate falling to less than 1.0 percent in the years 2005-07. Of course, the bubble did begin to burst in 2007, as the building boom led to so much over-supply that prices could no longer be supported. By the middle of 2007, prices nationwide had peaked and began to head downward. This process accelerated through the fall of 2007 and into 2008.

As prices decline, more homeowners face foreclosure. People realized that they owed more than the value of their home, and decided that paying off their mortgage was a bad deal. In many of the hardest hit areas, the number of foreclosures actually exceeded existing home sales. As default rates increased in 2006 and 2007, banks began to tighten their standards and to require larger down payments. As a result, many potential homebuyers were excluded from the market. By the end of 2007, real house prices had fallen by more than 15 percent from peak. House prices in many of the most over-valued markets, primarily along the two coasts, had fallen by more than 20 percent. US household debt as a percentage of annual disposable personal income was 127% at the end of 2007, versus 77% in 1990.

## **2.2. What we know about bubbles**

There is no commonly accepted definition of price bubble. Moreover, albeit the fact that the phenomena bubble has a long history, there are still disagreements around many themes that relate to it. Are bubbles rational or irrational? What are the main factors of bubbles creation? Do bubbles actually exist? The next paragraphs attempt to study different views on the definition of bubble and to determine the main agreements and disagreements in those views, as well as the challenges in defining “price bubble”.

### **2.2.1. The history of the term**

The majority of the papers on the history of the bubbles mention the Dutch Tulip Mania as the first bubble event properly documented in history. Robert Shiller in his work

“Irrational Exuberance” (2000) connects the beginning of bubble history with the appearance of newspapers. At that time, bubbles were called “manias” and were not used to characterize an event or a process. The term bubble originates from the British Sea Bubble (1711-1720), in reference to the joint-stock companies and their inflated stocks. One of the most widely quoted definition of bubble is that proposed by Kindleberger in 1987: “(a bubble) is a sharp rise in price of an asset or a range of assets in a continuous process, with the initial rise generating expectations of further rises and attracting new buyers—generally speculators interested in profits from trading in the asset rather than its use or earning capacity. The rise is usually followed by a reversal of expectations and a sharp decline in price often resulting in financial crisis.”

In 1990 the term of an asset bubble was defined by Stiglitz as: "the basic intuition is straightforward: if the reason that the price is high today is only because investors believe that the selling price will be high tomorrow-when "fundamental" factors do not seem to justify such a price-then a bubble exists." There are few issues around such a definition of a bubble as a phenomenon. First, that definition is focused only on one stage of the bubble as a process, i.e., the increase of the price. Yet, it does not mention the crash of the prices, that is the other stage of the process. The second issue is about the reasons of the price increase. The first reason is the positive expectation of the investors about the future increase of prices. But what if investors could have also unrealistic expectations about the other things like incomes or interest rates? The third reason is that Stiglitz mentions whatever factors, not just fundamentals. However, the term «fundamentals» is indefinite and unclear.

In 2000 Peter M. Garber in his work “Famous first Bubbles. The Fundamentals of Early Manias” was studying the reasons of appearing of the first known bubbles in human history, such as Dutch Tulip Mania, the Mississippi Bubble, and the South Sea Bubble. Garber admits that bubbles lie at the intersection between finance, economics, and psychology. But he writes that among those factors, psychology stands at most in the background. In contrast, Shiller (2000) states, that a bubble is a situation in which temporarily high prices are sustained largely by investors’ enthusiasm rather than by consistent estimation of real value. Fundamental value is characterized by the net present value of the asset. What can be drawn out of these definitions? Asset price bubbles contain a strong speculative element.

In 2006 Smith and Smith suggested another definition of bubble: “We define a bubble as a situation in which the market prices of certain assets (such as stocks or real estate) rise far above the present value of the anticipated cash flow from the asset”. They said that market prices can rise rapidly if fundamental values are increasing rapidly or if prices are far below fundamental values. The fundamental value here is the present value of the expected cash flows, generated by the real estate. As the real estate is the investment, it is important to calculate the fundamental value. Smith and Smith say that one of the main sources of mispricing in the housing market is that almost none of the participants estimate the fundamental value of their home. As a result, in order to detect the price bubble, it is important to compare actual home prices with the value of homes.

What truly defines a bubble is that market prices are not justified by the asset’s anticipated cash flow. We find the support of that idea in Case and Schiller survey (2003), where they stated that the residential real estate market agents are amateurs, who are not estimating the fundamental value of the properties, but making infrequent transactions on the basis of limited information. Moreover, the homebuyers are using the “comps” as the orientation in the prices, while making decision about investment. Comps tell us how much others have paid for homes recently, but not whether these prices are justified by the cash flow.

Another widely recognized definition characterizes an asset price bubble as an explosive and isometric deviation of the market price of an asset from its fundamental value, with the possibility of a sudden and significant reverse correction (Kubicova and Komarek, 2011).

Robert Shiller in his book *Irrational Exuberance* (2015), defined bubble as a kind of social epidemic—a period of feedback, where price increases generate enthusiasm among investors, who then bid up prices more, and then it feeds back again and again until prices get too high. During that period, people are motivated by envy of others who made money doing it, regret in not having participated and the gambler’s excitement. Stories develop that justify the bubble, they become current and then people think they’re right because everyone’s confirming the stories. So, that happens. Eventually prices get too high and the bubble bursts.

While studying the different definitions of the bubble, it must be mentioned, that exists the opposite view. For instance, the economist Eugene Fama, who supports the efficient

markets hypothesis, share his skepticism about the existence of the bubbles. In his interview to “The New Yorker” (2010), Fama said: “I don’t even know what a bubble means. These words have become popular. I don’t think they have any meaning”. With those words, Fama does not declare that bubbles do not exist. The core challenge about admitting the existence of the phenomenon and its definition is: “They (bubbles) have to be predictable phenomenon. I don’t think any of this (bubbles) was particularly predictable”. Fama thinks, that most bubbles are twenty-twenty hindsight. In 2016 in panel discussion between Fama and Thaler (the developer of the behavioral science), Fama said: “For bubbles, I want a systematic way of identifying them. It’s a simple proposition. You have to be able to predict that there is some end to it. All the tests people have done trying to do that don’t work. Statistically, people have not come up with ways of identifying bubbles.” (Fama, 2016).

### **2.2.2. Defining bubble**

As was discussed in previous part, there are several ways of defining bubble and there is no agreement among the scholars on the topic. The importance of the definition is more about understanding the nature of the bubbles, clarifying the main factors and drivers of that phenomenon. Hence, while defining bubble, there are few issues, that we should pay attention to.

The first is the characteristic of a price increase. If we read different definitions of a bubble, we often see “dramatic”, “sharp”, “extreme” rise of the prices. But the numerical meaning of these features is unclear. According to the bubbles that happened in the past, the interesting fact is that the increase of the prices during the stock bubble is more dramatic than in the case of house bubble. The second issue is the period of time, during which the prices fall after peaking. So, what is staying unclear is the length of the period, when prices start to fall down after the peak and when the prices crash completely after starting to fall down. What we usually see in bubble definitions is something like “fast” or “quick” fall. The third controversial feature is the period of the prices’ stabilization after the peak. If the period of stabilization is too long, the price increase and the price decrease would be seen as two separate events. The fourth issue is the characteristic of the price fall in numerical expression. Should the prices fall at least to the level before the increase for the event to be called a bubble? Hans Lind (2008) gives an example: “Suppose that house prices triple from 100 to 300, and then fall by 50% to 150. Even if

the price does not fall back to the initial level, it seems reasonable to see such a period as a bubble period as a 50% fall must be seen as a dramatic fall in property prices”. The fifth problem comes out of definitions, when the change in price is compared to the present value of an asset. Is there definite way of calculating the fundamental value of an asset? Do investors calculate the value of an asset, or just compare the market prices?

To sum up, we suggest that there is no strong need in definition of the bubble; rather it is important to have a definition of the factors and the drivers that cause bubble and their analysis.

### **2.2.3. Reasons behind the formation of the bubbles**

So, what are the factors and drivers that cause asset bubbles, specifically the housing bubbles? Hans Lind (2008) help in this context, presenting five conditions that should cumulatively hold:

1. The macroeconomic situation and macroeconomic policies: It is a period when the macroeconomic policies have been rather lax, or the period of a rapid economic expansion.
2. Structural changes in the economy: The author writes about periods when society faces something new and unknown (for instance, internet during the dot.com bubble). In such contexts, it is more difficult to evaluate what is “normal”. This period usually coincides with the beginning of a bubble.
3. The capital and credit market: economic agents must have savings or easy access to credit. This has already been mentioned by Kindleberger (2003), who underlines the role of the credit market for asset price bubbles.
4. The beliefs, expectations and plans of the economic agents: this is important for understanding the logic and motivation of the investors, who buy the asset at high prices. Two patterns of behavior dominate. The first is to buy an asset during a dramatic period of price increases, hold it for a short period of time and sell it in order to win the difference in prices. The second is to enter the market before the prices grow even more. In both cases, home-buyers have the positive belief about the prices and expect a continuous growth.
5. The incentive of the individuals: which relates to the principal-agent problems and information asymmetry.

Brzezicka and Wisniewski (2014) look into a similar issue focusing in the real estate market. According to them, the following features help explain why bubbles emerge in such a market:

1. The specifics of real estate as an object of investment: real estate usually entails long-term investment, which is somewhat protected from inflation. Further, the supply side is inflexible when compared to the demand;
2. Capital intensity: the real estate market is especially high-capital intensive and low investment liquidity, which increases the role of the mortgage sector;
3. Uncertainty: in the real estate market, uncertainty has an endemic nature. Uncertainty, together with financial restrictions and the irreversibility of decisions, cause variation in the housing market at the microeconomic level. Increasing instability on the microeconomic level causes the lack of complete rationalism in behaviors of investors;
4. Connection with economic cycles: the certain stages of the economic cycles define the behavior of consumers and investors. For instance, during the recession phase, the developers and households are less prone to invest, while the recovery stage, when GDP is growing and the consumer confidence is increasing, the investing is becoming more interesting.

So, despite the long history of the bubbles, they keep on being the matter of dispute. The main issue is not about the definition of the phenomena, rather its about the main factors and drivers that stand behind the bubble formation. The basic conclusion is that the fundamental factors are not sufficient in explaining the nature of the bubbles. The behavioral aspect is considered to be one of the driving forces of the bubbles. The irrational decisions of the investors, caused by the behavioral biases might provoke the sharp increase of the prices and their further sharp decline.

