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Behavioral finance in crypto-assets: alternatives to the positivist paradigm?

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BEHAVIORAL FINANCE IN CRYPTO-ASSETS: ALTERNATIVES TO THE POSITIVIST PARADIGM?

Introduction

Research in finance belongs almost exclusively to the positivist functionalist paradigm since it is strongly linked to the objectivist ontology: the financial world is composed of financial markets and companies, stable, tangible entities external to the observer. This objectivist ontology is associated with a positivist definition of knowledge that seeks to identify the regularities and causal mechanisms that unite the various entities, with methodologies aimed at identifying universal laws (Lagoarde-Segot, 2015). Most of the research in finance is based on mathematical models and is used to identify the causes of different financial challenges and the basic assumptions of theories. However, the positivist paradigm is not the only source of knowledge in finance and the way to broaden the scope of research is to combine the paradigm with others, such as interpretivism (Sultana, 2020).

The crypto-assets market has attracted the attention of the media and academia since 2013, due to increasing price volatilities and transaction volume (Al-Mansour, 2020). Crypto-assets, especially cryptocurrencies, emerged after the 2008 financial crisis with the white paper published under the pseudonym of Satoshi Nakamoto (2008). The Bitcoin virtual currency is designed to be a decentralized currency with a fixed amount of issuance. Instead of there being an entity to control it, there is a global network of volunteers based on open-source software that does the job. The main feature is that the transactions do not have banks or national states as intermediaries (Butler, 2021). In May 2010, Bitcoin is used as a means of payment for two pizzas for ten thousand Bitcoins (BTC) (Hidajat, 2019). Twelve years later, an apartment in the Portuguese city of Braga is sold for three BTC, in the first European transaction for the sale of a physical asset for cryptocurrency without any conversion to euros (Idealista, 2022).

Although still incipient, research combining behavioral finance and cryptocurrencies shows a growing trend: from two studies identified, in the Web of Science (WoS) and Scopus databases in 2018, to twenty-three in 2021. The field of behavioral finance is more extensive and inclusive combining economics, finance, behavior, and cognitive psychology. It aims to explain why market investors engage in non-rational decisions and studies in this field can be the opening to the path of diversification of paradigms in finance (Lei, 2021). In this way, by exploring new perspectives from other paradigms, one can have a better understanding of the multifaceted nature of the area of finance (Ardalan, 2003).

There is no study, to the authors' knowledge, which has proposed to analyze the topic of behavioral finance and cryptocurrencies under the lens of the paradigmatic approach. This proposal involves a diagnosis of the types of paradigms found in the articles and, later, a discussion of alternatives. Thus, the research problem of this study is to identify the paradigmatic approach of articles on behavioral finance in the cryptocurrency market. Fifty-nine articles on behavioral finance and crypto-assets were selected and read to analyze the paradigm used by the authors and establish possibilities to adopt another paradigmatic view. According to Sultana (2020), the adoption of tools from different paradigms enhances the contribution to the knowledge of the world.

This study aims to answer the following question: what is the paradigm predominantly used in the study of the behavior of investors in crypto-assets? Subsequently, we intend to discuss what would be the advantages and disadvantages of using another approach to study the behavior of investors

in crypto-assets. Moreover, this article intends to contribute to the discussion of the use of other paradigms as complements to positivism for the enrichment of knowledge in finance.

Theoretical Background

Research paradigms are generated from different ontological (the understanding of how things are) and epistemological (the way in which knowledge is believed to be generated) views. The way the world is perceived and the physical or social phenomena investigated is defined by the ontological position adopted, which coexists in three views: (i) the realistic view that presupposes the existence of the world independently of perceptions and mental constructions; (ii) the idealistic or subjectivist view in which an object or entity depends on the observer's perception to exist and (iii) the subject-object interaction that considers that reality results from a social construction as a product of negotiation and sharing of meanings between people. Strongly linked to the ontological assumption, epistemology is related to the way in which knowledge is believed to be generated. The three major schools of thought are (i) objectivism which assumes that, regardless of the human mind, there is meaning about all objects and entities, with mathematics as a great ally for the construction of knowledge; (ii) subjectivism which assumes that the characteristics of objects are not important because it is possible to assign them any meaning that is mentally elaborated and (iii) constructivism for which there is not a reality waiting to be discovered, but to be constructed. not just mentally but because of the interaction between subject and object (Saccol, 2009).

Although several research paradigms can be adopted in Administration: Positivism and Post-Positivism, Interpretivism, Symbolic Interactionism, Phenomenology, Hermeneutics, Critical Theory, Feminism, and Postmodernism (Saccol, 2009), academic finance research belongs almost exclusively to the positivist functionalist paradigm (Lagoarde-Segot, 2015).

Positivism is based on logic, measurement, and the use of deductive reasoning to prove that absolute truths can be applied to the study of phenomena. The researcher's role is one of objectivity and distance, explorer of universal realities, verifier of theories/hypotheses in a hypothetical-deductive logic, in the search for impartial universal truths with quantitative methods, including mathematical and statistical analytical procedures, to determine probabilities or general laws of the phenomena under study (Kelly, Dowling & Millarm, 2018). The axiology of positivism (question of paradigm values) preaches the absence of personal values or moral judgment of the researcher associated with the research process. Values or judgments are considered biases that must be avoided through the adoption of clear, structured, and quantitative research methods and procedures, taking care to use impersonal language (in the third person singular) instead of the first person (singular or plural) (Saccol, 2009).

Finance research considers that the world is made up of tangible and stable entities that are external to the observer and that financial institutions and behavior exist independently of an individual or collective representations of the social world. This realist ontology is linked to objectivist epistemology and the positivist functionalist paradigm (Lagoarde-Segot, 2015). According to Ardalan (2003), theories in academic finance are all based on the positivist paradigm.

Thus, there is the assumption of a clear separation between reality and the observer, using methods to discover the causal mechanisms that regulate the social domain in a cycle of theory formulation, hypothesis testing, and refutation. However, this view has been the target of many criticisms in recent decades, as financial theories necessarily play a sociopolitical role (Lagoarde-Segot, 2015). According to Bettner, McGoun & Robinson (1994) research should be approached with an open mind that allows deducing knowledge and beliefs from multiple perspectives. The authors

understand that the rigid constraints of pure positivism can be relaxed with the critical and creative investigation and that alternative research paradigms should be seen as extensions, not replacements, of traditional methodologies.

