

An Investigation of Cryptocurrencies: Behavior Finance Perspective

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ABSTRACT

The cryptocurrency market has ignited heated debates since its large fluctuation during 2013. This project first discusses a brief connection in certain representative cryptocurrency assets, with certain properties raising from the fields of behavior finance. Then I study the link between behaviors in cryptocurrency market with these properties using event study analysis. In order to proxy such behaviors, I extract confidence and uncertainty index which is a proxy of fully rational measurement and any deviations would imply the space of behavior finance theories. I discuss how such measurements could explain various individuals' reactions to cryptocurrencies both quantitatively and qualitatively.

Keywords: *cryptocurrency market, behavioral finance perspective, uncertainty index, confidence index*

1. INTRODUCTION

One of the recent popular topics in the field of Economics and Finance is the combination with Science of psychology. It is important to know how financial market would react to investors' sentiments especially in cryptocurrency area, a block-chain crypted financial asset designed as a new de-centered medium of exchange. The actual investors' behaviors can be traced through realized time series data, pointed out by the textbook written by Thaller (2005). The behavioral finance uses the experimental facts, survey facts, as well as methods of psychology to find the appropriate solution about how certain events may alter investor's decision and how the effects of these results for aggregate financial market behavior. In this project, I will briefly analyze a few types of cryptocurrencies using theories from behavior finance. First and foremost, I will broadly explain how and why the recent development of cryptocurrency relates to various theories of behavior finance. Then, based on event studies, I link different irrational behavior events in the past with behavior finance theories, respectively. A straightforward example is the event that Elon Musk, the CEO of Tesla who once tweeted: "Tesla will support bitcoin payment in the future.", the bitcoin price soared right after this event, and millions of individual investors herd to purchase bitcoin and drive the price up to a new level. This type of financial behavior affected by such event is named "following the herd". Another simple example is that individual investors usually behave Optimism and Overconfidence according to the theory of

behavior finance, because they themselves conceive their ideas must hold true while such overconfidence usually leads to investment failure[1][2].

The nature of the cryptocurrency is a tradable digital asset or digital form of money, built on online blockchain technology. Cryptocurrencies are encrypted to authenticate and protect transactions, attract billions of investors, and even contain illegal inflow and money laundry purposes. Moreover, the volatility in cryptocurrencies' prices is significantly higher than average volatility in stock market. De Bondt and Werner [3] document the stylized fact that the volatility premium in cryptocurrency can be partly explained by the overoptimism and "following the herd" which are first adopted in theories of behavior finance. In order to link the application of behavior finance to the analysis of recent development in cryptocurrency, I collect a measure of stock market sentiment which could proxy the irrational behaviors in overall financial markets. Moreover, the prices of cryptocurrencies are just like other financial asset prices, which are connected with global economic developments. To analyze how the prices of cryptocurrencies could link with such measure, I choose the economic uncertainty index which is argued by scholars that can be connected with how individuals overreact to potential economic uncertainty. If the uncertainty index predicts a drop in cryptocurrency price, the individual would be conceived rational agent since uncertainty usually drive rational agent to precautionary hold liquid, safe, and low volatile assets rather than assets

like cryptocurrencies. The last measurement I chose is named policy uncertainty index, which could measure how unexpected policies changes since the cryptocurrency price may also be affected by policy uncertainty according to Fang et al [4][5][6].

COVID-19 pandemic leads to the inefficiency of economic machines, the economic slow-down, which ignites long-term investment drop, thus individuals turn to liquid short-term asset holdings, such as participating stock markets. The lock-down policy makes people cannot go out but staying home, which turned to more focus on stock markets since they can be accessed online. Besides, the monetary policies such as helicopter-cashing initiated by the Federal Reserve in the U.S. equipped millions of individuals more cash support. At the same time, cryptocurrency has been starting to draw more attention, thus experiencing a surging asset price.

I choose a few cryptocurrencies as the benchmark analysis, such as Bitcoin (first decentralized cryptocurrency released in 2008, with 1.149 trillion dollar, the largest market capitalization), Litecoin (similar to Bitcoin, with 11.9 billion dollars capitalization), Ethereum (initiated in 2015 and is second only to Bitcoin in market capitalization), Dogecoin (created as a "joke", making fun of the wild speculation in cryptocurrencies but experienced a large price increase). As can be seen in Figure 1, the overall prices of these cryptocurrencies has experience a large increase since Oct, 2014. Such soaring price has been criticized to be contained speculative bubbles, which is a recent developed heated topics. This leads us to connect the concepts in behavior finance which are usually conducted by scholars to explain such speculative bubbles.