### **CHAPTER 3. BEHAVIORAL ECONOMICS**

Behavioral economics is a revolution that occurred in economics in the last 20-30 years. The development of the behavioral finance as a study coincides with the revolution in neuroscience, the study about how the human brain operates. Human brain is a really

complicated organ, that makes us complex beings. Humans have cognitive limits, emotions, fears and believes. Moreover, we succumb to manipulations. As such, in the end, we are not perfectly rational creatures. Since financial institutions are designed for real people and their functioning depends on people behavior, it is important to study the influence of behavioral biases on the economy.

### **3.1. Early contributions**

Kahneman and Tversky are considered by many to be the fathers of behavioral finance. These two cognitive psychologists began to collaborate with one another in the late 1960s, ultimately publishing about 200 works in the field. Most of the work of Kahneman and Tversky focuses on how various psychological concepts relate to behavior in the financial realm.

In 1974, Kahneman and Tversky published a paper «Judgment under uncertainty: heuristics and biases». The paper examined how people make less than-rational decisions in situations involving economic risks. Ingrained human biases and failings cause us repeatedly to make wrong decisions, especially in complex situations. This paper remains the most cited analysis ever in social sciences and it laid the foundation for their, ground-breaking, Behavioral Economics theory.

In 2002, Kahneman received the Nobel Memorial Prize in Economic Sciences for his contributions to the study of rationality in economics. In 2017 other Nobel Prize in behavioral finance went to Richard H. Thaler for his research «Integrating economics with psychology». In his work, Thaler has incorporated psychologically realistic assumptions into analyses of economic decision-making. By exploring the consequences of limited rationality, social preferences, and lack of self-control, he has shown how these human traits systematically affect individual decisions as well as market outcomes.

Starting from the 2000 there has been a significant development in the behavioral financial research area, with several review papers on behavioral finance being published. In fact, according to the survey by Park and Sohn, in seven premier finance journals for the time period 1990–2010, 8% of the total papers examine behavioral finance-related topics. Most of the researches during 1950s-2010 refer to such topics as: mispricing, limits of arbitrage, prospect theory, market efficiency, heuristics, over-reaction, investor

sentiment, loss aversion, mental accounting, behavioral corporate finance. Currently, more than 100 psychological biases have been identified and analyzed.

### **3.2. Basic concepts**

Behavioral finance consists of two basic pillars: macro and micro behavioral finance (Park & Sohn, 2013).

*The macro behavioral finance* describes anomalies or irregularities in the overall market that contradict the efficient market hypothesis. Fundamental to the behavioral standpoint is prospect theory (PT). It represents a critique to the classical Expected Utility Theory (EUT) as a descriptive model of decision making under risk. It was developed by Kahneman and Tversky in 1979. The main contradictions between the two theories are presented in table below:

1. According to the EUT, decision makers are risk-averse. PT theory stands on that individuals are not universally risk-averse. They dislike risk in some situations, while liking risk in others. Individuals are risk-averse for most gains, but risk seeking for most losses.
2. PT states that decision makers are not perfectly rational. By EUT they are rational.
3. According to PT, preferences will depend on how a problem is framed. Actual cause of the effect is the fact that people dislike losses more than they like gains. On the opposite, EUT declares, that preferences between prospects do not depend on the manner in which they are described.
4. By PT, while choosing between gains and losses, people think about expected utility relative to a current wealth (reference point), rather than absolute outcomes. On the contrary, by EUT, choices only reflect final outcomes (wealth).
5. PT: People tend to overvalue a sure thing. EUT: the individual's indifference about the prospects should be independent of context.

As can be seen, Prospect Theory is, to some degree, the behavioral economics equivalent to the more traditional Expected Utility Theory, one of the cornerstones of the efficient market hypothesis. Montier (2002) commented on the topic arguing that “unlike expected utility theory which concerns itself with how decisions under uncertainty should be made (a prescriptive approach), prospect theory concerns itself with how decisions are actually made (a descriptive approach).” In the same vein, Glaeser (2013) says, that “buyers don't

appear to be irrational but rather cognitively limited investors who work with simple heuristic models, instead of a comprehensive general equilibrium framework.” Prospect theory is very important since it helps explain price anomalies that occur in the real estate market and makes a case on how irrational behavior can affect investors’ decision-making process.

Limits of Arbitrage (LA) is the other topic for studying of behavioral finance on macro level. The traditional finance theories, specifically the Efficient Markets Hypothesis (EMH), assume that prices are correct in the sense that asset prices reflect the fair value of the security; the security price always fully reflects the available information on the market; if there is a mispricing in the market, the rational traders arbitrage it away. EMH also suggests, that there are no limits to arbitrage. Arbitrage is seen as costless investment that generates riskless profits, by taking advantage of mispricings.

Behavioral finance, however, argues that, markets are inefficient, many deviations in asset prices exist, and these deviations are brought about by irrational investors. Moreover, the arbitrage can be risky and cause losses. It happens because there are certain limits to arbitrage, related to the risks associated with the factors that affect arbitrage returns.

*Fundamental risk.* Fundamental risk refers to the risk that new bad information appears to the market after investor purchased the security. In this case, risk could be perfectly hedged by buying a closely related product. Unfortunately substitute securities are rarely perfect, making it impossible to remove all the fundamental risk.

*Noise Trader Risk.* Noise traders limit arbitrage. Once a position is taken, noise traders may drive prices farther from fundamental value, and the arbitrageur may be forced to invest additional capital, which may not be available, forcing an early liquidation of the position.

*Implementation risk.* Investors, who exploits mispricing should properly calculate benefits and costs before making decision. When asset is mispriced, transaction costs are sometimes high enough to limit the desire of arbitrageurs to get involved in and take advantage of the mispricing.

The listed limits to arbitrage can be applied to the real estate market. The real estate investors face the limit of information related to the local house market (e.g. insider

information); high agent cost and relatively long duration of the period between the request for investment and the end of the deal; short-sale constraint. Such circumstances might prevent the investors from exploiting the arbitrage and keep the mispricing last longer.

*The micro behavioral finance* recognizes that individual investor behavior deviates sharply from the predictions of traditional models based on the notion of rationality. In particular, standard finance is characterized by rules that address how investors *should* behave rather than describing how they *actually* behave. The core problem is: “Are investors rational in their decision-making process, or cognitive and emotional errors affect their financial decisions?”

Further, we are going to discuss the most common biases cited in the BF literature: overconfidence and representativeness.

**Overconfidence** is the natural human tendency to overestimate their own abilities.

Daniel and Hirshleifer (2015) define it as: “*Overconfidence means having mistaken valuations and believing in them too strongly*”. Overconfidence has impact on money related decisions and forecasting the future. Thus, in the matter of investing, the overconfidence can lead to an excessive trading, when investors with too much confidence in their trading skill often trade too much, with a negative effect on their returns (Byrne & Utkus, 2013). For instance, Barber and Odean (1999) studied US investors with retail brokerage accounts and found, that more active traders earned the lowest returns. Whatever insight the traders think they have, they appear to be overestimating its value in investment decisions. Such a behavior can be explained by the other bias, known as self-attribution. It means, that any successful outcome, that followed the decision, people attribute to their own abilities and skills. Although, if the outcome appears to be negative, this is attributed to a misfortune, bad luck or coincidence. Having such a view on the things, people just block the negative feedback, concentrating on positive, multiplying it and becoming overoptimistic and overconfident.

Another situation, when the overconfidence may affect the investors is the diversification. Traditional financial theory suggests, that the investors should hold diversified portfolios in order to avoid the concentration of the risk in one particular area. But overconfident investors might believe that the performance of the portfolio that they chose is undoubtful

and they exercise more control over their investments than they actually do. As a result, investors overestimate their own abilities and overlook broader factors influencing their investments.

In literature, overconfidence impact is mostly studied related to the stock market. Unlike the liquid stock market, real estate market has certain characteristics, that present some challenges for studying the effect of overconfidence. Theoretical and empirical studies are lacking in real estate sector. The main challenges are: low frequency of transaction and lack of statistical data; experimental data is hard to generate because real estate decisions are difficult to replicate or simulate in laboratory environment; measurements of overconfidence.

**Representativeness heuristic.** Heuristic in psychology is one of the strategies that people follow to limit their use of mental resources, while making decision. Heuristics are cognitive shortcuts or rules of thumb that are used when one must make a decision but lacks either ample time or the accurate information necessary to make the decision. Often people use that strategy without even being aware that they are doing so. One common heuristic is the representativeness heuristic, which was proposed by psychologists Tversky and Kahneman in the early 1970s.

Representativeness heuristic as a rule of decision-making or judging work in further way: one determines whether another person or an event should be put into a certain category by judging how similar the person or event is to the prototypical person or event of that category. The prototype is the one that possesses the highest number of representative characteristics of that category. Shortly to say, it means judging other people or events according to the stereotypes.

The representativeness heuristic can be dangerous strategy while making decision. It can hinder accurate judgments of probability by focusing on the aspects that are similar to the prototype and ignoring other characteristic information that is not fitting the representatives of prototype. The desire to use the cognitive shortcut by relying on the stereotypes may supersede the desire to seek accurate and complete information.

Despite the long history of heuristics research in psychology and cognitive science, the absence of formal models for important heuristics has made it impossible to test the accuracy of these heuristics.

### **3.3. Behavioral real estate**

The final step in literature review was to cover a few publications that look at prices on the real estate market from the behavioral finance perspective. One of such contributions is that by Christopher J. Mayer and Todd Sinai. In their paper «U.S. House Price Dynamics and Behavioral Finance» the authors examine the relative roles played by economic fundamentals and market psychology in explaining US house price dynamics using two different boom periods, one in the 1980s and the other one in the early-to-mid-2000s. Their empirical analysis examines which factors, fundamental and behavioral, are correlated with house price dynamics within U.S. metropolitan areas. Their baseline analysis assumes a rational model of asset price equilibrium to see how much of the empirical volatility in the price-rent ratio such a model can explain. To that baseline, authors added proxies for other rational and behavioral factors to see which are correlated with the unexplained residual. Overall, results suggest that the house price boom in the 1980s was more of a behavioral nature than the boom in the 2000s, where fundamentals seem to have dominated.