One of the possible paradigms of complementation to positivism, although, or even because opposed to it, is interpretivism. Saccol (2009) argues that interpretivism has the ontology of subject-object interaction, in which it considers the existence of interaction between the characteristics of a given object and between the understanding that human beings create about this object. Thus, interpretivism epistemology is constructivist, assuming that all our knowledge about reality depends on human practices and is constructed through the interaction between people and the world in which they live. As the researcher tries not to impose the previous understanding of the researched situation, the inductive logic prevails. In the same way, the researcher avoids imposing categories for the study of a phenomenon to capture what is most significant according to people in the researched context. With this, the researcher is not neutral, and his beliefs, values, and interests are contained in the research context and the results of this, therefore, an interpretation of the researcher on the interpretations of the participants in a certain phenomenon. Consequently, the use of the first person is allowed, and the research methods are essentially qualitative.

Each paradigm advocates a research strategy that is logically coherent and the phenomenon to be researched can be conceptualized and studied in diverse ways generating different types of perception and understanding. As the insights generated by any approach are, at best, partial and incomplete, the researcher can make important gains from reflecting on the nature and merits of different approaches (Ardalan, 2003).

Methodology

The Web of Science (WoS) and Scopus databases are the two main and most comprehensive sources of publication metadata and impact indicators. Even after being extensively compared for more than fifteen years, there is no way to choose which is the best: both are constantly improving due to intense competition and transfer of academic activities to the internet-based digital environment and encompass so many features and functionalities that do not manage to draw such a general conclusion that a base may be a better choice for one purpose but not another (Pranckutė, 2021). For this work, both bases are used in order to have the greatest possible coverage in the search for published articles on financial behavior and crypto-assets. The obvious disadvantage of this strategy is that there is a need to identify duplicate articles, as well as to generate a unique basis for further analysis of the research.

Once the selection is complete, a “quasi” bibliometric analysis of the articles is carried out. Used to identify the behavior and evolution of literature in each context or period, bibliometrics presents a quantitative analysis of document information based on the application of statistical and mathematical techniques (de Queiroz Tavares & Celerino, 2018). According to Teixeira et al. (2013), the denomination of “quasi-bibliometric” studies is more appropriate for bibliometric studies in Administration since the traditional techniques of bibliometrics do not fully meet the needs of researchers. Teixeira et al. (2013) propose a classification for bibliometric studies in Administration: (i) bibliometric categories that include laws such as those of Lotka, Zipf, and Price for public policies for the generation of knowledge, or analysis of the production of knowledge by the institution or the geographical origin of authors; (ii) categories related to authors' profile for demographic characteristics and academic maturity of authors; (iii) to identify the evolution of knowledge in time and space; (iv) to identify the most influential authors and the influences they

receive; and (v) to identify dominant and non-dominant approaches and methodologies in the field. The emphasis of this study is on the identification of the dominant pragmatic and thematic approaches of the articles, as well as the evolution of the themes in time and space and in the influence of the authors.

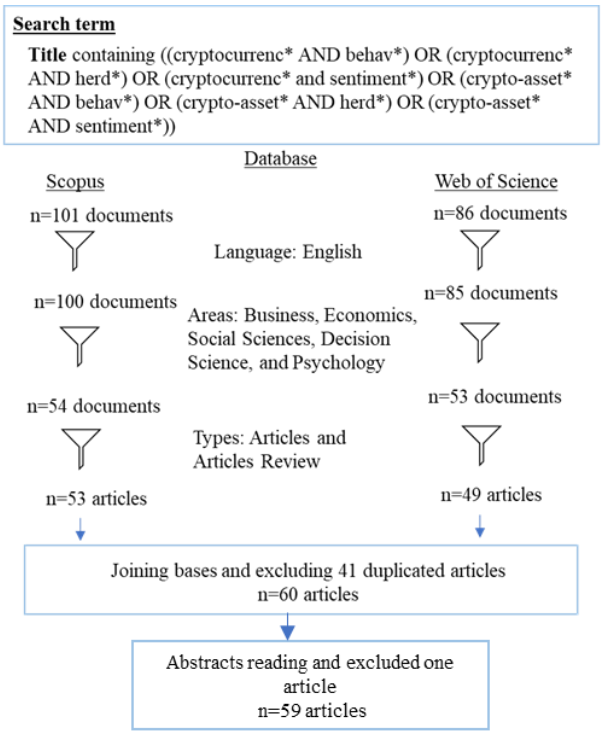
To do so, within the R environment, the Bibliometrix tool developed by Aria & Cuccurullo (2017) is used. The Bibliometrix is an open-source software that facilitates bibliometric study for data analysis and visualization. For ease of use, the web-based application the Biblioshiny is included which performs mapping analysis using the key features of the Bibliometrix (Ingale & Paluri, 2022). In addition to the Bibliometrix, the reading of each article provides the identification of the paradigm and the topic addressed.

Results and discussions

To prepare the base of articles for the search for the answer to the research question, the following keywords (cryptocurrency OR crypto-assets) AND (behavior OR herding OR sentiment) should contain in the title of the document.

Once the documents written in English were selected and filtered for the following areas related to the theme: Business, Economics, areas Social Science, Decision Science, and Psychology. Then, documents that are not in the form of an article or review article were excluded. Next, through commands in R language, the joining of the WoS and Scopus was done followed by the deletion of duplicate articles, resulting in a total of sixty articles. Finally, after reading the abstract of each article, one was excluded because it referred to a real estate market conference report which does not belong to the topic of interest. Figure 1 summarizes the search process and results.

Figure 1 – Search Process



Source: Elaborated by the authors with Scopus and Web of Science databases

Table 1 shows the main journals in which the five most relevant contribute with more than a third of the total publications.

