Herding Behavior: Insights from Narrative Economics and Neuroeconomics*

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Abstract

Herding behavior has driven major economic events, especially financial crises, in the past. Much research has been done on the behavioral economics of herding, but not much on its origins. In this essay, we provide evidence about the role of narratives in shaping people's decisions by comparing narrative trends to economic data. It can be seen that during recent financial crises, the frequency of certain keywords have been closely related to our economic index of interest. Then we investigate the neuroeconomics of processing narratives. The literature suggest that the Default Mode Network (DMN) is responsible for processing narratives. We propose a hypothesis that the activations in DMN are correlated with herding behavior. We also provide a procedure to test this hypothesis.

Keywords: herding, financial crisis, narrative economics, neuroeconomics, DMN

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1 Introduction

As stated by (Welch, 1996) [5], herding can be defined as behavior patterns that are correlated across individuals. However, correlation does not mean causation and some correlated behaviors are just results of a normal human behavior, much like predicted by simple economic models. Another definition which is proposed by (Baddeley, 2012) [1], defines herding as a state in which individuals' private information is overwhelmed by the influence of public information about the decisions of a herd or group.

In this essay we mainly focus on herding behavior during financial crises as it is the most observable and common case. Most financial crises are characterized by huge fluctuations in stock market, which is usually considered an indicator of investors sentiments. In (Cont, 2000) [4] fat tails in the stock market return distributions are associated with herding behavior among people, demonstrating the correlation between huge market fluctuations and herding behavior.

Our main approach to study herding behavior is through the narrative economics perspective. We provide evidence that narratives were important factors in previous financial crises, as they led people into social herding. Next, we investigate the neuroeconomics of narratives, first by identifying the brain regions involved with processing narratives and then proposing a hypothesis to test whether activations in these regions are also correlated with herding behavior. Finally, we provide some future research directions and conclude our findings.

2 The Narrative Economics Perspective

As stated by Robert J. Shiller in his book "Narrative Economics: How Stories Go Viral and Drive Major Economic Events" [8], an Oxford English Dictionary definition of narrative is "a story or representation used to give an explanatory or justificatory account of a society, period, etc" in which a story is not necessarily a simple chronology of human events but may

also be a song, joke, theory, explanation, or plan that has emotional resonance and that can easily be conveyed in casual conversation.

Narratives have the ability to significantly impact social and economic events. By shaping people's beliefs and actions, narratives can unite individuals and even institutions, leading them to conform to trends. Therefore, studying the mechanisms behind the virality of stories can offer valuable insights for predicting future events.

2.1 Methodology

In this paper, we analyze the effect of narratives on some of the past financial crises, using a methodology used by Robert J. Shiller in [8].

This methodology involves a mix of qualitative and quantitative approaches and it is focused on identifying and analyzing narratives as a significant driver of market movements and investor decision-making.

1. Identification of Narratives: First step requires identifying narratives that capture the sentiment and stories circulating among market participants and the general public. These narratives often influence market perceptions, investor behavior, and economic expectations.

2. Media Analysis: Second step is to analyzes media content, including newspapers, magazines, online articles, television, and social media, to understand the narratives prevalent in the public. Media analysis helps to identify the dominant stories and themes shaping public sentiment.

3. Survey Research: Surveys are conducted in order to capture the attitudes and beliefs of investors and consumers. These surveys can show how narratives affect people's expectations about the economy, financial markets, and other relevant factors.

4. Construction of Narrative Indices: To quantify the prevalence and strength of particular narratives over time, narrative indices are constructed. These indices can be based on media sentiment analysis, survey responses, or other relevant data sources.

5. Relationship with Market Indicators: Comparing narrative indices to market indica-

tors, such as stock market returns, trading volumes, or investor sentiment, we can examine how are they correlated with each other. This analysis helps to understand the impact of narratives on market movements.