Another attempt to study the behavioral aspect in REM prices is that by Farlow (2004a, 2005). These papers look at the real estate market of the United Kingdom and test to what extent the fundamental factors of house prices (income, interest rates, housing stock, demographic changes, credit availability and the tax structure) explain the high volatility of the prices during the last decades. Farlow comes to the conclusion that house prices are very volatile and this volatility cannot be explained by fundamentals. Therefore, it is posited that house prices are, to a large extent, determined by the behavior of consumers and financial institutions. Farlow actually concludes that the REM is inefficient. In particular, arbitrage seems to be absent from the REM, which supports the Barberis and Thaler's (2003) concept of limits to arbitrage.

In related research, Farlow (2004b) portrays over-optimism as the most important psychological bias in REM. In particular, he finds that households believe that buying a house does not involve a great deal of risk and that house prices will, on average, increase

more than 11 percent per year. In general, households have over-optimistic assessments of future levels of interest rates, and underreact to the risk of changes in interest rates (Case et al., 2003). An often-neglected perspective in the determination of housing market sentiment and the construction of bubbles is the role of the media. Farlow (2004b) argues that media prefer optimists over pessimists neglecting the possibly harmful consequences that over-optimistic information publishing has for ordinary investors.

Another study on the behavioral biases effecting REM participants' behavior was conducted by Robert Shiller. In his research «Irrational Exuberance» (2005), herd behavior plays a crucial role in the human decision-making process. People do not always exercise independent judgment due to social pressure. The thought that not everybody can be wrong is used to rationalize herd behavior. Herd behavior is shown to be a source of mispricing and speculative bubbles. Shiller mentions other psychological effect - irrational exuberance - which means that investors' enthusiasm drives asset prices up to levels that aren't supported by fundamentals.

To resume written above, there are empirical evidences of the inefficiency of the markets and the house market as well. The limits to arbitrage and the irrationality of the investors cause the deviations of the market price of the real estate from the real value of the asset. The traditional theories, as well as fundamentals, are not sufficient to explain the market anomalies, specifically bubbles. The behavioral finance appears as the supportive theory to investigate the psychological limits of individuals and their effect on the decision-making process under risk and uncertainty. It is important to study the behavior of the market agents, because the error decisions, based on the psychological and behavioral biases can lead to the significant price deviations and even bubbles.

The objective of the current systematic literature review is to assess the implementation of the behavioral theory in studying the nature of the real estate bubbles. In order to reach the objective, the proper selection of the most relevant articles and their further synthesis is to be done. In the next part, we describe the methodology of the current systematic review as well, as the results and findings.

## **CHAPTER 4. METHODOLOGY**

As previously mentioned, the objective of the current thesis is to conduct understand the behavioral aspect of the bubbles in the real estate market. In order to do so, this thesis employs the systematic literature review methodology. In fact, such methodology is particularly suited for identifying the main contributions of a field of research, which helps detect gaps that may be used to develop future research. The present chapter consists of two parts. The first explains the meaning of the systematic literature review, its basic idea and the stages. The second part describes the strategy employed in the current systematic review.

### **4.1. About the systematic literature review**

Systematic literature review is the method for conducting a scientific overview of research activities within a specific field (Petticrew and Roberts, 2006). Originally, it appeared in medicine. Later, the method migrated to other disciplines. It is a review of a clearly formulated question that uses systematic and explicit methods to identify, select, and critically appraise relevant research, and to collect and analyze data from the studies that are included in the review.

Although the systematic review is a relatively new method, a reasonable consensus has emerged as to its desirable methodological characteristics. The Cochrane Collaboration's Cochrane Reviewers' Handbook (Clarke and Oxman, 2001) and the National Health Service Dissemination (2001) provide a list of stages in conducting systematic review. These are:

1. planning the review:
  - identification for the need for a review;
  - preparation of a proposal for a review;
  - development of a review protocol.
2. conducting the review:
  - identification of research;
  - selection of studies;
  - study quality assessment;
  - data extraction and monitoring progress;
  - data synthesis;

3. reporting and dissemination:
  - the report and recommendations;
  - getting evidence into practice.

## **4.2. Systematic literature review: step by step**

### **4.2.1. The strategy**

Following the list of the basic stages and phases, provided in 2001, the strategy of current review was adopted. The main steps are as follows:

1. Planning the review
  - defining the topic. We used deductive reasoning to specify the topic of the current literature review. The prior interest for the research was behavioral finance as an approach that provides alternative explanations of how financial markets operate. To narrow the subject, the idea of a bubble was selected as the phenomenon, and the real estate market as the environment.
  - preliminary study of the subject. This was conducted with 2 purposes: to narrow the subject and identify a topic; to identify the relevant keywords.
2. Framing the selection of the relevant articles
  - selecting the source of information/database;
  - identifying the most relevant keywords and constructing their logical combinations. The objective is to achieve a balance between sensitivity (finding as many articles as possible that may be relevant) and specificity (making sure those articles are indeed relevant), so that nothing important is missed.
3. Assessment and selection:
  - Exclusion criteria, partially applied with a help of database filters and partially through reading the title and abstract of each article.
  - Inclusion criteria are applied through reading the entire article.

The desirable objective is to select the final scope of the most relevant articles.

4. Analysis and synthesis of the selected articles
5. Findings. Reporting on the results of the stage 4.

### **4.2.2. The database**

“Web of Science” is the main source of articles employed in this review. This search platform consists of three databases. We used the “Core Collection” database, which

contains more than 20 000 scientific journals, books, proceeding papers in different scientific fields and covers literature from 1900 to present. Web of Science uses the Journal Impact Factor as a metric for measuring research/publication impact. Further, this platform is a user-friendly online database that offers a variety of options on search, analysis and processing of the bibliographic results.

#### **4.2.3. The keywords**

The selection of the relevant keywords was done through the stage of preliminary and scoping study on the research topic. We also checked the keywords used by prior authors researching in the relevant area of knowledge. In the end, we grouped the keywords around three main topics:

1. **Bubble (or price bubble)** – this is the central element. It is a phenomenon, the nature and specific of which is at the core of our interest. The term “bubble” is widely used in literature and doesn’t have good alternatives. In fact, very rarely, researchers use synonymous such as “balloon” or “froth”. But, the last one is the term to indicate the state, preceding an actual market bubble. A “froth” might become a bubble or not and thus can be misleading for our search. As a result, the term bubble was used as the only one for identifying the phenomenon of interest.

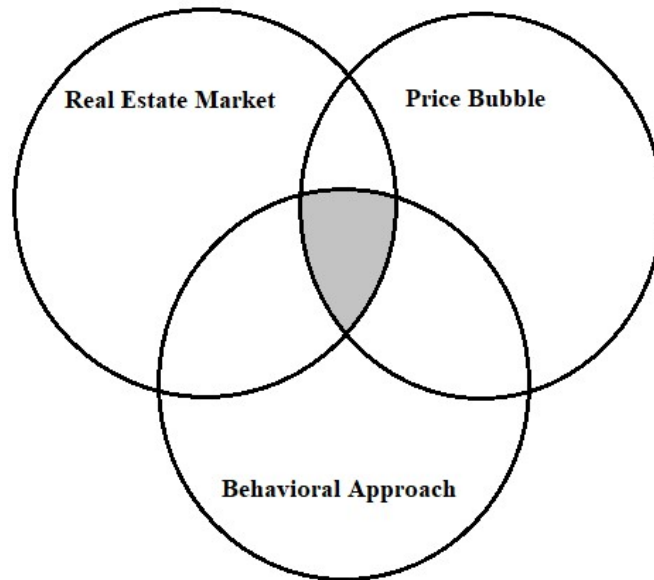
2. **Real estate Market** – this is the system/structure in which we suggest the bubble might appear. Real estate, as the environment, has its own specific characteristics, that can affect the behavior of the agents and the nature of the bubbles. For instance, high agent costs, short-sell limits, long duration of the deal bring the limits to arbitrage. The heterogeneity of the houses as the asset cause the subjectivity in valuing the asset. The inflexibility of the supply in short period of time, cause the high disbalance on the market, in case if the demand is increasing rapidly.

Certain characteristics of the real estate market can also be the challenge for the researches. For instance, the low liquidity of the market causes the lack of the statistical data.

3. **Behavioral finance.** The third element represents the behavioral approach to finance as a set of new concepts and ideas. Thus, our focus moves from fundamentals and rationality to irrationality, human-being psychology and its impact on decision-making process under the risk and uncertainty and these elements can help explain the bubble phenomenon in the context of the real estate market.

The three elements above were used as “dimensions” for framing the search of the relevant articles. The overlapping area of all three dimensions is supposed to be the scope of relevant papers. In the Figure 4.1 below, the idea of dimensions is visualized.

*Figure 4.1 Searching frames*



The identification of the keywords was done according to the three elements mentioned above. Table 4.1 lists the keywords that were employed.

*Table 4.1 Keywords*

Bubble	Real estate market	Behavioral approach
Price bubble*	House*	Behavioral bias*
	Property*	Investor* sentiment*
	Real estate	Speculation*
		Market reaction
		Market impact

The keyword «bubble» is the most common term, that explains the certain price behavior, caused by the irrational investors. That certain behavior is the subject to the current systematic review. There are some terms, that might seem to be the synonyms of the «bubble», but they can not substitute the term perfectly. For instance, the term boom-bust seems to be the substitute term for «bubble». But, when boom period ends, economic situation levels out, the industry experiences a minor setback. When a bubble ends

(bursts), a significant number of people experience serious economic hardships. That's the difference between bubble and boom. Can be said, that a boom is what we call a bubble before it bursts. The other synonym is froth. But that term rather characterize the pre-bubble stage and might not end up with the explosion stage.

We used the signs \* and \$ to prevent the search issues, connected with singular/plural forms, verbal forms, adjectives and different spellings of the words. For instance: investor\* sentiment\* - to include both singular and plural; house\* - to include housing as the term variation; and behavior\$ral – to include in search both behavioral and behavioural (American and British spellings).

#### 4.2.4. The searching strings

The next step was to build logical combinations of the keywords, according to "three dimensions" idea. As a result, we built three searching strings:

**1. (house\* OR property\* OR real NEAR/0 estate) AND price AND bubble\***

This searching string helps implement a broad search in the main field of interest, the real estate price bubbles. We do not specify here the approach or theory, that are used for studying the nature of the bubble. We include in the search string the most common synonymous of «house» to maximize the number of papers that can be found with this string.

**2. (price AND bubble\*) AND (behavior\$ral AND bias\* OR investor\* AND sentiment\* OR speculation\*)**

This string aims to select the papers that cover the behavioral aspect of the price bubble. As such, we aim at identifying the paper that look at human psychology in explaining the creation and development of bubbles. In order to maximize the number of paper we uncover with the string we do not specify the market.