Table 1 – Number of publications per journal

Sources	**Articles**
Finance Research Letters	8
Journal of Behavioral and Experimental Finance	4
Journal of Behavioral Finance	3
Journal of International Financial Markets Institutions and Money	3
Applied Economics	2
Cogent Economics and Finance	2
Economics Letters	2
International Journal of Applied Behavioral Economics	2
International Review of Economics and Finance	2
Journal of Asian Finance Economics and Business	2
Journal of Risk and Financial Management	2
Research in International Business and Finance	2

Source: Scopus e Web of Science databases

Table 2 lists the authors with two or more participations in the selected articles including the affiliation, country of the institution, the total number of published articles, number of citations, and H-index.

Table 2 – Authors with two or more selected articles

Author	**Institution**	**Country**	**Articles**	**Total of Articles**	**Total of citations**	**H-index**
Elie Bouri	Lebanese American University	Lebanon	3	278	9,802	50
Sang Hoon Kang	Pusan National University	South Korea	2	201	4,517	38
Marcelo Klotzle	Pontifícia Universidade Católica RJ	Brazil	2	183	1,120	16
Xuan Vinh Vo	University of Economics Ho Chi Minh City	Vietnam	2	125	3,174	35
Muhammad Abubakr Naeem	Massey University	New Zealand	2	113	1,115	20
Konstantinos Drakos	Athens University of Economics and Business	Greece	2	103	2,761	23

Syed Jawad Hussain Shahzad	Montpellier Business School	France	2	9	n.d.	n.d.
Antonis Ballis	Athens University of Economics and Business	Greece	2	7	77	3
Imen Mbarki	Universite de Tunis	Tunisia	2	4	75	4

Source: Scopus, Web of Science, and Google Scholar databases

Table 3 shows the countries whose institutions contribute to two or more selected articles on the research topic. The British authors with six articles stand out. Brazil presents two articles, both from PUC-RJ, on the herd effect and contagion in the stock market and cryptocurrencies.

Table 3 – Countries with two or more selected articles

Country	**Articles**
United Kingdom	6
China	3
South Korea	3
Lebanon	3
Malaysia	3
Saudi Arabia	3
Brazil	2
Greece	2
India	2
Indonesia	2
Turkey	2

Source: Scopus and Web of Science databases

The most cited articles are shown in Table 4. Among these, most articles refer to the herd effect of investors in the cryptocurrency market.

Table 4 – Most cited articles

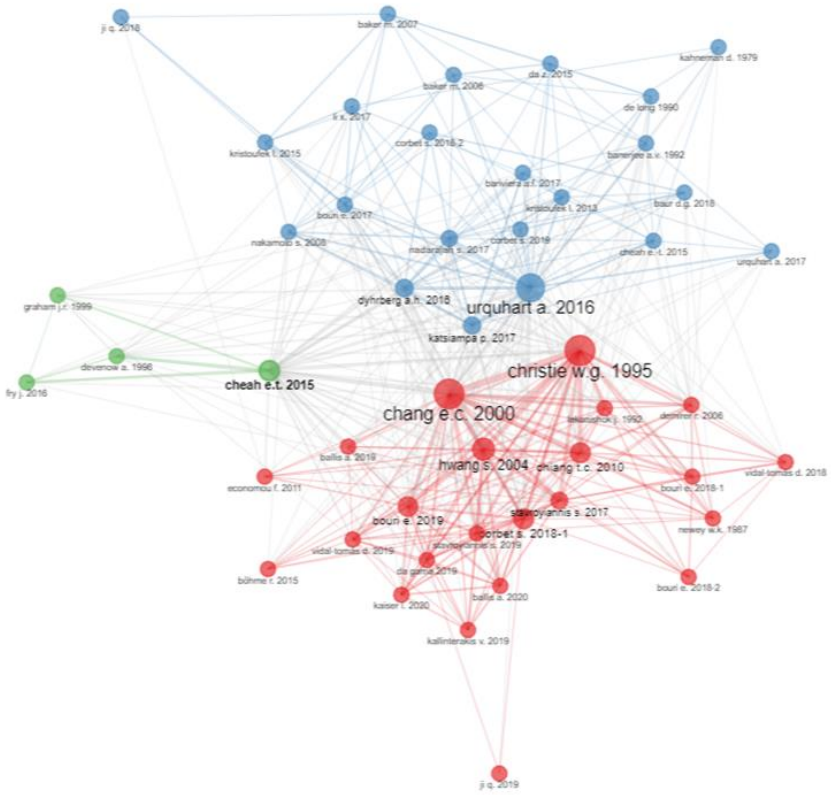
Authors	**Title**	**Total citations**
Bouri, Gupta & Roubaud (2019)	Herding behaviour in cryptocurrencies	123
Vidal-Tomás, Ibáñez & Farinós (2019)	Herding in the cryptocurrency market CSSD and CSAD approaches	66
da Gama Silva *et al*. (2019)	Herding behavior and contagion in the cryptocurrency market	50
Kraaijeveld & De Smedt (2020)	The predictive power of public twitter sentiment for forecasting cryptocurrency prices	46
Kallinterakis & Wang (2019)	Do investors herd in cryptocurrencies and why	27

Stavroyiannis & Babalos (2019)	Herding behavior in cryptocurrencies revisited novel evidence from a TVP model	27
Rognone, Hyde & Zhang (2020)	News sentiment in the cryptocurrency market an empirical comparison with forex	24
Ballis & Drakos (2020)	Testing for herding in the cryptocurrency market	23
Mikhaylov, Sokolinskaya & Lopatin (2019)	Asset allocation in equity fixed income and cryptocurrency on the base of individual risk sentiment	23
Yarovaya, Matkovskyy & Jalan (2021)	The effects of a black swan event covid19 on herding behavior in cryptocurrency markets	22
Gurdgiev & O'Loughlin (2020)	Herding and anchoring in cryptocurrency markets investor reaction to fear and uncertainty	22
Kaiser & Stöckl (2020)	Cryptocurrencies herding and the transfer currency	21
Hu *et al*. (2019)	Intraday price behavior of cryptocurrencies	20

Source: Scopus and Web of Science databases

Figure 2 shows the network of co-citations among the selected articles. The formation of three clusters can be observed: (i) articles related to the herd effect, influenced by Christie & Huang (1995) and Chang, Cheng & Khorana (2000); (ii) articles discussing the role of Bitcoin influenced by Urquhart (2016) and in a lesser diffusion (iii) articles referring to speculative bubbles of cryptocurrencies with Cheah & Fry (2015).

