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Are Crypto Currencies Unbiased? The Case of Bitcoin in Brazil

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ABSTRACT

Cryptocurrencies are now one of the most important alternative investment markets and have been in spot for regulatory purposes for many reasons. In particular, its attractiveness to be easy traded all over the world without governmental interference and without incurring in conversions costs whatsoever. So basically, a cryptocurrency like Bitcoin, the most liquid of them, is traded at the same time in many different exchanges, their particular markets. According to Financial theory, assets with these characteristics will be priced seemingly (considering transactions costs) thanks to international arbitrage among agents. Any exception should be a regulator concern. This paper raises a yellow light by finding that Bitcoin prices are not neutral in their expectations but have a pattern that should be deeper understood. Results indicates that prices either in USD, EUR and BRL are cointegrated and they have a balanced price response up to four times, in other words, 4 lags of 15 minutes, making some predictability possible. Questions about market efficiency, regulations and practice are the consequences of this study.

Keywords: *Blockchain, Bitcoin, Behavior Finance.*

INTRODUCTION

Plihon (1995), in his research, sought to show that international finance has entered a new era, dominated by speculative logic. It is a systemic change that requires the elaboration of new conceptions of public policies. Nowadays, the economist and the decision maker are behind in comparison with the economic and financial reality. The introduction of cryptocurrencies is a financial innovation, so the relevance of this research is to verify the applicability of financial technical analysis in this new emerging market, which resembles a combination of currency analysis and capital market analysis, in light of the concepts of behavioral and traditional finances.

Satoshi Nakamoto (2008) , describes for the first time the bitcoin like “a peer-to-peer electronic cash system, where transactions are validated by the participants themselves without the involvement of a third party that doesn’t make part of the blockchain network”. It becomes the most famous between cryptocurrencies and getaway for a lot of more other existing cryptocurrencies. In this same article, it’s described how does the decentralized network works, and how would it be the operation blocks validations work, these validations are called mining and payment for mining works is in bitcoins. For the first time blockchain was used in this way.

Since 2009, were created numbers of cryptocurrencies, the release of what was called ICO (Initial Coin Offering), they are used to finance the development of new cryptocurrencies and raise funds for new technological projects. Until May 2008, were accurate more than 900 cryptocurrencies being negotiated at the “digital market”, according to the Coin Maket Cap (2018), this market moves more than US$ 350 billion, with price fluctuations ranging from $ 0.00016 (BitSoar crypto) to Bitcoin, with $ 153 billion every 24 hours.

Chu (2017), detects that in China is occurring a large and growing demand for bitcoin, being used by reserve value and investing opportunity. Even the Federal Reserve Board in the United States of America, has been encouraged the central banks to study the new innovations in the financial sector. In particular, the president expressed the need of learning more about innovations, including the bitcoin, blockchain e decentralized accounting technologies.

A new paradigm can be experienced. Cheah (2015) indicates the increase of researches in the area of behavioral finances technologies, besides the interests in the global investments, it’s believed that the bitcoin studies, and others relevant digital currencies, becomes key pieces of how technology affects behavioral finance, or vice versa.

Being a recent subject, there are a few studies that can provide time analyses, practically beginning in 2013, more focused on series measurements and properties than on theoretical links. Debugging the research carried out by Gertchev (2013), Harwick (2014), Bergstra (2014), Cheah (2015), Li (2016), Hayes (2016), Chu (2017), Phillip (2017), Bariviera (2017), Peng (2017), search for an econometric model to parameterize the variations of digital currencies, applying models such as GARCH, Value at Risk (Var), showing results about the digital price currency and attempts to understand the cryptocurrency market, as well as market forecast measurements, currency equalization and economic bubbles, subjects commonly researched in the traditional capital market.

Methodological Analysis Procedures

This study was based on econometric statistics tools using collected data from exchanges in Brazil, the United States and Europe, from August 1, 2017 to July 31, 2018, with a trading data frequency of 15 minutes, totalizing 40.895 observations.

As the bitcoin trading market has no time restrictions, unlike the stock exchange, there was a facilitation so that the obtained data were always in equilibrium between the markets, the trading in England is at the same time as trading in the United States (any city and / or state) and at the same time as in Brazil, for example.