**3. (behavior\$ral AND bias\* OR investor\* AND sentiment\* OR speculation\*) AND ((house\* AND market OR "real estate" AND market) AND (reaction OR impact))**

The last string is designed to find papers on the behavioral aspect of the real estate market, the influence of behavioral biases on the behavior of the market actors and the impact on the market in general, as well as the price behavior in the market.

#### **4.2.5. The exclusion and inclusion criteria**

We use exclusion and inclusion criteria to evaluate the papers that we obtain with the help of the search strings above.

The exclusion criteria are applied by reading the title and the abstract of each paper. The list of exclusion criteria is as follows:

1. Language: We excluded all the publications that are not written in English (this is done with the help of the Web of Science language filter).
2. Document type: we exclude publications such as book chapters, book reviews, and editorial materials. Editorial materials refer to an article that gives the opinions of a person, group, or organization. That brings the subjectivity to the assessment, that we can not rely on. The research or assessment must be objective. Book reviews, that are the form of literary criticism can also be subjective view of a certain person, which might even rely on its person taste. The information in the books can be already outdated at the time of publication. The books cover different aspects of a topic and provide a big picture, while, for example, articles are written from a specific angle and more focused. Moreover, the structure of these three types of the type of document does not let us make the selection, analyzing the abstract, as well, as apply the inclusion criteria. Importantly, we keep articles that are still not peer-reviewed publications. This was done in order to avoid the exclusion of the newest articles on the selected topic.
3. Science Category: we exclude articles that come from areas that are not related to finance/management. For instance, the keyword “bubble” might bring the articles related to engineering, geography, energy fuels, thermodynamics and those categories are not relevant for our search.
4. Duplicates papers are excluded at this stage.
5. Aim of the paper: we exclude papers that study bubbles but do not focus in the real estate market. We also exclude papers that deal with bubbles but do not focus on their behavioral aspects.

The papers that pass the exclusion criteria selection phase go through a qualitative assessment, which is done by implementing a set of inclusion criteria. This step requires reading the entire text of the paper. The inclusion criteria are as follows:

#### **Empirical papers:**

- *hypothesis* must be clearly defined;
- *methodology* must be well described;
- *results* must be presented as statistical data or as substantial quotations from research participants, that are interpreted according to the research question;
- *discussion (conclusion)* on how the research results influence professional practices or future studies must be developed.

#### **Theoretical papers:**

- *research question(s)*, which are to be answered must be clearly defined;
- *the objective* of the research must be clarified, including the explanation of the importance of a current research;
- *relevant background* must be provided (existing theories, concepts, terms and ideas, that might be relevant to the research question);
- *new theoretical model* must be presented and explained;
- *results and contribution* (explain how the developed model can answer/resolve the research question/problem).

#### **4.2.6. Literature synthesis process**

The final sample is supposed to include the papers, that would pass mentioned above criteria. The last step of the current systematic review would be the synthesis of the content of selected articles and interpretation of the findings.

The guiding points of the synthesis would be:

1. The core motivation of the research and its support, based on the existing knowledge.
2. The basic concept of the article and the reason for that concept.
3. The theoretical support of the presented concept.
4. The motivation for the methodology applied.
5. The challenges of applying the selected methodology, considering the concept of the article.
6. The core contribution of the results to the understanding of the studied issue.
7. What can be done by the future researchers in order to improve the study.

#### **4.3. Results and findings**

This sub-section presents the main results of applying the search strings, the inclusion and exclusion criteria previously mentioned.

#### **4.3.1. The searching strings**

As mentioned in the previous Chapter, we use three main searching strings to find the initial set of papers that could be a part of our final reviews. The results per search string is as follows: searching string 1: 666 papers; searching string 2: 214 papers; searching string 3: 56 papers. As such, we start with a total of 936 papers. The next step was the application of the exclusion criteria.

#### **4.3.2. Exclusion criteria**

As previously mentioned, Web of Science provides users with a number of useful filters to process the list of the papers. Hence, exclusion criteria 1 to 3 (Language, Document Type and Science Category) were applied with the help of the platform's filters. All papers that complied with these initial exclusion criteria were downloaded and their titles, authors and journal of publication were saved into an Microsoft Excel file. We then remove duplicates (exclusion criteria 4) with the help of a duplicate removal function. After applying the exclusion criteria 1 to 4 we find 605 publications potentially interesting contributions.

Exclusion criteria 5 is then applied, which entailed reading the title and abstract of each surviving publication. This resulted in the exclusion of 570 articles, among which:

- 44 % were excluded, because the research was done on stock market bubbles, but not the real estate market bubbles;
- 43 % were covering other, than the behavioral approach in studying the bubbles, for example, the focus on fundamentals;
- 13% of the papers were about the price behavior, but not the bubbles, as the extreme price behavior.

After applying all exclusion criteria we find 35 articles that could be potentially interesting for the final review (i.e., only 3,7% of the initial set). Next, we apply the inclusion criteria by reading the entire text of each article.

#### **4.3.3. Inclusion Criteria**

The analyses of the full text of each publication lead us to eliminate 18 articles. Among them, 13 articles were excluded because of being non relevant to the topic of study. To

remind, some articles had the abstract, the content of which was not clear or informative enough to apply exclusion criteria 5-7 and required further full text analysis.

2 more articles we exclude because of no free access to the source. 3 more articles didn't pass the inclusion criteria for empirical papers "Literature review" and were excluded.

As a result, our final scope of the most relevant publications includes 17 articles, that is only 2% of the initial scope.

#### 4.3.4. Papers included in the final review

The final list of the publications included in the review is presented in Table 4.2.

**Table 4.2 Final scope of publications**

	Author(s)	Year	WOS Accession number
1	Alexiou, Chan and Vogiazas	2019	WOS_000455484400028
2	Abildgren, Hansen and Kuchler	2018	WOS_000435625000001
3	Granziera and Kozicki	2015	WOS_000363825500008
4	Zheng, Wang, Wang and Wang	2017	WOS_000394399400005
5	Kouwenberg and Zwinkels	2015	WOS_000356932500039
6	Ling, Ooi and Le	2015	WOS_000352014600010
7	Zhang, Hudson, Metcalf and Manahov	2015	WOS_000361628700003
8	Kuang	2014	WOS_000342266300025
9	Changha, Soydemir and Tidwell	2014	WOS_000338821500003
10	Huston, Spencer and Roger	2014	WOS_000333569200013
11	Walker and Clive	2014	WOS_000342298300007
12	Tomura	2013	WOS_000305951200004
13	Nofsinger	2012	WOS_000305951200004
14	Scherbina and Schlusche	2012	WOS_000304188000007
15	Rouwendal and Longhi	2008	WOS_000254131600008
16	Roche	2001	WOS_000167597200008
17	Brunnermeier and Julliard	2008	WOS_000253859300007

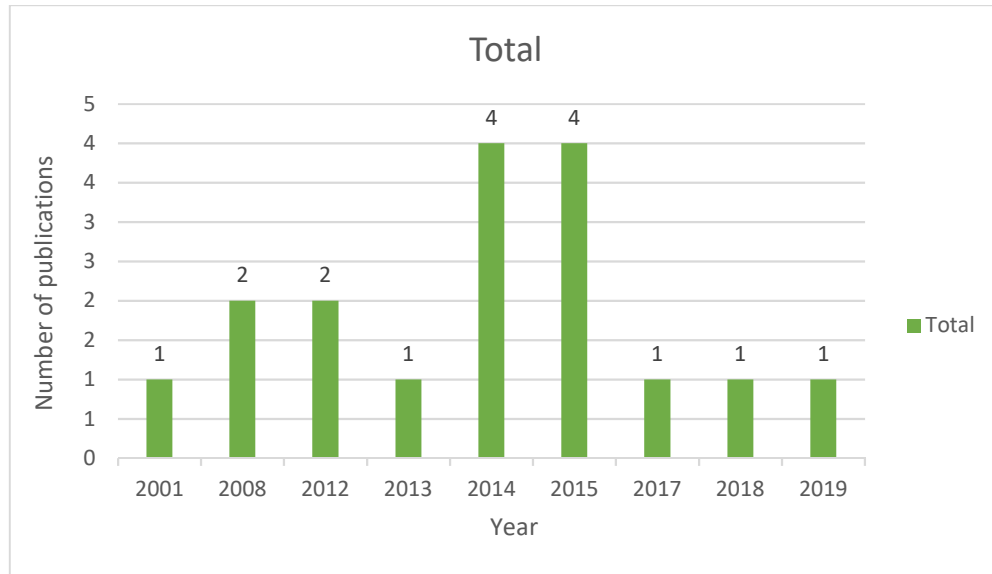
Source: Web of Science database

Among the 17 articles, 16 are peer-reviewed and one is a proceeding's paper. Sixteen articles are empirical and one is a non-empirical study.

#### 4.3.5. Publication frequency

The time span of the publication of articles reviewed is from 2001 to 2019. The most active years of publication are 2014 and 2015: four articles published per year. Figure 4.2 shows the frequency of publication per year.

**Figure 4.2 Publications by year**



**4.3.6. The science area and the ranking of the sources of publications**

Nine papers were published in the economics area and six are in the business finance area. There is one paper published in the area of environment and urban study and another coming from multidisciplinary sciences. In Annex 1 we classify all the papers included in the final review according to the type of research (empirical/non empirical), objective, methodology, data set, geographical location, findings and type of behavioral bias that is considered.

We also analyzed the quality of the resources according to the journal ranking SCImago Journal Rank (SJR). SJR is a measure of the number of times an average paper in a particular journal is cited. Important fact is that the SJR gives each citation a value greater or less than 1.00, based on the rank of the citing journal. The weighting is based on the calculation of the three-years period. SJR uses Scopus database. The ranking of the journals by year (from 2014 to 2018) as well as average rank is presented in table 4.3. As can be seen, eight out of 15 journals that contribute to the final sample covered in this dissertation have the average rank less than 1. Moreover, two of 8 journals have an

average rank of less than 0,5. The most highly ranked journal from the list is *The Review of Financial Studies*, with an average rank 12,895.