Figure 2 - Co-citation Network



Source: Prepared through biblioshiny using Scopus and Web of Science databases

Table 5 shows the evolution of finance behavior themes referred to crypto-assets along of the years.

Table 5 - Evolution of finance behavior themes in crypto-assets

Theme	2018	2019	2020	2021	2022	Total
Herd effect		5	8	8	4	**25**
Sentiment		2	1	9		**12**
Behavior	2	2	4	1		**9**
Influence			3		1	**4**
Intention				3	1	**4**
Risk		1		2		**3**
Relationship		2				**2**
Total	**2**	**12**	**16**	**23**	**6**	**59**

Source: Elaborated by the authors

The research topic on the herd effect remains predominant over the years and there has been an increase in the number of articles referring to the analysis of investor sentiment on the price of cryptocurrencies, demonstrating the search for understanding predictors and/or explanations of the volatility of cryptocurrencies (Sifat, 2021).

To identify the paradigmatic approach, reading each article is essential. The following should be observed: (i) ontology (realistic, idealistic, or subject-object interaction); (ii) epistemology (objectivist, subjectivist, or constructivist); (iii) logic (hypothetical deductive or inductive); (iv) the absence or intervention of the researcher in the research process; (v) language treatment (impersonal, first person singular or plural); (vi) the research method (Case Study, Action Research, Ethnography, Documentary Research, Experiments, Survey Research, Grounded Theory); (vii) data collection (Sampling, Questionnaires, Interviews, Observation, Focus Group) and (viii) data analysis (Statistical Analysis, Content Analysis, Discourse Analysis, Storytelling). With this, there is a good possibility of understanding the paradigmatic approach of the author of the article (Saccol, 2009). All fifty-nine selected articles present realistic ontology, and objectivist epistemology, with hypothetical deductive logic and apparent absence of the researcher in the research process.

Table 6 lists the articles with the Herd Effect theme. They aim to investigate the existence of the movement that arises when investors abandon their information and beliefs to imitate their peers.

Table 6 – Articles with the Herd Effect theme

Authors	Narrative	Main technique	Data collection	Data Analysis
Choi, Kang & Yoon (2022)	First person	CSAD	Sampling	Statistical Analysis
Mandaci & Cagli (2022)	First person	Granger causality	Sampling	Statistical Analysis

Raimundo *et al.* (2022)	First person	OLS regression	Sampling	Statistical Analysis
Youssef (2022)	First person	CSAD	Sampling	Statistical Analysis
Arsi, Guesmi & Bouri (2021)	First person	CSAD	Sampling	Statistical Analysis
Aydin, Agan & Aydin (2021)	Impersonal	CSAD	Sampling	Statistical Analysis
King & Koutmos (2021)	First person	OLS regression	Sampling	Statistical Analysis
Omane-Adjepong *et al.* (2021)	First person	CSAD	Sampling	Statistical Analysis
Papadamou *et al.* (2021)	First person	Logit regression	Sampling	Statistical Analysis
Rubbaniy *et al.* (2021)	First person	CSAD	Sampling	Statistical Analysis
Yarovaya *et al.* (2021)	First person	CSAD	Sampling	Statistical Analysis
Yousaf *et al.* (2021)	First person	CSAD	Sampling	Statistical Analysis
Amirat & Alwafi (2020)	First person	CSAD	Sampling	Statistical Analysis
Ballis & Drakos (2020)	First person	CSAD	Sampling	Statistical Analysis
Coskun, Lau & Kahyaoglu (2020)	First person	CSAD	Sampling	Statistical Analysis
Gurdgiev & O'Loughlin (2020)	First person	GLS regression	Sampling	Statistical Analysis
Haryanto, Subroto & Ulpah (2020)	First person	CSAD	Sampling	Statistical Analysis
Jalal *et al*. (2020)	Impersonal	CSAD	Sampling	Statistical Analysis
Kaiser & Stöckl (2020)	First person	CSAD	Sampling	Statistical Analysis
Philippas *et al.* (2020)	First person	CSAD	Sampling	Statistical Analysis
Bouri *et al.* (2019)	First person	CSAD	Sampling	Statistical Analysis
da Gama Silva *et al.* (2019)	First person	CSAD	Sampling	Statistical Analysis
Kallinterakis & Wang (2019)	First person	CSAD	Sampling	Statistical Analysis
Stavroyiannis & Babalos (2019)	First person	CSAD	Sampling	Statistical Analysis
Vidal-Tomás *et al.* (2019)	First person	CSAD	Sampling	Statistical Analysis

Source: Elaborated by the authors
Notes: CSAD - Cross-Sectional Absolute Deviation; GLS - Generalized least squares; OLS - Ordinary least squares

In the Herd Effect theme, among twenty-five selected articles, only two are written in impersonal language. The studies opt for the use of secondary data by sampling and all of them show evidence from statistical analyses. There is a predominance of the Cross-Sectional Absolute Deviation (CSAD) technique present in twenty studies. CSAD, suggested by Chang et al. (2000) to measure herd behavior in the stock market, since models such as the Capital Asset Pricing Model (CAPM) do not work when there is great instability in the market and there is a non-linear relationship between return dispersions and the market return (Choi et al., 2022).
Table 7 lists the articles with the Sentiment theme, whose objective is to examine whether emotions, feelings and behavioral attitudes can play a significant role in predicting returns on investments in cryptocurrencies through evidence collected on social networks, especially Twitter.