2.2 Financial Crises Narratives and Herding Behavior

Dot-com Bubble (Late 1990s - 2000): After the internet went public in 1993, many companies saw the opportunity to use this new technology to automate and eventually improve their operations. On the other hand, people were becoming familiar with internet and its abilities. The prevailing narrative was that the internet would revolutionize businesses. This narrative along with the fact that establishing an internet company required very low fixed costs, led to frequent IPOs for dot-com companies in NASDAQ.

This was the result of a herding behavior among both the individuals (investors) and institutions. Investors followed other investors in buying dot-com stocks and the institutions (dot-com companies) were rushing to establish their company without sufficient technologies and go public before their competitors do. Eventually, as more investors followed the trend, stock valuations became disconnected from underlying fundamentals, eventually leading to a dramatic market crash.

In Figure 1, NASDAQ index from 1990 to 2010 has been illustrated. There was a peak around year 2000 (dot-com boom) and a major drop in year 2001, when the dot-com bubble burst. Figure 2 illustrates the relative usage of the phrase "dot-com" in media (newspaper, books, papers, etc). It shows a growing trend between years 1995 and 2001, similar to the NASDAQ index.

Global Financial Crisis (2007-2008): This major economic event was also the result of another herding behavior. Banks and financial institutions issued mortgages easily and without sufficient restrictions as they could get rid of their risk by selling them as mortgage-backed-securities (MBS). On the other hand, individuals who saw this opportunity to own a house, rushed to receive these mortgages, thus rising house prices. As houses started to

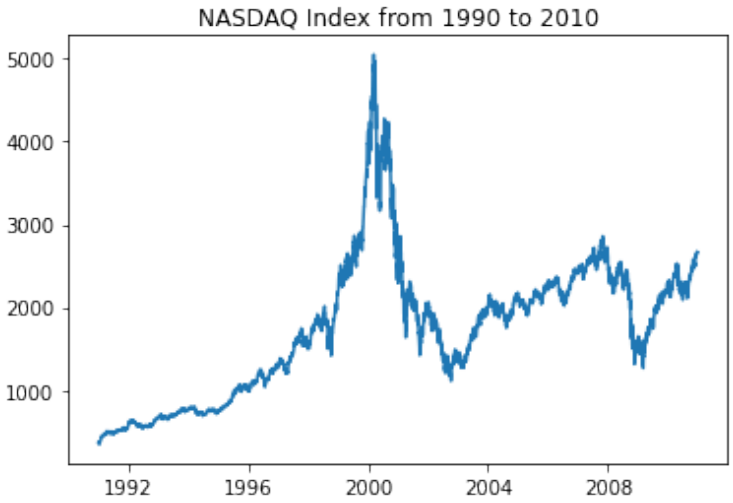

Figure 1: NASDAQ index history shows a peak around year 2000

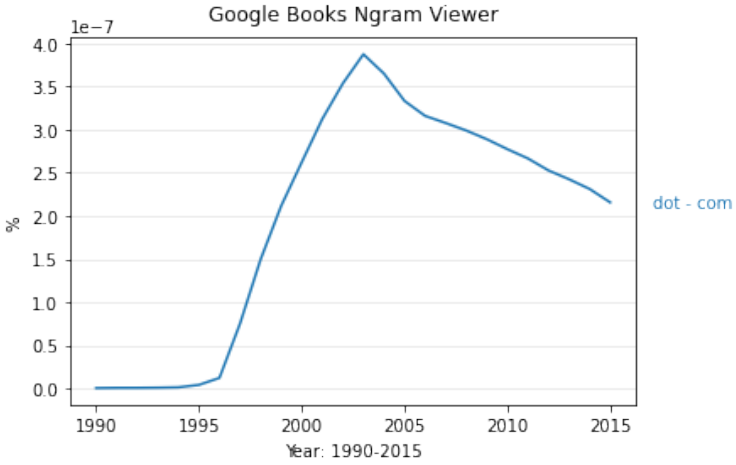

Figure 2: Ngram analysis for "dot-com" similar to NASDAQ index between 1995 and 2001

become more and more expensive, many other people also started to get mortgages and buy houses as a great investment strategy. Herding behavior was also practiced by private rating agencies, as they were in a competition with each other to attract more and more MBS-issuing financial institutions.