**Table 4.3. Journal Ranking**

Journal name	# of papers	Science area	ISSN	SCImago Journal Rank (SJR)					
				2014	2015	2016	2017	2018	Average
The Review of Financial Studies	1	Business Finance	0893-9454	13,305	10,87	13,55	14,237	12,516	12,895
Economic Modelling	1	Economics	0264-9993	0,688	0,811	0,954	0,966	1,039	0,892
Housing Studies	1	Environmental/Urban Studies	0267-3037	0,871	1,137	1,398	1,379	1,511	1,259
European Financial Management	1	Business Finance	1354-7798	1,321	0,796	1,064	0,955	0,618	0,951
Journal of Financial Stability	1	Business Finance	1572-3089	1,561	1,485	1,446	1,356	1,488	1,467
Journal of Economic Dynamics & Control	2	Economics	0165-1889	1,179	0,956	1,295	1,795	1,559	1,357
Applied Economics	2	Economics	0003-6846	0,489	0,451	0,47	0,445	0,499	0,471
Applied Economics Letters	1	Economics	1350-4851	0,312	0,34	0,358	0,327	0,38	0,343
Journal of Real Estate Research	1	Business Finance	0896-5803	1,072	1,305	1,024	0,533	0,967	0,980
European Economic Review	1	Economics	0014-2921	2,152	1,869	2,106	2,277	2,21	2,123
Journal of Money Credit and Banking	1	Business Finance	0022-2879	2,075	2,254	2,602	3,002	2,357	2,458
PLoS One	1	Multidisciplinary	1932-6203	1,559	1,427	1,236	1,164	1,1	1,297
Economic Modelling	1	Economics	0264-9993	0,688	0,811	0,954	0,966	1,039	0,892
Journal of Macroeconomics	1	Economics	0164-0704	0,637	0,659	0,69	0,718	0,68	0,677
International Journal of Finance & Economics	1	Business Finance	1076-9307	0,607	0,539	0,338	0,565	0,514	0,513

Source: SCImago Journal Rank <https://www.scimagojr.com/journalrank.php>

## CHAPTER 5. DISCUSSION

The general objective of the selected papers can be summarized as application of the behavioral economics theory and concepts in order to study the effects of psychological, cognitive, emotional, cultural and social factors on the economic decisions of individuals and institutions and how those decisions lead to the real estate bubble formation. Those factors are considered as behavioral biases, that became the focus of further discussion. In all the publications a certain behavioral bias, or the set of biases is seen as one of the driving forces for the bubble formation. The authors of the articles conduct the empirical research in order to test and measure the linkage between the bias(es) and the house price deviations.

The grouping of the findings, that were extracted from selected papers is going to be done thematically: we group the papers according to the behavioral bias studied. The following discussion reports on how each of the bias was measured and implemented in the certain model; the results and findings of the tests; the challenges, that were faced while conducting the research; the suggestions for the further studying of the question raised.

### 5.1. Consumer Optimism and Confidence

*Abildgren, Hansen and Kuchler (2018)* study the reasons behind the strong house price booms in the mid-1980s and the mid-2000s in the Danish real estate market. The main objective of the research is to explore the linkages between consumer confidence and house prices within the framework of standard structural VAR (SVAR) models. Since the mid-1970s the correlation between the consumer confidence and house prices in Denmark is strong. The study focus on nominal house prices since the nominal market value of a house usually serves as collateral in loan contracts.

The results showed that over-optimism (defined in terms of households, i.e., those that stay very optimistic while realizing a negative growth in real income over the subsequent 3 years) accounts for 15–20% of the deviation of nominal house prices from a constant growth trend in both the mid-1980s and the mid-2000s. Further, the results show that the share of overoptimistic households involved in real estate trades was particularly large during the house-price boom in the mid-2000. Particularly, the share of overoptimistic households that purchased real estate was substantially larger than the corresponding

share of other households in 2004–06. Furthermore, Abildgren et al. (2018) suggest that overoptimistic households may have contributed to an upward pressure on house prices by leveraging to a larger extent than other households. In addition, there were more overoptimistic households in the pre-crisis period. Yet, there is no evidence in results that overoptimistic households contributed to the strong increase in house prices prior to the crisis by purchasing overvalued real estate compared to other households. Finally, Abildgren et al. (2018) admits that housing-market decisions are relatively rare (only 3–6% of households in the sample purchase real estate in a given year), so a large sample is needed in order to have enough observations in which households are active on the housing market.

*Nneji, Brooks and Ward (2015)* conducted research on the sharp increase of the house prices in Netherlands during the years 1999 and 2000. The real estate market of Netherlands faced a large downfall at the beginning of the 1980s. In the mid-1980s prices started to pick up in line with the rise of the homeownership rate among Dutch households. In the beginning of the 1990s demand for owner-occupied housing remained strong while interest rates gradually went down and the Dutch economy flourished. During these years supply of new housing stagnated and prices increased. As a result, the average monthly sales price increased by 19% from 1999 to 2000 and then by 13% by the end of year 2000. The mortgage interest rate was slowly decreasing during the first half of 1999.

Nneji et al (2015) try to explain this peculiar market dynamics by linking the development of house prices to an indicator of consumer confidence that represents the consumers' expectations of economic developments in the near future and their willingness to spend money in the state of the economy. The authors rely on the general conclusion from the macro literature about the specific of the short-run development of house prices, that may differ substantially from a long-run relationship that is determined by market fundamentals such as income, the mortgage interest rate and the supply of new housing. Thus, it is shown in the research that during the studied period, the mortgage rate gradually increased from about 5 % per year to more than 6 % per year. The increase in per capita income in these two years was high: 6.8 % and 5.9 %, respectively. However, this growth is still not enough to balance the percentage increase in the mortgage interest rate.

According to the classical approach, a negative effect on the house prices from the increased mortgage rate is to be expected. Moreover, supply within 2 years stayed inelastic. However, such an expectation is not matching the reality of the Dutch house market during 1999-2000. Even more, in the years 1999 and 2000 consumers were exceptionally optimistic, relative to previous and later years. The research was also done on alternative explanations, based on housing market indicators (the volume of the stock of houses for sale and the time on the market) in order to find the explanation for the house market booming. But the market indicators were unable to provide such an explanation. Generally, the paper documents that the development of Dutch house prices during this period was determined in large part by consumer sentiments. In fact, according to the authors, the correspondence between the development of house prices and consumer expectations is remarkable. The drop-in consumer expectations at the end of 2000 coincided with falling house prices.

The situation changes after 2001, when the index of consumer confidence in the Netherlands decreases, while house prices remained at the high level, and even increased somewhat. The authors explain this price stickiness by the restrictions on the supply side of the market and relatively low level of mortgage interest rate (it decreased in 2001). Such a short-term trend in house prices, which departs from the fundamentals, is considered to be the result of the error correction framework: long-run housing development is explained by economic fundamentals, while short-run fluctuations may be related to psychological variables such as the index of consumer confidence.

*Tomura (2013)* looks at the real estate market prices of 18 developed countries covering the period of 1970-2000. The paper investigates the role of two factors in the boom-bust cycles: over-optimism and monetary easing. Tomura suggests two types of households: one is mortgage borrowers, who finance housing investments through mortgage debt; and the other is savers, who lend to mortgage borrowers. If both types of household show optimism, based on the outside signals (news), then the real interest rate rise due to savers' optimistic expectations dampens housing investments by mortgage borrowers. In contrast, an expectation-driven housing boom occurs if savers regard a public signal as noise. In this case, the real interest rate does not rise because only mortgage borrowers become optimistic.

As a result, a housing boom occurs as mortgage borrowers increase their housing investments on optimistic expectations about future house prices. A housing boom collapses when the optimistic expectations of mortgage borrowers turn out to be wrong ex-post. If one adds the credit constraint condition for the borrowers, the optimism push them to raise internal funds to finance their housing investments. The result is the increase of the labor supply. If price stickiness is introduced into the model, then an increase in aggregate labor supply lowers the inflation rate through a decline in real wages during a housing boom. In response, the central bank lowers the policy rate, given the Taylor rule. These results replicate the housing-market boom-bust cycles in developed countries.

Since the labor supply plays important part in the model, Tomura (2013) splits mortgage borrowers in two groups: young ones and old ones. In fact, the real house price growth rate in U.S. has been closely correlated with the excess of young households' confidence in future aggregate economic activity over old households' confidence in survey data. The results show that the labor supply and the real house price have tended to co-move during boom-bust cycles. Moreover, the inflation rate and the short-term nominal interest rate have tended to be low during housing booms.

The subjective belief of the households, that can show optimism or pessimism, or overconfidence can also be developed on the basis of the public signals (news). Thus, *Walker and Clive (2014)* conducted research in order to test if there is any relationship between news media and the UK house price boom during 1993-2008. The paper also studies if media influenced opinions on the housing market and lead to the price boom. Results show that the optimism of the UK news media is not correlated with the price increase. Yet, previous media optimism is a significant determinant of this period's real average house price change. So, media sentiment may help predict future house price changes

## **5.2. Extrapolative expectations**

*Granziera and Kozicki (2015)* investigate the run up in the U.S. house prices observed over the 2000-2006 period and the subsequent sharp downturn. The main reason for the research to be conducted is that an asset-pricing model solved under rational expectations does not generate the large and persistent fluctuations observed in the data. Granziera and

Kozicki suggest a solution in which agents extrapolate the future from the latest realizations and the degree of extrapolation is stronger in good times than in bad times, generating waves of over-optimism. Extrapolative expectations arise when agents form conditional expectations of future variables based on past observations, therefore extrapolating future behavior from past behavior. The results show that under this solution the model matches key moments of the data, as well as, replicates the run up in the U.S. house prices.

*Kouwenberg and Zwinkels (2015)* use an alternative approach, i.e., a multi-agent complex system in order to study the nature of the boom-bust cycles in the US house market during the 1960-2014. For instance, in the first quarter of 2006 the overvaluation of the U.S. housing market reached its maximum, when the log house price was 48% above its fundamental value. This was an unprecedented situation, since the misalignment had never exceeded the 10% mark before.

According to Kouwenberg and Zwinkels, the housing market is more vulnerable to inefficiencies than other markets due to lack of effective short selling mechanisms that prevent bearish (pessimistic) investors from participating; the heterogeneity in housing stock as well as the heterogeneity in market participants prevents standard arbitrage processes from functioning properly. Instead of the classical assumptions of agent rationality and market efficiency, agents in the model are heterogeneous, adaptive, and boundedly rational.