Table 7 – Articles with the Sentiment theme

Authors	**Narrative**	**Main technique**	**Data collection**	**Data Analysis**
Akyildirim *et al*. (2021)	First person	VAR	Sampling	Statistical Analysis
Alnemer, Hkiri & Khan (2021)	First person	Wavelet coherence	Sampling	Statistical Analysis
Anamika, Chakraborty & Subramaniam (2021)	First person	OLS Regression	Sampling	Statistical Analysis
Anastasiou, Ballis & Drakos (2021)	First person	Panel regression	Sampling	Statistical Analysis
Hassan, Hudaefi & Caraka (2021)	Imperson	Counting through machine learning	Sampling	Statistical Analysis
Mohsin *et al*. (2021)	First person	OLS Regression	Sampling	Statistical Analysis
Naeem *et al*. (2021a)	First person	OLS Regression	Sampling	Statistical Analysis
Naeem, Mbarki & Shahzad (2021b)	First person	OLS Regression	Sampling	Statistical Analysis
Sifat (2021)	First person	Bayesian inference	Sampling	Statistical Analysis
Kraaijeveld & De Smedt (2020)	First person	Granger causality	Sampling	Statistical Analysis
Chen & Hafner (2019)	First person	VAR	Sampling	Statistical Analysis
Park & Lee (2019)	First person	SNA	Sampling	Statistical Analysis

Source: Elaborated by the authors
Notes: OLS – Ordinary least squares; SNA – Social Network Analysis; VAR – Vector Autoregressive models

Only one of the twelve studies on the Sentiment theme opts for impersonal writing. All of them use sample data and statistical analysis and there is a variety of mathematical techniques across studies.

Table 8 presents the articles with the theme of Behavior. They aim to understand the characteristics of investors and contributing factors for investment decisions in cryptocurrencies. Of the nine articles selected, four studies show the option of collecting data through questionnaires, while the other five present the option of sampling secondary data. Among the authors, three use impersonal language, and the others choose to write in the first-person plural. All use mathematical techniques and statistical analysis of data.

Table 8 – Articles with the Behavior theme

Authors	**Narrative**	**Main technique**	**Data collection**	**Data Analysis**
Pham *et al.* (2021)	First person	OLS regression	Questionnaires	Statistical Analysis
Ababio (2020)	First person	GARCH	Sampling	Statistical Analysis
Ayedh *et al.* (2020)	Impersonal	SEM	Questionnaires	Statistical Analysis
Kumar (2020)	First person	CSAD	Sampling	Statistical Analysis
Xi, O'Brien & Irannezhad (2020)	Impersonal	Logit regression	Questionnaires	Statistical Analysis
Hackethal *et al*. (2019)	First person	OLS regression	Sampling	Statistical Analysis
Senarathne (2019)	Impersonal	CSAD	Sampling	Statistical Analysis
Duma & Gligor (2018)	First person	Counting by question	Questionnaires	Statistical Analysis
Gusev (2018)	First person	OLS regression	Sampling	Statistical Analysis

Source: Elaborated by the authors
Notes: CSAD – Cross-Sectional Absolute Deviation; GARCH – Generalized autoregressive conditional heteroskedasticity; OLS – Ordinary least squares; SEM – Structural equation modeling

For the Influence theme, the articles, shown in Table 9, propose to examine the influence of trust, news, elections, and other factors on investor behavior in decision-making in relation to the cryptocurrency market have the dominant impersonal language with three of the four articles making use of it. Two of the articles use questionnaires for data collection, while the other two choices to use secondary data by sampling. Each study presents different mathematical techniques, but all with statistical analyses.

Table 9 – Articles with the Influence theme

Authors	Narrative	Main technique	Data collection	Data Analysis
Koroma *et al.* (2022)	Impersonal	SEM	Questionnaires	Statistical Analysis
Al-Mansour (2020)	Impersonal	OLS regression	Questionnaires	Statistical Analysis
Rognone *et al.* (2020)	First person	GARCH	Sampling	Statistical Analysis
Schaub & Phares (2020)	Impersonal	Event window	Sampling	Statistical Analysis

Source: Elaborated by the authors
Notes: GARCH - Generalized autoregressive conditional heteroskedasticity; OLS - Ordinary least squares; SEM - Structural equation modeling

The studies on the topic of Intention bring together articles that investigate factors that influence the investment intention and adoption of cryptocurrencies, and all four studies use the Structural Equations Model (SEM) with collection by questionnaires and statistical analysis. Three studies present impersonal language. Table 10 summarizes these observations.

Table 10 – Articles with the Intention theme

Authors	Narrative	Main technique	Data collection	Data Analysis
Soomro, Shah & Abdelwahed (2022)	First person	SEM	Questionnaires	Statistical Analysis
Bharadwaj & Deka (2021)	Impersonal	SEM	Questionnaires	Statistical Analysis
Jariyapan *et al.* (2021)	Impersonal	TAM	Questionnaires	Statistical Analysis
er, Salamzadeh & Teoh (2021)	Impersonal	SEM	Questionnaires	Statistical Analysis

Source: Elaborated by the authors
Notes SEM - Structural equation modeling; TAM – Technology Acceptance Model

Articles with the theme Risk, listed on Table 11, aim to study the effects of volatility of cryptocurrencies. With different mathematical techniques, two of the three studies opt for the sampling of secondary data while the third works with primary data collected by questionnaire. All show evidence of statistical analysis. Two studies are written in the first person while one is written in the impersonal language.

Table 11 – Articles with the Risk theme

Authors	Narrative	Main technique	Data collection	Data Analysis
Mensi *et al.* (2021)	First person	VAR	Sampling	Statistical Analysis
Siu (2021)	Impersonal	GARCH	Sampling	Statistical Analysis
Mikhaylov et al. (2019)	First person	OLS regression	Questionnaires	Statistical Analysis

Source: Elaborated by the authors
Notes: GARCH – Generalized autoregressive conditional heteroskedasticity; OLS – Ordinary least squares; VAR – Vector Autoregressive models

Finally, Table 12 lists studies with the theme of Relationships dealing with the analysis of correlation and price behavior between cryptocurrencies. The two selected articles use different mathematical techniques but opt for secondary data by sampling and statistical treatment for analysis. Both are written in the first person.

Table 12 – Articles with the Relationships theme

Authors	Narrative	Main technique	Data collection	Data Analysis
Costa, Silva & Ferreira (2019)	First person	DFA	Sampling	Statistical Analysis
Hu *et al*. (2019)	First person	OLS regression	Sampling	Statistical Analysis

Source: Elaborated by the authors
Notes: DFA – Detrended fluctuation analysis; OLS – Ordinary least squares

Overall, of the fifty-nine articles, thirteen are written impersonally (22%), an unexpected fact under strict positivist observation. But all articles present realistic ontology, objectivist epistemology, with hypothetical deductive logic, the apparent absence of the researcher in the research process, use of statistical analysis with primary data collection (eleven articles - 18%) or secondary by sampling (forty-eight articles - 82%) and various mathematical techniques (highlighting CSAD – 37%, Regressions – 32% and SEM – 10%). Thus, it can be concluded that all selected articles present a positivist approach.