The narrative was that these investments were safe due to the perceived stability of the housing market. As the prices surged, many people defaulted on their mortgage payments which led to major downgrades of the MBS held by financial institutions. Due to their obligations on one hand and lack of available funds on the other hand, they tried to liq-

uidate their positions which led to fire sales. Because of the connections between financial institutions, the crisis was intensified.

In Figure 3, Case-Shiller index (average housing prices) have been shown between years 2000 and 2015. There has been a housing boom around year 2006 before a massive bust between years 2007 and 2010. Figure 4, shows relative Google searches for "housing bubble" from 2004 to 2015. Searches have been peaked around year 2005, one year before housing price boom, indicating that people forecasted a bubble but were not willing to bet against.

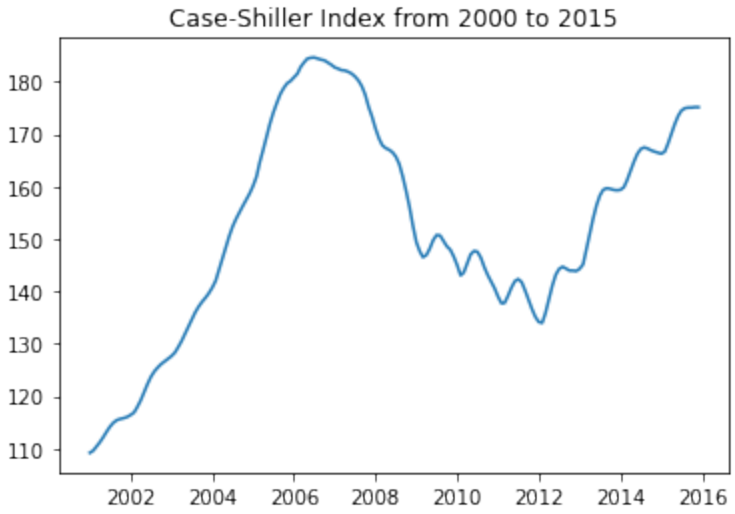

Figure 3: Case Shiller index shows a peak in housing prices around year 2006

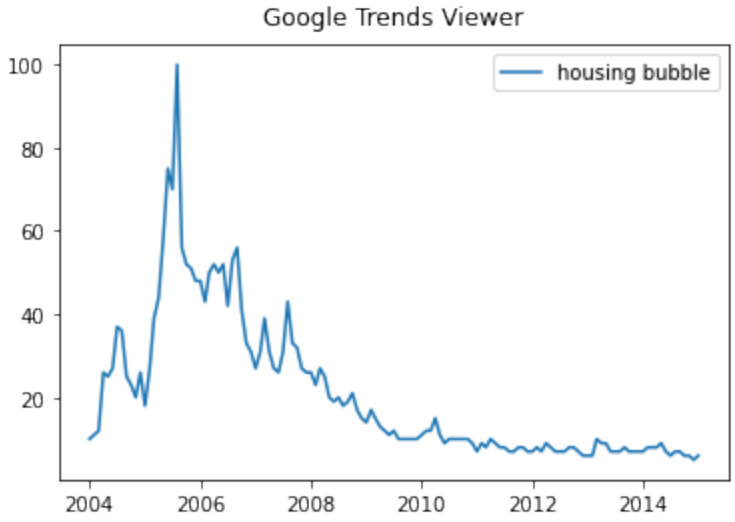

Figure 4: Google Trends shows a peak for searching "housing bubble" around year 2005