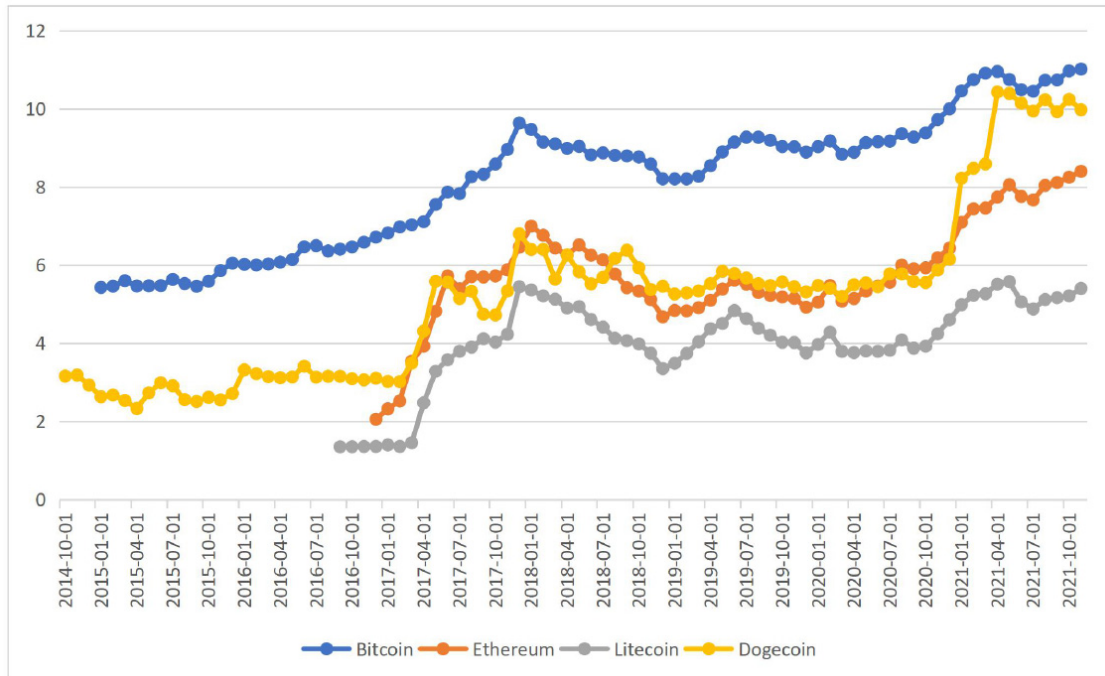


Figure 1. Cryptocurrency monthly price (2014M1-2021M10). Data sources from: www.finance.yahoo.com. (all price are in log level for comparison)

Another interesting fact shown in the following table, is that almost every increase for each cryptocurrency is linked with each other, they appear to share common signals. Such co-movement is at odds in financial markets since stock prices within a certain sector usually contains competition and substitution among each other,

which denotes a long-term increase in certain assets will usually be associated with a decrease in others if these assets share common properties. This is also important to address the theories in behavior finance in the following chapter.

Table 1. Correlation among each cryptocurrencies

	Bitcoin	Ethereum	Litecoin	Dogecoin
Bitcoin	1.0000			
Ethereum	0.5858	1.0000		
Litecoin	0.6789	0.5508	1.0000	
Dogecoin	0.4488	0.4135	0.4767	1.0000

2. EVENT STUDY

2.1 Herding and Heuristics

The large share of noise traders implies the increased volatility in cryptocurrency market, the bubble-like behavior. Unsophisticated noise traders are easily affected by expectations and behaviors of others, which could lead to “herding behavior” and hence the decisions are mostly made in the light of heuristics instead of incorporating actual assessments (Hamrick et al [7] and Jalal et al [8]). For instance, Tesla CEO once called dogecoin his favorite cryptocurrency and “the people’s crypto”, and further announced his corporation will support Dogecoin for trading, the Dogecoin price surged. Specifically, in August 16th, 2021, Elon Musk agreed with Cuban's point of view that Dogecoin is the most powerful medium of exchange, the price rebounded. During May, Elon Musk cooperated with the developers

of Dogecoin, and he also told the developers of Dogecoin that he wants Dogecoin to be easily used in the future, so that investors can use cryptocurrency for consumption in reality, such as buying coffee. In fact, the most ironic thing is that at the beginning, Dogecoin was designed to make jokes of all other cryptocurrencies. The currency used to cut leeks has actually become a currency that can be used. When this incident was reported, many investors thought that since Elon Musk had said so, the price of Dogecoin and other cryptocurrencies would definitely rise despite the facts that all cryptocurrencies are not supported by major governments and there’s no solid arguments to sustain that digital currencies are the future of online payments, they just simply followed to buy Dogecoin. In fact, people rushing to buy Dogecoin is the reason for the increase in cryptocurrency prices, not words from Elon Musk. Actually, an empirical herding model practiced by Poyser [9] is able to characterize the existence of different herding regimes in cryptocurrency market.