As they are strongly based on calculations, the herd-effect articles, related to risk (volatility) and the relationship between cryptocurrencies would present more difficulties in working in a different approach from the positivist. However, the themes of sentiment, influence, behavior, and intention could be candidates for qualitative methods complementing the positivist view.

The interpretive paradigm for assuming that social reality is the result of the subjective interpretations of individuals and seeing the social world as a process created by individuals can be a suitable alternative. As an example, in the sentiment theme, one can seek to understand how investors, with their multiple realities, see and deal with the challenges of a volatile market such as cryptocurrencies. This understanding can go through interviews in which the researcher, recognizing his role as a participant and not an observer, seeks to understand the world as it is, seeking explanations within the scope of the individual's consciousness and subjectivity. With this, one can find the orders that prevail within the phenomenon considered.

An eventual disadvantage of interpretivism is that it is not possible to generalize, but even the positivist approach cannot guarantee that the generalization is effective. But an important advantage of an interpretive approach is that the topics covered in behavioral finance pertain to human beings. As such, they must be studied by the cultural sphere that needs analytical methods to understand human beings, their minds, their feelings, and the way they express themselves in their external actions. The interpretive paradigm believes that science must be understood within a specific context and cannot generate objective and value-free knowledge. Thus, it is understood that the application of a paradigm other than the positivist enriches the research. However, it is not proposed that this eventual paradigm replaces positivism but complements it.

Final considerations

Our understanding is that the process of scientific investigation is affected by human values in a way that the scientific method is not immune. Since the birth of his study problem, the researcher exerts influence and, therefore, affects the way in which knowledge is obtained.

This study shows that there is room for alternative approaches to positivism, especially in the Behavioral Finance line involving emerging themes, but not restricted to, such as the behavior of crypto-asset investors. The use of lenses additional to those of positivism can expand the universe of knowledge that often goes through creative, innovative, and even controversial activities.

Bibliographic references

Ababio, K. A. (2020). Behavioural portfolio selection and optimisation: Equities versus cryptocurrencies. *Journal of African Business*, *21*(2), 145-168.

Akyildirim, E., Aysan, A. F., Cepni, O., & Darendeli, S. P. C. (2021). Do investor sentiments drive cryptocurrency prices? *Economics Letters*, *206*, 109980.

Al-Mansour, B. Y. (2020). Cryptocurrency market: Behavioral finance perspective. *The Journal of Asian Finance, Economics, and Business*, *7*(12), 159-168.

AlNemer, H. A., Hkiri, B., & Khan, M. A. (2021). Time-Varying Nexus between Investor Sentiment and Cryptocurrency Market: New Insights from a Wavelet Coherence Framework. *Journal of Risk and Financial Management*, *14*(6), 275.

Amirat, A., & Alwafi, W. (2020). Does herding behavior exist in cryptocurrency market? *Cogent Economics & Finance*, *8*(1), 1735680.

Anamika, Chakraborty, M., & Subramaniam, S. (2021). Does sentiment impact cryptocurrency? *Journal of Behavioral Finance*, 1-17.

Anastasiou, D., Ballis, A., & Drakos, K. (2021). Cryptocurrencies' price crash risk and crisis sentiment. *Finance Research Letters*, *42*, 101928.

Aria, M., & Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics*, 11(4), 959–975. https://doi.org/10.1016/j.joi.2017.08.007

Ardalan, K. (2003). Money and academic finance: the role of paradigms. *International Journal of Social Economics*.

Arsi, S., Guesmi, K., & Bouri, E. (2021). Herding Behavior and Liquidity in the Cryptocurrency Market. *Asia-Pacific Journal of Operational Research*, 2140021.

Aydin, Ü., Ağan, B., & Aydin, Ö. (2021). Herd Behavior in Crypto Asset Market and Effect of Financial Information on Herd Behavior. *International Journal of Economics and Finance Studies*, 12(2), 581-604.