The model suggests two groups of agents: fundamentalists, who believe in market efficiency and expect the house price to revert to the present value of future payoffs; and chartists, who simply expect past price trends to continue. Agents in the model can switch between the fundamentalist and chartist forecasting rules, depending on the recent performance of the prediction rules. It is this feature that allows the market to be driven by chartists when a price bubble builds up; yet, it is dominated by fundamentalists during the eventual burst. Results show that in the period 1980–2007 chartists dominate, with a weight of roughly 85% to 90%. This is when house prices rise far above their fundamental value. However, in the crisis years 2008–2009, the fundamentalist weight increases sharply and the price level falls back down. The main result is that the interaction between

agents in the model can generate boom-bust cycles endogenously, even in the absence of underlying fundamental news.

*Zheng, Wang, Wang and Wang (2017)* study the significantly increasing pattern of the house prices in Beijing (China) during the 2002-2016 period. Even after the financial crisis of 2008, the housing prices of Beijing bounce up quickly, beyond the increases of the fundamental economic factors. The authors develop a model where the investors are boundedly rational, heterogeneous and extrapolate their expectations. Extrapolative method means that investors are confident in the continuation of the price trend in the next period. The results of research showed that investors that strictly follow an extrapolative strategy may cause the benchmark price to lose its stability. In this case, when the extrapolative intensity is large, an upward deviation of housing prices away from the benchmark level can lead to an “explosion” of the house market.

### **5.3. Biased expectations**

*Zhang, Hudson, Metcalf and Manahov (2015)* propose approach to quantifying a bubble in housing by incorporating the present value of housing user cost into a state space model. Applied approach is a relative valuation approach which contrasts with the discounted cash flow valuation approach used in many previous studies. The key advantage of a relative valuation approach, especially when contrasted with the present value approach, is that house purchase prices are not necessarily the summation of discounted future values. Moreover, a relative valuation approach is much more likely to reflect people’s psychology and expectations than a discounted cash flow valuation approach in the short run, since it is an attempt to measure relative and not intrinsic value. The idea is to spot bubbles as they emerge, not just after they have collapsed. Zhang et al investigate the house market of the UK during the 1995-2012 period.

Results show that UK house prices were undervalued from January 1995 to May 2001 and subsequently moved into a bubble over the period from 2001 to October 2012. As a proportion of house price, the bubble ranged substantially in size from  $-22\%$  to  $64\%$  on a log scale, which is indeed a quite substantial range. Nonfundamental factors, such as peoples biased forward-looking expectations, played an important role in driving UK house prices from October 1999 to April 2008. Based on their results, Zhang et al (2015)

suggest that any modelling of house prices without the consideration of a bubble element, or the nonfundamental components, will be somewhat problematic.

#### **5.4. Money illusion**

*Brunnermeier and Julliard (2008)* study the house market of the USA (data is from 1975 to 2005) and the UK (data is from 1966 to 2005). The main objective is to identify whether the link between housing price movements and inflation is due to money illusion. The analysis shows that a reduction in inflation can generate substantial increases in housing prices in a setting in which agents are prone to money illusion.

For example, when people need to make a choice between buying or renting a house, they compare the cost of the rent and the cost of monthly payment of a fixed nominal interest rate. As such, they mistakenly assume that real and nominal interest rates move in lockstep. Hence, they wrongly attribute a decrease in inflation to a decline in the real interest rate and consequently underestimate the real cost of future mortgage payments. As a result, they cause an upward pressure on housing prices when inflation declines. In general, the results of the study, support the money illusion hypothesis. The research also suggests that an anchoring bias effect exists. In particular, there is evidence that people ignore the fact that higher inflation affects the interest rate of the mortgage and the labor income growth rate in a symmetric way.

*Huston, Spencer and Roger (2014)* argue that people are money-illuded and thus inflation, which leads to high nominal interest rates, convinces buyers that real rates are also high (as well as mortgage rate) and thus reduce their demand for housing. For instance, rational buyers would see a rise in inflation as a decrease in the real mortgage rate, which would drive up house prices. The desire to use real estate to hedge against inflation would also support a rational explanation of higher prices.

Huston et al examine the housing market from 1987 to the present with particular attention to the 2003 to 2007 bubble, using both behavioral and traditional variables. A momentum variable is included in model and can have a behavioral impact if past price increases feed into a belief in rising future prices. Also, the model includes two variables from the Thompson/Reuters-University of Michigan Consumer Sentiment survey to capture public attitudes towards real estate. As part of the survey, subjects are asked

whether it is a good time to buy a house and why. The responses are considered to show not only the willingness of purchasing a house but the hope for financial gain as well. A state-space model shows that the coefficients on those behavioral variables vary in ways consistent with the emergence and dissipation of the recent housing bubble. But observed autocorrelation does not prove behavioral influence.

*Alexiou, Chan and Vogiazas (2019)* study how the motivation for the purchase of the three types of agents in the real estate market (households, landlords and speculators) drives house prices. The sample is the house market of 34 gloom, bust-and-boom, and boom countries during the 1970-2016 period. Results show that both households and landlords bear the wrong sign, potentially indicating that, despite decreasing affordability and a long payback period, both continue to purchase houses, driving prices up even further. The situation might get worse with the credit expansion despite the increasing price-to-income gap. The results also confirm that short-term speculators impact the housing market, though their actual effect appears to be weak. In fact, when Alexiou et al (2019) consider only developed countries, the impact of speculators becomes statistically insignificant. It is also important to stress that this paper suggests that households' and landlords' demonstrate an optimistic view of continuing price increases, which they extrapolate from past returns. As a result, the reaction to the real current market information is lagged. Households and landlords are driven by expectations of capital gains through price appreciation. Their motivation for this expectation is derived from momentum or past performance. Households and landlords represent the majority of the agents on the real estate market. So, the group misreading of the real market situation together with the irrational exuberance may cause house bubbles.

## **5.5. Discussion**

The core motivation of the researches is a lack of explanatory power of fundamentals, when talking about the reasons behind the bubble formation. The question of why bubbles are so prevalent is yet a matter of concern for academics and policy makers.

Behavioral theory is appearing as the additional explanatory framework to complement the fundamental studying and explain the irrationality of the market agents, that might cause the bubbles. Behavioral models explain how a bubble may be initiated, under which conditions it would burst, and why arbitrage forces may fail to ensure that prices reflect

fundamentals at all times. It argues, that investors may prefer to 'ride' bubbles for some time instead of immediately trading against them. Moreover, the high costs and risks of betting against bubbles may prevent arbitrageurs from engaging in such bets. In addition, real estate transaction costs are relatively high, and short sale constraints are binding, preventing rational investors from easily trading against an overvaluation.

All the publications are based on the theory of markets inefficiency, market agents' irrationality, imperfect information. Most of the papers rely on the knowledge developed by Robert Shiller, whose name is the mostly cited across the selected papers. Although, none of the author's publication appeared in the final scope of publications. The authors assume that actual human behavior is less rational, stable, and selfish than traditional normative theory suggests, due to bounded rationality, limited self-control, and social preferences. The behavioral biases are seen as the core factor of agents' irrational decisions, that lead to the demand and price increases, that turn into bubbles, at least in short period of time.

The long period mispricing is seen as the result of the fundamental factors. From the consumer side, it is found, that people learn from their mistake and in long run exclude the influence of psychological biases on their decisions.

Among the biases, that are the most commonly studied in the papers, there are: consumer confidence and optimism; money illusion; extrapolative expectations, which is the manifestation of the representativeness heuristic bias.

The researches, described in the selected publication, use the combination of both quantitative and qualitative data. For instance, the consumer confidence index is received from the responses of questionnaires, that reflect the subjective view of certain individual on the economic state and the prediction of the future situation, that is biased by people beliefs, expectations and optimism/pessimism.

There is some issue about the consumer confidence index. One reason for concern over the validity of the consumer confidence index as an explanatory variable for house prices is that it may itself be influenced by the increase in house prices. If consumers regard increasing house prices as an indication of a flourishing economy, this may increase their

confidence in the economic situation. Therefore, it is doubtful that the relationship between consumer confidence and house prices was caused by an effect of current house prices on this variable. Overoptimism as a variable is also bringing challenge: most of the overoptimism definitions are arbitrary and requires additional robustness tests in the research.

In general, psychological factors are hard to measure. One of the difficulties in capturing behavioral effects is that they are, by their very nature, ‘inherently psychological, potentially unstable, and subject to contagion and herd behavior’. The two methods, observation and experiment, of collecting data on psychological factors while studying the bubbles bring some challenges. The one of them was already mentioned – the measurements of biases.

The observation method suffers from the fact, that bubbles are usually detected post factum, as well as the fact that real estate market is not liquid. All that cause the lack of sufficient set of statistical data.

The experimental method has the gaps in the way, that during the experiment, the participants do not face the real risk of losses as a result of wrong decision. As a result, the responses of the participants might not suffer from biases as much as it could be in real life.

The general conclusion of the selected papers, considering the objective of the current systematic review is:

The results provide the support for the hypothesis, that the real estate market participants are not fully rational or irrational and suffer from the psychological limitations, that lead to the errors in their investment decisions. It is determined that the magnitude of the behavioral factors varies over time and in patterns consistent with the emergence and dissipation of the recent housing bubble. Although, the behavioral impact is valid in a short run, it is being leveled by the fundamental factors in the long run. That can be the supportive result for the characteristic of the bubble, that requires the relatively short period between the sharp increase and the sharp decrease of the prices.

## CHAPTER 6. CONCLUSIONS

This current systematic literature review explores the literature on the application of behavioral economics theory to real estate bubbles. The results of the review help us to understand the scope of the literature on the related topic, to define the main focus in behavioral concepts, that are applied for studying house bubbles, and to put light on the basic challenges, that appear while applying the behavioral theory and models for the research of bubble formation.

The results show the scarcity of studies on this topic. There are 3 reasons for that: the prevalence of the traditional theories and fundamentals; the specific characteristics of the real estate market; the complications, related to the measurements of psychological factors and their data collection.

Among 17 articles, that made up the final scope, there are 16 empirical researches and 1 theoretical survey.

The theoretical survey is studying the application of the behavioral models to the residential real estate market. The main motivation of the paper is that the residential market is represented mostly by non-sophisticated traders (households), whose decisions to buy are frequently justified by unrealistically optimistic expectations that are shaped by extrapolation, false beliefs about real estate markets, and a word-of-mouth sentiment about real estate investment. At the same time, more sophisticated participants (real estate agents) use the psychological limits of the households and ride the bubble by re-selling frequently bought properties with the goal to gain profit. Such an irrational behavior of households and speculative behavior of real estate agents has the impact on the house prices and might drive the bubble. So, the behavioral model can be a useful framework in order to explain, predict or even prevent the house bubbles. The four behavioral models are presented in the survey. Among 16 empirical researches, 15 present the evidences of the behavioral factors impact on the house price deviations, and the correlation of those factors with the recent bubbles' patterns.