Figure 2. Dogecoin monthly price. Sources from: <https://finance.yahoo.com/quote/DOGE-USD/>

2.2 Overconfidence and Contagion

The overconfidence symptom in cryptocurrencies reveals the higher frequently trading as well as large non-fundamental component in their prices. It is documented by many research and newspapers that it is mostly men under 30 trading bitcoins where men trade stocks 45% more frequently than women. Such excessive trade is a symptom of overconfidence. For example, Justin Sun, a Chinese tech entrepreneur, the founder of the cryptocurrency platform, frequently short and long Bitcoin over the past two years, while there’s also plenty of contractionary traders forming heterogeneous beliefs of overconfidence. Such higher non-fundamental component in the trading of Bitcoin forms speculative bubbles. Another possible explanation named contagion, which is usually interpreted that one certain cryptocurrency’s good or bad news may be contagious to the overall cryptocurrency market while other cryptocurrencies’ fundamentals are not changed.

However, the high correlation and co-movement among cryptocurrencies imply the contagious phenomenon. For instance, on Oct 28th, 2021, Shiba Inu price explosion stirred the Doge-pound into action, Dogecoin prices have increased 28% and the reason is just because they two are both dog-type cryptocurrencies.

2.3 News from policy

During Oct 28th, 2021, Ms. Yellen, the former chief of Federal Reserve in the U.S., once announced to depress all cryptocurrencies, which is an unexpected signal to the overall financial market participants in cryptocurrency market. Such a general policy signal triggers huge fluctuation in various cryptocurrencies. There’s also some other policies that have large influence on the cryptocurrency market. For instance, On September 24th, 2021, China declared cryptocurrency mining illegal and forbidden all legal transactions within China. Since there’s a large share of cryptocurrency mining in mainland China, thus, the related policy formed a huge

supply-side shock, depressing cryptocurrency market. Moreover, it may also affect access to cryptocurrency market for Chinese investors. It has generated a time-trend decreasing in Bitcoin and other cryptocurrencies. This is one of the ways that influence the fluctuations in cryptocurrency market souring from news and policies. Besides, there's another type of policies that may affect cryptocurrency market through demand-side. For example, in June 6th, 2021, El Salvador announced that Bitcoin will become legal tender, alongside the US dollar in three months, which makes El Salvador the first country in the world to officially classify any cryptocurrency as legal currency. Such news generated large movement in Bitcoin as well as contaminating other cryptocurrencies. In general, a policy that delivers ambiguous effects to cryptocurrency market, only enlarges asset fluctuation. Policies related to either supply-side or demand-side could have one-way effect to the price of cryptocurrency. A policy signaling contractionary supply, will increase the overall price since holding the demand constant, but supply shifts to the left leading to higher price but lower amount. A policy signaling expansionary demand, given limited supply in cryptocurrencies from mining, leads to a higher market price.

3.CONFIDENCE AND UNCERTAINTY INDEX AND CRYPTOCURRENCY PRICE

In order to better describe how behavioral finance affect cryptocurrency price, I collect a few index which could measure behavioral in different dimensions. The first index I used is called Stock Market Confidence Index, extracted from Robert Shiller's website. This index is constructed by a monthly survey on the behavior of U.S. institutional investors and individual investors, respectively. The second measure is named Economic Policy Uncertainty Index, This index is constructed three main component related to policies, which consists news coverage about policy-related economic uncertainty (key words shown in daily newspaper such as 'uncertainty' or 'uncertain', the terms 'economic' or 'economy' and one or more of the following terms: 'congress', 'legislation', 'white house', 'regulation', 'federal reserve', or 'deficit') as well as tax code expiration data and economic forecaster disagreement component. This index is able to measure the ambiguity aversion to potential uncertain policies. The last measure we use is the financial uncertainty index constructed by Jurado et al [10] which proxies the uncertainty shocks in business cycle theory, and is also able to measure individual's ambiguity aversion in behavioral finance to financial conditions.