Ayedh, A., Echchabi, A., Battour, M., & Omar, M. (2020). Malaysian Muslim investors' behaviour towards the blockchain-based Bitcoin cryptocurrency market. *Journal of Islamic Marketing*.
Ballis, A., & Drakos, K. (2020). Testing for herding in the cryptocurrency market. *Finance Research Letters, 33*, 101210.
Bettner, M., McGoun, E., & Robinson, C. (1994). The case for qualitative research in finance. *International Review of Financial Analysis, 3*(1), 1-18.
Bharadwaj, S., & Deka, S. (2021, December). Behavioural intention towards investment in cryptocurrency: an integration of Rogers' diffusion of innovation theory and the technology acceptance model. In *Forum Scientiae Oeconomia* (Vol. 9, No. 4, pp. 137-159).
Bouri, E., Gupta, R., & Roubaud, D. (2019). Herding behaviour in cryptocurrencies. *Finance Research Letters, 29*, 216-221.
Butler, S. (2021). The Philosophy of Bitcoin and the Question of Money. *Theory, Culture and Society*. https://doi.org/10.1177/02632764211049826
Chang, E. C., Cheng, J. W., & Khorana, A. (2000). An examination of herd behavior in equity markets: An international perspective. *Journal of Banking & Finance*, *24*(10), 1651-1679.
Cheah, E. T., & Fry, J. (2015). Speculative bubbles in Bitcoin markets? An empirical investigation into the fundamental value of Bitcoin. *Economics Letters*, *130*, 32-36.
Chen, C. Y. H., & Hafner, C. M. (2019). Sentiment-induced bubbles in the cryptocurrency market. *Journal of Risk and Financial Management*, *12*(2), 53.
Choi, K. H., Kang, S. H., & Yoon, S. M. (2022). Herding behaviour in Korea's cryptocurrency market. *Applied Economics*, *54*(24), 2795-2809.
Christie, W. G., & Huang, R. D. (1995). Following the pied piper: Do individual returns herd around the market? *Financial Analysts Journal*, *51*(4), 31-37.
Coskun, E. A., Lau, C. K. M., & Kahyaoglu, H. (2020). Uncertainty and herding behavior: evidence from cryptocurrencies. *Research in International Business and Finance*, *54*, 101284.
Costa, N., Silva, C., & Ferreira, P. (2019). Long-range behaviour and correlation in DFA and DCCA analysis of cryptocurrencies. *International Journal of Financial Studies, 7*(3), 51.
da Gama Silva, P. V. J., Klotzle, M. C., Pinto, A. C. F., & Gomes, L. L. (2019). Herding behavior and contagion in the cryptocurrency market. *Journal of Behavioral and Experimental Finance*, *22*, 41-50.
de Queiroz Tavares, W., & Celerino, V.G. (2018). The importance of bibliometrics for automatic indexing. Folha de Rosto, 4(2), 7-15.
Duma, F., & Gligor, R. (2018). Study regarding Romanian students' perception and behaviour concerning the fintech area with a focus on cryptocurrencies and online payments. *Online Journal Modelling the New Europe*, (27).
Gurdgiev, C., & O'Loughlin, D. (2020). Herding and anchoring in cryptocurrency markets: Investor reaction to fear and uncertainty. *Journal of Behavioral and Experimental Finance*, *25*, 100271.
Gusev, A. A. (2018). Public Opinions Impacts on Cryptocurrency Valuation: A View from Behavioral Finance Perspective. *Journal of Reviews on Global Economics, 7*, 696-702.
Hackethal, A., Hanspal, T., Lammer, D., & Rink, K. (2019). The Characteristics and Portfolio Behavior of Bitcoin Investors: Evidence from Indirect Cryptocurrency Investments. *Forthcoming, Review of Finance, SAFE Working Paper*, (277).
Haryanto, S., Subroto, A., & Ulpah, M. (2020). Disposition effect and herding behavior in the cryptocurrency market. *Journal of Industrial and Business Economics, 47*(1), 115-132.

Hassan, M. K., Hudaefi, F. A., & Caraka, R. E. (2021). Mining netizen's opinion on cryptocurrency: Sentiment analysis of Twitter data. *Studies in Economics and Finance*.
Hidajat, T. (2019). Behavioural biases in bitcoin trading. *Fokus Ekonomi: Jurnal Ilmiah Ekonomi*, *14*(2), 337-354.
Hu, B., McInish, T., Miller, J., & Zeng, L. (2019). Intraday price behavior of cryptocurrencies. *Finance Research Letters*, *28*, 337-342.
Idealista (2022) - House in Braga sold for 3 Bitcoins: 1st 100% crypto transaction - Available at <https://www.idealista.pt/news/imobiliario/habitacao/2022/05/06/52164-casa-em- braga-and-purchased-by-3-bitcoins-and-the-1st-transaction-100-crypto> Accessed on 05/31/2022
Ingale, K. K., & Paluri, R. A. (2022). Financial literacy and financial behaviour: a bibliometric analysis. *Review of Behavioral Finance*, *14*(1), 130–154. https://doi.org/10.1108/RBF-06-2020-0141
Jalal, R. N. U. D., Sargiacomo, M., Sahar, N. U., & Fayyaz, U. E. (2020). Herding behavior and cryptocurrency: Market asymmetries, inter-dependency and intra-dependency. *The Journal of Asian Finance, Economics, and Business*, *7*(7), 27-34.
Jariyapan, P., Mattayaphutron, S., Gillani, S. N., & Shafique, O. (2021). Factors Influencing the Behavioural Intention to Use Cryptocurrency in Emerging Economies During the COVID-19 Pandemic: Based on Technology Acceptance Model 3, Perceived Risk, and Financial Literacy. *Frontiers in Psychology*, 12, 814087-814087.
Kaiser, L., & Stöckl, S. (2020). Cryptocurrencies: Herding and the transfer currency. *Finance Research Letters*, *33*, 101214.
Kallinterakis, V., & Wang, Y. (2019). Do investors herd in cryptocurrencies–and why? *Research in International Business and Finance*, *50*, 240-245.
Kelly, M., Dowling, M., & Millar, M. (2018). The search for understanding: The role of paradigms. *Nurse Researcher*, *25*(4), 9-13.
King, T., & Koutmos, D. (2021). Herding and feedback trading in cryptocurrency markets. *Annals of Operations Research*, *300*(1), 79-96.
Koroma, J., Rongting, Z., Muhideen, S., Akintunde, T. Y., Amosun, T. S., Dauda, S. J., & Sawaneh, I. A. (2022). Assessing citizens' behavior towards blockchain cryptocurrency adoption in the Mano River Union States: Mediation, moderation role of trust and ethical issues. *Technology in Society*, 101885.
Kraaijeveld, O., & De Smedt, J. (2020). The predictive power of public Twitter sentiment for forecasting cryptocurrency prices. *Journal of International Financial Markets, Institutions and Money*, *65*, 101188.
Kumar, A. (2020). Empirical investigation of herding in cryptocurrency market under different market regimes. *Review of Behavioral Finance*.
Lagoarde-Segot, T. (2015). Diversifying finance research: From financialization to sustainability. *International Review of Financial Analysis*, *39*, 1-6.
Lei, L. (2021) Behavioural Finance Versus Mainstream Finance. *Academic Journal of Business & Management*, *3*(11), 99-102.
Mandaci, P. E., & Cagli, E. C. (2022). Herding intensity and volatility in cryptocurrency markets during the COVID-19. *Finance Research Letters*, *46*, 102382.
Mensi, W., Al-Yahyaee, K. H., Al-Jarrah, I. M. W., Vo, X. V., & Kang, S. H. (2021). Does volatility connectedness across major cryptocurrencies behave the same at different frequencies? A portfolio risk analysis. *International Review of Economics & Finance*, *76*, 96-113.