The left research did not succeed to prove the influence of the behavioral factor on the price deviation. The research examines the relationship between media optimism and the UK housing bubble. The results show that there was not detected the correlation between

the optimistic news about house market and the increase of the house prices. Although, the results show, that the correlation is lagged one year in average. The author interprets such a result as the ability of media sentiment to predict the future house prices.

15 empirical researches, that succeed to prove the contribution of the behavioral factors to the bubble formation rely on the behavioral concepts of the cognitive biases and psychological limitations of the market participants. All the researches present the models, that include at least one irrational agent. Important to note, that the models combine both fundamental and behavioral factors.

Our review and analysis of the papers was focused on the biases, that are studied in the researches. According to the selected papers, we found the most studied behavioral biases, that impact the bubble formation, which are, among others, overconfidence and overoptimism; extrapolative expectations (representativeness heuristic) and money illusion. To remind, for now more than 100 psychological biases have been identified and analyzed. (Park & Sohn 2013)

Other biases, presented in the selected papers, are mostly studied in the combination with the three biases previously mentioned. Among them are: momentum, self-attribution; group think; status quo; overreaction and subjective beliefs.

Overoptimism and overconfidence biases are presented in the papers by the consumer confidence index. That index reflects the consumers personal valuation of the current economic situation and the beliefs about the future economic situation. Current index is the qualitative variable, that is being calculated on the basic of the questionnaires. As a behavioral concept, consumer confidence (optimism) is a bias that influence the demand for the real estate, as well as the demand for the mortgages. The overoptimism and the overconfidence might drive up the prices and also cause the credit expansion.

The main concern over the validity of the current bias, reported in the papers, is that it may itself be influenced by the increase in house prices. If consumers regard increasing house prices as an indication of a flourishing economy, this may increase their confidence in the economic situation. In the research by Abildgren et al (2018) it is argued that optimism is hard to define because of its arbitrary.

Still, overoptimism is reported to be the influential factor in the bubble formation, specially when supported by the group think bias. For instance, overoptimism might have accounted for 15–20% of the deviation of nominal house prices from a constant growth trend in both the mid-1980s and the mid-2000s in Denmark (Abildgren et al, 2018). Although, the effect of the behavioral bias is characterized as a relatively short-term. For instance, Zhang et al (2015) state, that people make mistakes in the short run, but learn from their mistakes in the long run. The bounded rationality hypothesis essentially implies that there is cointegration or long-run equilibrium between fundamental factors and house price bubbles.

The extrapolative expectations bias is the manifest of the representativeness heuristic bias. The main idea behind the bias is that people create their expectations, based on the previous trends, without analyzing the current ones. The effect from the bias is enforced by the conditions of uncertainty (lack of knowledge or information) and the lack of time. The interaction between the investors, who suffer from the extrapolation (chartists) and those, who analyze fundamental factors (fundamentalists) can cause the deviations of the house prices. Kouwenberg et al (2015) report, that the house market is being driven by chartists when a price bubble builds up, but dominated by fundamentalists during the eventual burst. Such a result in a way supports the long-run equilibrium idea, expressed by Zhang et al (2015): «people learn from their mistakes and attempt to satisfice by acting as rationally as possible in the long run».

The next bias studied is a money illusion. Brunnermeier and Julliard (2015) in their research on the US and the UK house market provide the evidences, that money illusion as an aggregate phenomenon can generate house price run-ups without changes in economic fundamentals. Huston et al (2014) in their research on the US house market provide the evidence, that the magnitude of money illusion factor, in combination with momentum and subjective beliefs biases varies over time and in patterns consistent with the emergence and dissipation of the recent housing bubble.

The main concern about applying the behavioral factors in the asset price models in order to explain bubbles is the measuring the biases and collecting the data. Shiller (2008): «one of the difficulties in capturing behavioral effects is that they are, by their very nature,

‘inherently psychological, potentially unstable, and subject to contagion and herd behavior’. To sum up the results of the analyzed papers, we can state, that modelling of house prices without the consideration of a bubble element, or the nonfundamental components, will be somewhat problematic.

The result of only 17 articles in the final set proves, that there is a lack of studies and research on real estate bubbles from the behavioral theory view. The narrow final set of papers considered in this review might also be explained by the specific methodological approach adopted. The other reasons for the narrow final set of papers might be caused by the methodology specific of the systematic review.

As we know, the method originates from the medical science, which is characterized by the highly standardized and structured papers, as well, as the specific and obvious single-meaning terms. The economic area of studying contains terms that might have double meaning, or be interpreted differently. The reviewed papers also report different structures.

The issue about the terms might bring the challenge on the stage of the keywords selection. A balance between the narrowly specific words and the general words must be found.

The abstract of the article is an important element of the systematic review. The exclusion criteria are applied by reading and analyzing the title and the abstract. Some of the abstracts did not provide the sufficient information on the objective or the method of the research. Despite the abstract is relatively short part of the research, it should contain the most important information. As the result, the analysis of such unclear abstracts might suffer from the subjectivity bias. For instance, because of the lack of sufficient information in the abstract, the reader might interpret with a certain degree of subjectivity. The result is the exclusion of a possible relevant article. The other bias is the lack of expertise in the studied issue, that might limit the ability of the researcher to analyze the abstract objectively. The suggestion is that, for example, the stage of exclusion criteria application on the base of abstracts must be done by the group of researchers.

The results of our systematic review might prove the possible existence of such a bias: around 60% of the articles from the initial scope were excluded because of irrelevance of the article, analyzed by the abstract reading on the basis of the abstract.

Getting back to the matter of expertise of the researcher in the studied topic, important to note, that the objective of the systematic review must be narrowly focused. In the case of current systematic review, it is possible that the objective was to a certain extent too broad. We suggest, that the systematic literature review is a good method to apply to the very specific and narrow issue within the area of study, where the researcher has the profound expertise. That would also help with selecting the most effective key words.

The systematic literature review is the good method for conducting clear and objective research (if to exclude the mentioned above biases). Although, the fact that the method is well structured, it makes it less flexible to the correction of the research on the way.

## BIBLIOGRAPHY

- Abildgren, K., Hansen, N., Kuchler, A. (2018), *Overoptimism and house price bubbles*, Journal of Macroeconomics, Vol. 56
- Alexiou, C., Chan, A.S., Vogiazas, S. (2019), *Homeownership motivation, rationality, and housing prices: Evidence from gloom, boom, and bust-and-boom economies*, International Journal of Finance & Economics
- Bao, H. & Li, S. (2016), *Overconfidence and Real Estate Research: a Survey of the Literature*, The Singapore Economic Review, Vol. 61
- Brunnermeier, M.K. & Julliard, C. (2008), *Money Illusion and Housing Frenzies*, journal The Review of Financial Studies
- Brzezicka, J. & Wisniewski, R. (2014), *Price Bubble in The Real estate Market – Behavioral Aspects*, University of Warmia and Mazury in Olsztyn, Real Estate Management and Valuation, Vol. 22, No. 1
- Byrne, A. & Utkus, S. (2013), *Understanding how the mind can help or hinder investment success*, Vanguard Asset Management, Limited
- Case, K.E. & Shiller, R.J. (2004) *Is There a Bubble in the Housing Market?*, New Haven, Connecticut, Cowles Foundation, paper No. 1089
- Changha, J., Soydemir, G., and Tidwell, A. (2014), *The US Housing Market and the Pricing of Risk: Fundamental Analysis and Market Sentiment*, Journal of Real Estate Research, Vol. 36, No. 2
- Daniel, K. & Hirshleifer, D. (2015), *Overconfident Investors, Predictable Returns, and Excessive Trading*, Journal of Economic Perspectives, Volume 29 Available at: [http://www.kentdaniel.net/papers/published/JEP\\_15.pdf](http://www.kentdaniel.net/papers/published/JEP_15.pdf)
- Fama, E. & Thaler, R. (2016), *What is the efficient-markets hypothesis and how good a working model is it?*, Panel discussion, Chicago Booth Review, Available at: <http://review.chicagobooth.edu/economics/2016/video/are-markets-efficient>
- Fama, E. (2010), *Interview with Eugene Fama* by John Cassidy, The New Yorker Available at: <https://www.newyorker.com/news/john-cassidy/interview-with-eugene-fama>
- Garber, P.M. (2000) *Famous First Bubbles. The Fundamentals of Early Manias*, London, The Massachusetts Institute of Technology Press
- Granziera, E., & Kozicki, S. (2015), *House price dynamics: Fundamentals and expectations*, Journal of Economic Dynamics and Control

- Huston, J.H. & Spencer, W.R. (2014), *Housing and behavioural factors*, Applied Economics Letters, Vol. 21, No. 3, USA
- Kouwenberg, R. & Zwinkels, R. (2015), *Endogenous Price Bubbles in a Multi-Agent System of the Housing Market*, journal Plos One
- Kuang, P. (2014), *A model of housing and credit cycles with imperfect market knowledge*, European Economic Review, UK
- Kubikova, I. & Komarek, L. (2011) *The Classification and Identification of Asset Price Bubbles*, Finance a úvěr-Czech Journal of Economics and Finance, Vol. 61, No. 1
- Lind, H. (2008), *Price Bubbles on the Housing Market: Concept, theory and indicators*, Stockholm, School of Architecture and the Built Environment Royal Institute of Technology, Working Paper No. 58, Available at: <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.463.8957&rep=rep1&type=pdf>
- Ling, D., Ooi, J., Le, T. (2015), *Explaining House Price Dynamics: Isolating the Role of Nonfundamentals*, Journal of Money Credit and Banking, Vol. 47, No. 1, The Ohio State University
- Nofsinger, J.R. (2012), *Household behavior and boom/bust cycles*, journal of Financial Stability, United States
- Park, H. & Sohn, W. (2013), *Behavioral Finance: A Survey of the Literature and Recent Development*, Seoul Journal of Business, Volume 19, Number 1
- Roche, M.J. (2001), *The rise in house prices in Dublin: bubble, fad or just fundamentals*, journal Economic Modelling
- Rouwendal, J & Longhi, S. (2008), *The Effect of Consumers' Expectations in a Booming Housing Market: Space-time Patterns in the Netherlands, 1999–2000* journal Housing Studies, Vol. 23, No. 2
- Salzman, D. & Zwinkels, R.C.J.(2013), *Behavioral Real Estate*, Available at: <https://pdfs.semanticscholar.org/8d18/a93e753787f34c38bb208201bf6de144cc79.pdf>
- Scherbina, A. & Schlusche, B. (2012), *Asset Bubbles: an application to Residential Real Estate*, journal European Financial Management, Vol. 18, No. 3
- Scimago Journal & Country Rank, <https://www.scimagojr.com/journalrank.php>
- Shiller, R.J. (2000) *Irrational Exuberance*, New Jersey, Princeton University Press.
- Shiller, R.J. (2011), *Behavioral Finance and the Role of Psychology*, video lecture, Yale Courses online, Available at: <https://www.youtube.com/watch?v=chSHqogx2CI>