The tests that were elaborates are from ADF and Perron unit roots, for all currencies, BRL, EUR and USD. The best number of lags for the multivariate system was defined by the information criteria Akaike Information Criterion (AIC), Schwarz Bayesian Information Criterion (SBIC), Hannan Quinn (HQIC) e Final Predictor Error (FPE), details on LUTKHEPOL (1993).

To allow the independence between the series data, instead of raw data it was calculated the return for the Neperian logarithm between the data collected from these operations. Exchange and inflation data were collected to adjust the values, in order to eliminate exogenous effects to specific variation of the object of study.

Bitcoin was chosen because it is one of the main entry currencies among other cryptocurrencies and because it has a high liquidity ratio, therefore, is the method of choice was a cryptocurrency with restricted or limited liquidity, the results of this research could be skewed

Data Analysis

Econometric statistical negotiations between bitcoin and their peers in local currency rose, Brazilian Real (BRL), US Dollar (USD) and Euro (EUR). To study the possible influence of the exchanges, the data were analyzed with no lag between the exchanges and with a lag of 15 minutes between the negotiations in the Brazilian Exchange. This analysis allows to verify whether or not there is independence between the series, therefore, in Bitcoin pricing in the studied Exchange.

In the first table can be seen the first series of Euro data (EUR) indicates that it is stationary in level, as the test statistic (-203,385) is smaller than the critical threshold (-3.430). The same result is also seen in Phillips-Perron test. In the Brazilian Real (BRL) data series it also indicates the same test statistic signal (-247,931) for the critical threshold (3,430), indicating that it is stationary at level. The US Dollar (USD) data series indicates that it is also stationary at the level, according to the statistical indicators (-204,655) and the same critical limit of the series (-3,430)

Table1. *Unitary root test of the time series studied. Dickey-Fuller Test and Phillips-Perron*

UNIT ROOTS TEST Observations: 40.895								
Dickey-Fuller				Phillips-Perron			
Time Series	Z(t)	Conf. 1%	Conf. 5%	Time Series	Z(t)	Conf. 1%	Conf. 5%
Euro (EUR)	- 203.385	- 3.430	- 2.860	Euro (EUR)	- 203.872	- 3.430	- 2.860
Real (BRL)	- 247.931	- 3.430	- 2.860	Real (BRL)	- 266.872	- 3.430	- 2.860
Dollar (USD)	- 204.655	- 3.430	- 2.860	Dollar (USD)	- 205.164	- 3.430	- 2.860

By observing the co integration systems test, the second table presents Johansen's cointegration system of EUR USD, indicating that there is at least one cointegration equation in this system.

As the series are cointegrated, the error correction vector, run the model, it is clear that the equation in the euro system, the most important factor there is the very gap of EUR.

System shows the cointegration between the EUR and BRL, the error correction test, one can see that there is correction in the EUR and USD system, bequeaths error correction has significance -30.65 statistic, meaning that the error correction system works for these two series.

The first, second and third EUR lags influence to correct the trajectory of himself. The USD also corrects itself, as it is level, the first, second and third lag has high statistics for the T test and the p-value is almost zero. This shows us that they themselves change without external influence.

The second table also shows the EUR and BRL system test, is found the cointegration according to Johansen tests, where at least one equation occurs the parity cointegration, the best system lag number is also 4 lags (60 minutes) and error correction system, has almost the same criteria as the previous system, and the first, second and third gap of EUR correcting its own value, and soon after, the real variation also corrects it.

When observed the BRL equation, the same behave is noted, in other words, the error correction system cointegrate, just as the past of the EUR system and all real lags correct them, so we identified a complete system where the variables correct each other, cointegrating into a dynamic system. In the cointegration system it can be said that 100% of the value correction in BRL comes from the real BRL itself.

The USD BRL system was also cointegrated according to the Johansen test, with at least one cointegration equation with number of lags also in 4 lags as in the other systems, the error correction vector points out that in the BRL equation the error correction, with BRL in the first and second lead affecting its present value.

Looking at USD, the three past values affect the spot value of BRL, the cointegration system is working, the three past values of BRL and USD affect their present value (spot), the value currently being traded. The system is specified correctly and the error correction mechanism is working.In system 4 testing, the three parties together, BRL, EUR and USD, this system shows us that there are two cointegration equations, so when doing the lag tests, it is pointed out that there are also 4 lags that are significant in the lag.