Mikhaylov, A., Sokolinskaya, N., & Lopatin, E. (2019). Asset allocation in equity, fixed income and cryptocurrency on the base of individual risk sentiment. *Investment Management & Financial Innovations*, *16*(2), 171.
Mohsin, M., Naseem, S., Ivașcu, L., Cioca, L. I., Sarfraz, M., & Stănică, N. C. (2021). Gauging the Effect of Investor Sentiment on Cryptocurrency Market: An Analysis of Bitcoin Currency. *Romanian Journal of Economic Forecasting*, *24*(4), 87.
Naeem, M. A., Mbarki, I., Suleman, M. T., Vo, X. V., & Shahzad, S. J. H. (2021a). Does Twitter happiness sentiment predict cryptocurrency? *International Review of Finance*, *21*(4), 1529-1538.
Naeem, M. A., Mbarki, I., & Shahzad, S. J. H. (2021b). Predictive role of online investor sentiment for cryptocurrency market: evidence from happiness and fears. *International Review of Economics & Finance*, *73*, 496-514.
Nakamoto, S. (2008). Bitcoin whitepaper. URL: https://bitcoin. org/bitcoin. pdf-(: 17.07. 2019).
Omane-Adjepong, M., Paul Alagidede, I., Lyimo, A. G., & Tweneboah, G. (2021). Herding behaviour in cryptocurrency and emerging financial markets. *Cogent Economics & Finance*, *9*(1), 1933681.
Papadamou, S., Kyriazis, N. A., Tzeremes, P., & Corbet, S. (2021). Herding behaviour and price convergence clubs in cryptocurrencies during bull and bear markets. *Journal of Behavioral and Experimental Finance*, *30*, 100469.
Park, H. W. & Lee, Y. (2019). How are Twitter activities related to top cryptocurrencies' performance? Evidence from Social Media Network and Sentiment Analysis. *Drustvena Istrazivanja*, *28*(3).
Pham, Q. T., Phan, H. H., Cristofaro, M., Misra, S., & Giardino, P. L. (2021). Examining the Intention to Invest in Cryptocurrencies: An Extended Application of the Theory of Planned Behavior on Italian Independent Investors. *International Journal of Applied Behavioral Economics (IJABE)*, *10*(3), 59-79.
Philippas, D., Philippas, N., Tziogkidis, P., & Rjiba, H. (2020). Signal-herding in cryptocurrencies. *Journal of International Financial Markets, Institutions and Money*, *65*, 101191.
Pranckutė, R. (2021). Web of Science (Wos) and Scopus: The titans of bibliographic information in today's academic world. *Publications*, *9*(1). https://doi.org/10.3390/publications9010012
Raimundo Júnior, G. D. S., Palazzi, R. B., Tavares, R. D. S., & Klotzle, M. C. (2022). Market stress and herding: a new approach to the cryptocurrency market. *Journal of Behavioral Finance*, *23*(1), 43-57.
Rognone, L., Hyde, S., & Zhang, S. S. (2020). News sentiment in the cryptocurrency market: An empirical comparison with Forex. *International Review of Financial Analysis*, *69*, 101462.
Rubbaniy, G., Polyzos, S., Rizvi, S. K. A., & Tessema, A. (2021). COVID-19, Lockdowns and herding towards a cryptocurrency market-specific implied volatility index. *Economics Letters*, *207*, 110017.
Saccol, A. Z. (2009). A return to basics: understanding research paradigms and their application in management research. *Revista de Administração da UFSM*, *2*(2), 250-269.
Schaub, M., & Phares, H. B. (2020). Cryptocurrency value changes in response to national elections: do they behave like money or commodities? *Applied Economics Letters*, *27*(14), 1135-1140.
Senarathne, C. W. (2021). Gambling Behaviour in the Cryptocurrency Market. In *Research Anthology on Blockchain Technology in Business, Healthcare, Education, and Government* (pp. 1536-1552). IGI Global.

Sifat, I. (2021). On cryptocurrencies as an independent asset class: Long-horizon and COVID-19 pandemic era decoupling from global sentiments. *Finance Research Letters*, *43*, 102013.
Siu, T. K. (2021). The risks of cryptocurrencies with long memory in volatility, non-normality and behavioural insights. *Applied Economics*, *53*(17), 1991-2014.
Soomro, B. A., Shah, N., & Abdelwahed, N. A. A. (2022). Intention to adopt cryptocurrency: a robust contribution of trust and the theory of planned behavior. *Journal of Economic and Administrative Sciences*.
Stavroyiannis, S., & Babalos, V. (2019). Herding behavior in cryptocurrencies revisited: Novel evidence from a TVP model. *Journal of Behavioral and Experimental Finance*, *22*, 57-63.
Sultana, F. (2020). Paradigm shift and diversity in finance. *Journal of Finance and Accounting Research*, *2*(1), 94-113.
Teixeira, M. L. M., Medeiros, A. L., & Iwamoto, H. M. (2013). Bibliometric Studies (?) in Administration: Discussing the Transposition of Purpose. *Administração: ensino e pesquisa*, 14(3), 423-452.
Ter Ji-Xi, J., Salamzadeh, Y., & Teoh, A. P. (2021). Behavioral intention to use cryptocurrency in Malaysia: an empirical study. *The Bottom Line*.
Urquhart, A. (2016). The inefficiency of Bitcoin. *Economics Letters*, *148*, 80-82.
Vidal-Tomás, D., Ibáñez, A. M., & Farinós, J. E. (2019). Herding in the cryptocurrency market: CSSD and CSAD approaches. *Finance Research Letters*, *30*, 181-186.
Xi, D., O'Brien, T. I., & Irannezhad, E. (2020). Investigating the investment behaviors in cryptocurrency. *The Journal of Alternative Investments*, *23*(2), 141-160.
Yarovaya, L., Matkovskyy, R., & Jalan, A. (2021). The effects of a "black swan" event (COVID-19) on herding behavior in cryptocurrency markets. *Journal of International Financial Markets, Institutions and Money*, *75*, 101321.
Yousaf, I., Ali, S., Bouri, E., & Dutta, A. (2021). Herding on Fundamental/Nonfundamental Information During the COVID-19 Outbreak and Cyber-Attacks: Evidence from the Cryptocurrency Market. *SAGE Open*, *11*(3), 21582440211029911.
Youssef, M. (2022). What drives herding behavior in the cryptocurrency market? *Journal of Behavioral Finance*, *23*(2), 230-239.