Tehran Stock Exchange Crash (2020-2021): During the first year of COVID19 pandemic, people in Iran started investing heavily in stocks. Although many macroeconomic factors such as inflation boosted this behavior, there was also a prevailing narrative that a lot of people can get rich easily by investing in TSE stocks. People saw positive returns every day and the government also encouraged people to participate in state-owned companies' IPOs and ETFs. Herding behavior on one side among investors and government encouragement on the other side, resulted in a major peak in the TSE index, moving further away from its intrinsic value. Eventually, stock market crashed and prices got lower and lower every day, resulting in general dissatisfaction among people blaming the government for its investment encouragements.

In Figure 5, TSE index have been shown between years 2010 and 2023, indicating a peak around year 2020. Figure 6, shows relative Google searches for "Bourse" (Persian word for stock market from 2010 to 2023. The similarity in both figures having a peak around year 2020, shows a herding-driven investment during TSE Crash but not after that.

3 The Neuroeconomic Perspective

There has not been much research done on the neuroeconomic origins of this subject except (Baddeley et al 2012) [1] in which herding behavior is associated with amygdala activation. In that paper herding is generally considered a social behavior which correlates with activation in brain regions responsible for social behavior.

As discussed in the previous section of this essay, herding is mainly driven by narratives. Therefore, it is reasonable to investigate the neuroscience of narratives to determine if the same brain regions are involved in both narrative processing and herding behavior. As suggested by (Jääskeläinen et al, 2020) [6] and (Mehl-Madrona et al, 2022) [7], the Default Mode Network (DMN) is mainly responsible for processing narratives. The DMN is a network of brain regions including midline frontal and parietal structures, medial and lateral temporal

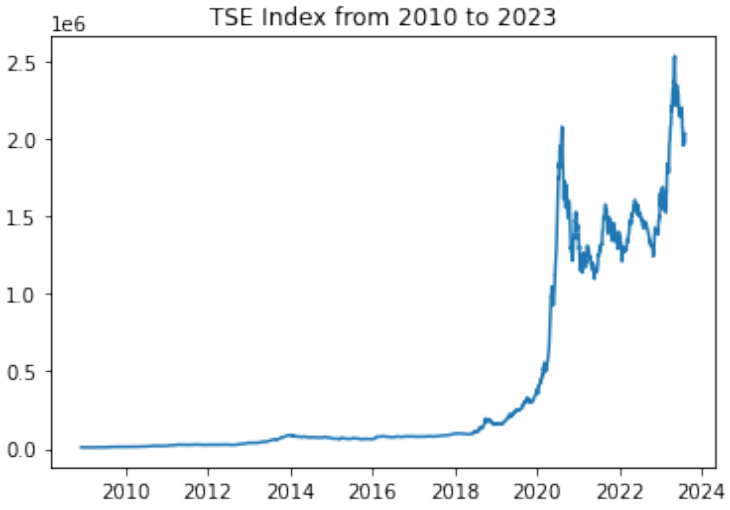

Figure 5: TSE Index shows a peak around year 2020

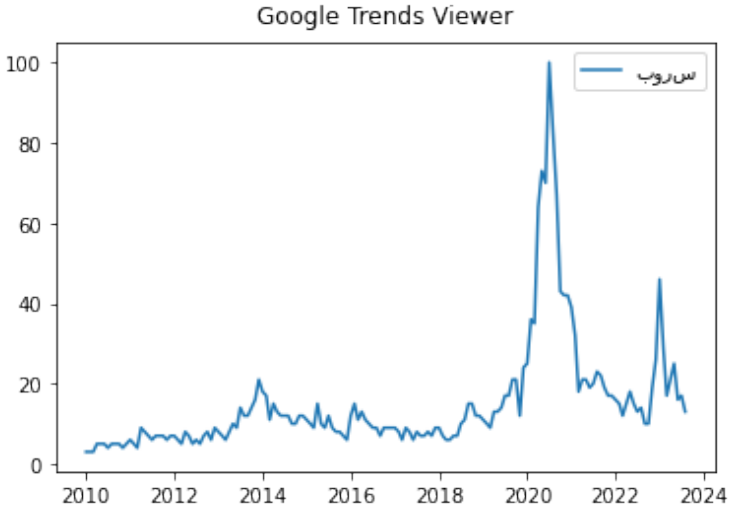

Figure 6: Google Trends shows a peak for searching "Bourse" (Persian word for stock market) around year 2020