- Smith, M.H. & Smith, G. (2006) *Bubble, Bubble, Where's the Housing Bubble?*, Brookings Papers on Economic Activity, 1:2006, Available at: [https://www.brookings.edu/wp-content/uploads/2006/03/2006a\\_bpea\\_smith.pdf](https://www.brookings.edu/wp-content/uploads/2006/03/2006a_bpea_smith.pdf)
- Stiglitz, J.I. (1990) *Symposium on Bubbles*, The Journal of Economic Perspectives, Vol. 4, No. 2., pp. 13-18.
- Tomura, H. (2013), *Heterogeneous beliefs and housing-market boom-bust cycles*, Journal of Economic Dynamics & Control, Japan
- Visco, I. (2002) *Recent Experience of Asset Price Bubbles*, Federal Reserve Bank of Chicago, Conference on Asset Price Bubbles. Available at: <http://www.oecd.org/finance/monetary/2088999.pdf>
- Walker, B.C. (2014), *Housing booms and media coverage*, Applied Economics, Vol. 46, No. 32
- Zhang, H., Hudson, H., Metcalf, H., Manahov, V. (2015), *Identification of house price bubbles using user cost in a state space model*, Applied Economics, Vol. 47, No. 56
- Zheng, M., Wang, H., Wang C., Wang, S (2017), *Speculative behavior in a housing market: Boom and bust*, Economic Modelling, volume 61

ANNEX TABLE 1

Publication	empirical/non-empirical	Objective	Methodology	Data		Findings	Biases
				timesclae	location		
Alexiou, Chan and Vogiazia (2019) WOS_000455484400028	Empirical	Do households drive housing prices? Are household rational in their buying decisions? Is the market a speculators' territory?	system Generalized Method of Moments (GMM)	1970–2016	34 countries	“Irrational exuberance” has been highlighted as one of the driving forces behind the financial crisis of 2007–2008.	expectation derived from momentum
Abildgren, Hansen and Kuchler (2018) WOS_000435625000001	Empirical	Explore the linkages between consumer confidence and house prices.	standard structural VAR (SVAR) models	1974-2015	Denmark	Overoptimistic households may have contributed to a house price bubble by putting an upward pressure on the number of real estate trades. They may also have contributed to an upward pressure on house prices by leveraging more when purchasing real estate.	overoptimism
Granziera and Kozicki (2015) WOS_000363825500008	Empirical	Explore whether expectations that are not fully rational have the potential to explain the evolution of house prices and the price-to-rent-ratio.	stylized asset-pricing model	1987-2011	USA	Extrapolative expectations in the form of a near rational bubble, might be an important element to include into more sophisticated models that aim at jointly replicating housing market dynamics and business cycle dynamics.	extrapolative expectations, overoptimism
Nneji, Brooks and Ward (2015) WOS_000254131600008	Empirical	The aim of article is to link the development of the house prices to an indicator of consumer confidence in the state of the economy.	multivariate analyses; an index of consumer confidence (by Statistics Netherlands)	1999-2000	Netherlands	Short-run fluctuations in house prices may be related to psychological variables such as the index of consumer confidence.	overconfidence, overoptimism
Roche (2001) WOS_000167597200008	Empirical	Was the house price increase caused only by fundamentals, or there is the evidence of speculative bubble	regime-switching model	1976-1999	Dublin (Ireland)	Findings indicate that there is some evidence of speculative bubble in house prices.	speculation

Scherbina and Schlusche (2012) WOS_000304188000007	Non-empirical	Survey of the academic literature that can offer insights into the dynamics of bubbles in residential real estate	-	-	-	Behavioural models seem particularly well suited for describing residential real estate markets since these markets are dominated by financially unsophisticated households and arbitrage is nearly impossible.	extrapolative expectations, self-attribution, representativeness heuristic
Nofsinger (2012) WOS_000305951200004	Empirical	To study the role of the households in real state bubbles. Households behaviors are motivated by cognitive limitations and psychological bias.	descriptive study	1928-2011	USA	During the run up of a bubble period, household behavior is biased toward exacerbating the bubble, not subduing it.	households' extrapolation bias, groupthink
Tomura (2013) WOS_000315061600002	Empirical	To check the hypothesis: overoptimistic expectations of mortgage borrowers about future technological progress generate a boom-bust cycle, if mortgage borrowers are credit-constrained and savers do not share their overoptimism.	business cycle model	1970-2000	18 developed countries	Overoptimism of mortgage borrowers can cause boom-bust cycles. Less stringent borrowing constraints on mortgage borrowers amplify boom-bust cycles.	ovreroptimism
Huston, Spencer and Roger (2014) WOS_000333569200013	Empirical	To test if behavioural factors contribute strongly to house price movements, and their importance varies over time, in consonance with the pricing cycle.	state-space model (included variables that have both rational and behavioural aspects)	1987-2012	USA	Three important behavioural factors emerge: the view that housing prices are low, opinions that favor housing as a good investment and housing price momentum. The coefficient magnitude of those behavioural factors varies over time and in patterns consistent with the emergence and dissipation of the recent housing bubble.	momentum

Changha, Soydemir and Tidwell (2014) WOS_000338821500003	Empirical	To test if the market sentiment unexplained by fundamental variables is a significant factor, and suppose that price changes are not completely dependent on fundamentals. Research is based on the behavioral concepts of overreaction and status quo.	error correction models, Engle-Granger two-step method	1998-2008	USA	Consumer irrational (non-fundamental-based) sentiment does indeed impact subsequent housing prices and can lead to euphoric behavior, therefore real estate pricing models should include a variable capable of measuring irrational sentiment.	overreaction, status quo
Kuang (2014) WOS_000342266300025	Empirical	To test if the response of house prices is amplified due to the comovement and mutual reinforcement between agents' price beliefs and house price realizations via credit expansion/contraction.	model of housing and credit cycles with imperfect market knowledge	2001-2008	USA	Positive (negative) development or surprise in house prices fuels optimism (pessimism) and credit expansion (contraction), which in turn boost (dampen) housing demand and house prices and reinforce agents' optimism (pessimism).	distorted beliefs, optimism/pessimism, subjective beliefs
Walker and Clive (2014) WOS_000342298300007	Empirical	To examine the relationship between news media and the recent UK house price boom. Did media influence opinions on the housing market and lead to price boom, or it did not contribute to the housing boom and may have helped constrain it.	VAR model, that includes the measure of average optimism of the articles	1993-2008, 30K articles on housing market	UK	1)The optimism of the UK news media is not correlated with the price increase. 2) Previous media optimism is a significant determinant of this period's real average house price change. So, media sentiment may help predict future house price changes	media sentiment
Ling, Ooi and Le (2015) WOS_000352014600010	Empirical	To test the hypothesis that house prices are affected by changes in sentiment among important market participants.	VAR model. Qualitative/Quantitative.	1990-2010	USA	Strong and consistent evidence that non-fundamentals-based housing market sentiment predicts real house price appreciation in subsequent quarters, above and beyond the impact of lagged price appreciation, lagged market liquidity, and changes in a broad set of fundamentals.	subjective beliefs of investors and home builders' perceptions of housing market conditions

<p>Kouwenberg and Zwindels (2015) WOS_000356932500039</p>	<p>Empirical</p>	<p>Test if the interaction between the agents of the house market (chartists and fundamentalists) endogenously produces boom and bust cycles.</p>	<p>multi-agent complex system (agents in the model are heterogeneous, adaptive, and boundedly rational)</p>	<p>1960-2014</p>	<p>USA</p>	<p>The interaction between agents in the model can generate boom-bust cycles endogenously, even in the absence of underlying fundamental news. Agents in the model can switch between the fundamentalist and chartist forecasting rules, depending on the rules' recent prediction performance. Precisely this feature allows the market to be driven by chartists when a price bubble builds up, but dominated by fundamentalists during the eventual burst</p>	<p>extrapolative expectations, subjective beliefs</p>
<p>Zhang, Hudson, Metcalf and Manahov (2015) WOS_000361628700003</p>	<p>Empirical</p>	<p>To find how much variation in house prices results from nonfundamental factors</p>	<p>user cost framework within a state space model</p>	<p>1995-2013</p>	<p>UK</p>	<p>UK house prices were undervalued from January 1995 to May 2001 and subsequently moved into a bubble over the period to October 2012. Results support the bounded rationality hypothesis in the long run. However, the irrational and the rational expectation hypotheses can coexist in the short run when explosive bubbles are driven by price dynamics</p>	<p>biased forward-looking expectations, money illusion</p>
<p>Brunnermeier and Julliard (2008) WOS_000253859300007</p>	<p>Empirical</p>	<p>To identify whether the link between housing price movements and inflation is due to money illusion</p>	<p>VAR model</p>	<p>1966-2005 (UK), 1975-2005 (USA)</p>	<p>UK, USA</p>	<p>Money illusion as an aggregate phenomenon can generate house price run-ups without changes in economic fundamentals.</p>	<p>money illusion, framing effect, mental accounting</p>
<p>Zheng, Wang, Wang and Wang (2017) WOS_000394399400005</p>	<p>Empirical</p>	<p>To study how the heterogeneity and bounded rationality of the house market agents may affect the volatility of the housing prices.</p>	<p>temporary equilibrium price model</p>	<p>2002-2016</p>	<p>Beijing, China</p>	<p>Because of the existence of investors speculative behavior, the equilibrium housing price may persistently deviate from the benchmark level and even explode. In contrast, investors' mean-reverting strategy can balance out the position of trend extrapolators, which may stabilize an otherwise explosive housing market.</p>	<p>extrapolative expectations</p>