Table 2. Correlation among each cryptocurrencies

	Bitcoin	Ethereum	Litecoin	Dogecoin
Individual Confidence	-0.1220	-0.1118	-0.2027	0.0581
Institutional Confidence	-0.1201	0.0631	0.0126	-0.2256
News based Uncertainty	0.0110	-0.0814	-0.1263	0.0315
Financial Uncertainty	-0.1278	-0.2871	-0.2404	-0.2404

In table 1, we compute the time-series correlation between various measurement and cryptocurrency prices. Normally, a higher confidence index will lead to a higher asset price and a higher uncertainty index will lead to a lower asset price for rational expected investors. Thus a positive correlation between asset price and confidence index, but a negative correlation between asset price and uncertainty index will imply fully rationality among investors in certain market. However, for Bitcoin, data reveals a strongly negative correlation to individual confidence index and institutional confidence index, thus leads to higher fluctuations. A positive correlation to news-based uncertainty index also imply a contraction to rational assumptions. For Ethereum, the results show a negative correlation to individual confidence, which indicates a contradiction to rationality and a higher volatility may be generated from such abnormal facts. Moreover, for Litecoin, there's also a negative correlation to individual confidence index, which implies similar irrational reasons. For Dogecoin, a negative correlation between asset price and institutional

confidence but a weakly positive correlation to news-based uncertainty index also contribute to reasons of possible violations to rational assumptions. Such abnormal correlations between various measurement and cryptocurrency prices leave spaces for us to find explanation from theories of behavior finance since any deviation from the measurements we choose involve considerations of behavior finance factors. Moreover, we can only give a hint to such deviations from rationalities, for a deeper analysis, by considering a few behavior factors, Al-Mansour [11] studies investors' decisions in cryptocurrency market using regression strategies. Another direction for further deeper research is to disentangle different stages of price trends for cryptocurrencies and assign related theories of behavior finance. As shown in Figure 3, we can actually separate our analysis into different stages of asset price where the first stage is associated with "following the herd", while the overall increase stage may be associated with overconfidence, and the decreasing market clears may indicate the loss aversion concept.



Figure 3. Different stage of asset-price trend linked with behavior finance properties.

4.CONCLUSION

Conventional economics states that investors' behavior does not significantly affect the prices of assets while this project documents the some phenomenon in cryptocurrency market that is related to emotional and cognitive factors. This project summarizes some stylized event facts in the cryptocurrency market with a special focus on Bitcoin, Ethereum, Litecoin and Dogecoin, from a behavioral finance perspective by first qualitatively analyzing events which may trigger investor's irrational behavior decisions based on event studies. Second, this project collects various rational measurements in which, for any deviations, they could provide a better description to behavioral concepts. Furthermore, I propose possible puzzles in data which provide more supporting evidence that investors in cryptocurrency market may deviate from strict assumptions of fully rationality, but could be affected by behavioral finance factors. Moreover, I summarize potential research prospective by decomposing the behavioral factors and link them with different stages of speculative bubbles.

The behavior finance theories state that investors' behaviors significantly affects the prices of assets. This indicates that behavior finance factors play a significant role in affecting investment decisions made by investors in the cryptocurrency market. The bubble existing in the cryptocurrency market is caused by noise traders which makes the market inefficient. Noise traders thus provide a hypothesis to behavior finance factors such as overconfidence, "following the herd", heuristic and overreactions to news from policy, which may all be important factors in studying the high volatility in cryptocurrency market.

Except event studies on whether cryptocurrency price fluctuates around events which may trigger potential individual's irrational behaviors, we also quantitatively analyze the correlation between certain rational

measurement index and cryptocurrency price. We argue that any deviation from rational predictions of these correlations lead to the possible explanation of behavior finance theories. Under the fully rational assumptions, the asset price should be positively correlated to confidence index but negatively correlated to uncertainty index. However, we found that cryptocurrency prices are sometimes negatively correlated with confidence index, that is a higher confidence level would be associated with a low cryptocurrency price. Besides, certain cryptocurrency prices are also positively correlated with uncertainty index. These contradict to our rational predictions, thus theories based on behavior finance may play a more important role on explaining high volatility in cryptocurrency market.

This project shows how behavior finance exhibition facts in cryptocurrency market has given me a deeper interest in researching behavior finance theories. In the future, I would like to study not only the relationship between cryptocurrency and behavior finance, but also how stock market could be interpreted via theories of behavior finance. For instance, there's possible quantitative finance models incorporating irrational behaviors of individual investors as well as fully rational institutional investors, which is an interesting phenomenon in China's stock market.

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