lobes, and lateral parietal cortex (Buckner et al, 2008) [3] that become active when the mind is at rest (Bar, 2009) [2] and helps to construct possible future scenarios, actions, and future outcomes. Its function is somehow relevant to what we except for individuals when making financial decisions based on narratives. For example, in dot-com bubble, people hearing news about this exciting new technology called internet and stories about others who got rich investing in internet companies, constructed possible positive scenarios in which they become rich as well.

4 Experimental Hypothesis

Summarizing the results of the narrative and neuroeconomics perspectives, we suggest a hypothesis to be experimented and tested.

"Activations in brain regions responsible for processing narratives (DMN) are correlated with herding behavior"

To test this hypothesis, we use a similar procedure as (Baddeley, 2012) [1]. Task structure we propose has a minor difference. When receiving social information, subjects are given narratives alongside the faces instead of just seeing positive or negative signs. This type of information helps us to capture whether the narrative-processing regions of brain are activated or not. For neuroeconomic analysis, we capture DMN activities using fMRI and we control for the amygdala activations as it is one of the factors affecting herding behavior according to (Baddeley, 2012) [1]. Significant activation of the DMN when herding can confirm our hypothesis that narratives play an important role in this kind of behavior.

5 Future Investigations

Both neuroeconomics and narrative economics are new subjects of economic research. Although there have been some work on the behavioral study of herding behavior, few work have been done on the neuroeconomic origins of this behavior and the main channels in which brain regions affect it.

Previous narrative economic studies, focused mainly on providing the evidence about the role of narratives in driving financial and economic events, but not many of them quantified or measured the effects of narratives. Using social networks we can provide models to quantify the propagation of narratives, and hopefully model their effects on people's herding behavior.

Lastly, it is important that we first study how narratives and news are stored and processed in the brain. Then, focusing on the narrative-processing parts of the brain, we can study if the regions responsible for narratives also play roles in herding behavior.

6 Implications and Conclusion

To understand human behavior, one needs a diverse research toolkit. Behavioral economics and psychology helps us to see the patterns in human behavior and how they deviate from ideal models. Narrative economics provides intuition on how stories, news, human interactions, and the conversations between them can result in social herding. Neuroeconomics goes deep into the brain and studies the brain regions responsible for different kinds of decision making. Policymakers equipped with this toolkit can analyze human behavior more accurately. They can forecast future events by investigating the current trends and narratives and use it to prevent crises from happening.

In this essay, we first provided some background on the herding behavior and why is it important. Then we introduced narrative economics, and the methodology used by Robert J. Shiller to study this subject. Providing evidence about major economic events, we demonstrated how narratives played important roles in causing herding behavior. After that, looking into the neuroeconomics and neuroscience literature, suggested that the DMN is the main brain region responsible for processing narratives. Finally, we provided a hypothesis that the activation of brain regions responsible for processing narratives are correlated with herding behavior. This hypothesis can be examined and tested using the same procedure as (Baddeley, 2012) [1] with only minor differences, as mentioned in section 5.

7 Data

The data for this essay was collected using the following APIs in python programming language:

pytrends: For collecting reports from Google Trends

yfinance: Yahoo! Finance API to download stock prices history

fredapi: Federal Reserve Economic Data API to download Case-Shiller index data

pytse-client: For downloading Tehran Stock Exchange (TSE) prices history

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