In the BRL system, the past of BRL, only the first and second lag matters, in USD, the first three lagged values are important, and in EUR the last three values matter. Thus, in the USD equation, the first three BRL values matter, the first three USD values matter, and the first three EUR values matter. In the EUR equation, it follows the same as the USD equation, but apparently the less real the lags exist, the better the present value of the EUR.

Table2. *Johansen test for market cointegration with 15-minute lag between observations and without lag*

COINTEGRATION JOHANSEN TEST - with lag (15 minuts)			
Observations:	**40.892**		
System	**Shuarzing**	**Vector Erro**	**Lag**
Euro x Dollar	-15,63942	-30,65	4
Euro x Real	-14,413	-35,73	4
Dollar x Real	-14,4818	-116,24	4
Euro x Dollar x Real	-22,67053	-118,12	4

COINTEGRATION JOHANSEN TEST - WITHOUT LAG			
Observations:	**40.892**		
System	**Shuarzing**	**Vector Erro**	**Defasagens**
Euro x Dolar	-15,63934	-30,64	2
Euro x Real	-13,99919	-48,15	2
Dolar x Real	-14,07124	-86,1	3
Euro x Dolar x Real	-22,64563	-63,79	3

By analyzing the systems differently, now without lag between EUR and USD with BRL. It was the first USD EUR system and where there is at least one cointegration equation 4 lags to run the system. In the first run system, being EUR versus USD, in the EUR equation, the error correction system works for itself, and the first three EUR values and the last three USD values interfere with the present value of EUR.

In the USD equation, its behavior is similar to that of EUR, with the last three of the USD and the last three values of EUR interfering with the present value of USD. The system and cointegration also works perfectly as shown in the third chart.

The second table tested the second system, EUR against BRL, where at least one cointegration equation can be observed, meaning that the relationship between them is not spurious, with 4 lag legs, and in error correction system the EUR value is interfered by the last three values of the EUR itself and the last three values of the BRL. In equation BRL variation, and for the BRL important are the first three values after the EUR is important only the first value past BRL, and the other has no significant importance.

The USD versus BRL system has at least one cointegration equation, 4 lags is the best number of leads for the system to run and within the error correction system, in the BRL equation we

have importance in the first and second past real values. and the last three past values of USD. In the USD equation, we have the first three past values of BRL and the first three past values of USD.

The system test brings the three joint currencies, USD, EUR and BRL, the result shows that there are two cointegration equations, which is positive from the systems test point of view. In the BRL equation, the important thing is the first three past values of BRL, the past three values of USD and also of EUR. In the USD equation, past values of BRL, USD and EUR are significant. In the EUR equation, the last three past values of BRL, the three past values of USD and no past values of EUR are important.

Conclusion

According to the data collected, exchanges that are trade in USD and EUR have a faster response to the market and their values are explained independently in most tests performed. Therefore, the values move in the same directions (shares a co-movement) in a shorter period of time and the exchange that trades in BRL, even testing with a 15-minute lag between trades, as, unlike the others. Two of the BRL test showed that there is a longer market response time, regardless of whether the move is up or down.

Moreover, it can be seen that the speed of market correction takes longer between USD and BRL, or EUR and BRL, which opens up the opportunity for arbitrage. In tests conducted with the response lag between the USD and EUR BRL markets to equate with the 60 minutes' delay, since data collected was 15 minutes, and the tests showed delayed by 4 leads to balance pricing.

Once the market adjustment does not occur instantly, there is an asymmetry, leading to the possibility of arbitration. This can be a symptom of an immature market in Brazil, with few investors and perhaps incomplete. Looking from the point of view of the cointegration of markets, prices in the markets in EUR and USD are regulation yourself which shows us that the market is highly co-integrate.

Cointegration tests show us that, in the EUR and USD equations, their last three values are statistically significant at the 1% degree to determine their spot value, while in BRL equations, the tests showed mostly that the last price is statistically significant.

From this analysis, it can be stated that the development of the studied markets presents a total cointegration in the researched data series, and their values, both in USD, EUR and BRL, justify their present value formation. Their own last values, being statistically significant at 1%, leading to markets being cointegrated, having a price equilibrium response of up to four time lags, ie 60 minutes (4 lags of 15 minutes).

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