

BITCOIN, THE MOTHER OF ALL BUBBLES OR THE FUTURE OF MONEY?

Sebastian Ilie DRAGOE, Camelia OPREAN-STAN

“Lucian Blaga” University, Sibiu, Romania

dragoesebastian@yahoo.com, camelia.oprean@ulbsibiu.ro

Abstract: *Crypto currencies have sparked great interest lately not only among regular people, billionaires and Wall Street, but it also caught the attention of national and global financial regulators across the world. In this article, we try to answer the following questions: what is bitcoin? It is money, a mean of payment, a huge bubble or just a way to evade taxes, launder money and fund illegal trade? We will answer these questions by testing whether bitcoin is a bubble with the help of right-tailed ADF tests and analyzing if the price of bitcoin has experienced shocks. We identify bitcoin price shock when the price of bitcoin is above its Hodrick-Prescott trend plus one standard deviation. Also, we will analyze if bitcoin fulfils the roles of money and if itself or a stablecoin like Libra can attain an important place within the international monetary system. We will also research the potential risks associated with the adoption of Libra, especially in poorer countries. Despite Bitcoin and Libra's weaknesses, an advantage is that they insist on the necessity of faster and cheaper cross-border funds transfers 24/7, 365 days a year.*

Keywords: bitcoin, crypto-assets, stablecoin, bubbles

1. Introduction

Bitcoin was created in 2009 by a group or a person who used the nickname “Satoshi Nakamoto”. It was created as an electronic payment system that allows two willing parties to transact directly with each other without the need for a trusted third party because it is based on cryptographic proof. Basically all the transactions are updated in groups of transactions called blocks. The lists of blocks are chained sequentially with the use of cryptography to form the blockchain. Blockchain is a type of distributed ledger consisting of lists of blocks. The miners are the bookkeepers of this system as they add transactions on the blocks. Their reward consists of newly created bitcoins and fees, therefore the miners are minting bitcoins. All transaction records are verified by multiple nodes, which are computers that are part of Bitcoin

network. Bitcoin is based on a permissionless distributed ledger, meaning that any person with a computer and the relevant software can join or exit the network [1].

Financial Stability Board uses the term crypto-assets and defines it as a type of private asset depending on cryptography and distributed ledger or alike technologies as part of their perceived or inherent value [2]. The benefits of using bitcoin or other crypto-assets over sovereign currencies within the banking system are higher speed transactions (it takes on average 10 minutes per transaction for the Bitcoin network to process) and payments on 24/7 basis including weekends and holidays. But while crypto-assets have an advantage in terms of speed over the traditional banking system, there is no comparison to the 24 000 transactions per second recorded by

Visa.

However crypto-assets have many issues like price manipulations. One study showed empirical evidence of price support for bitcoin by the use of Tether, a stablecoin [3]. A stablecoin is an altcoin that is pegged to fiat money. We intend to analyze whether bitcoin is viable as money and if it will have an important role within the international monetary system or it's just a speculative bubble. We propose to answer these questions by testing if it is a bubble and analyzing if it does fulfill the roles of money. Lately, Libra project is trying to create a global currency. Libra network will start as a permissioned blockchain and it will strive to become a permission less blockchain. The initial proposal for the value of libra coin was to be backed by a reserve of fiat currencies assets invested in government securities and bank deposits, however it was not consented by the regulatory authorities in this form. We will also analyze if libra in its original form could change the architecture of the current international monetary system. The paper is organized as follows: section two contains an overview of the bubble testing literature and in the third section we describe the models used. In the fourth section we present the results. Finally we will draw conclusions.

2. Literature Review

New powerful bubble test were developed [4] [5]. These tests are based on recursive and rolling ADF unit root tests which enable bubble detection in the time series and date-stamping their occurrence. The null hypothesis of the tests is a unit root and the alternative is a mildly explosive process.

Lowe and Borio (2002) used a simple tool for bubble detection. They have defined housing bubbles as deviations of real house prices above one standard deviations one sided HP filtered trend with a high lambda [6].

Although famous economists stated that bitcoin is a bubble [7], not much research

has been conducted to test this hypothesis. One paper has identified multiple bubble episodes on Mt. Gox bitcoin prices over the period 17 July 2010 to 18 February 2014 with the GSADF method [8].

3. Research methodology

In order to test if bitcoin is a bubble, we use the right tailed ADF tests and a threshold set equal to HP trend + one standard deviation of the cycle.

The right tailed ADF tests employed are standard ADF test and the rolling ADF test. We won't perform SADF test because it has a limited ability to locate bubbles when there are multiple bubbles. Although in most cases GSADF will outperform the other right tailed ADF tests we won't use it. Due to highly volatile nature of bitcoin price and the frequent booms and busts, the Hodrick-Prescott filter plus one standard deviation method might be more appropriate in determining bubbles because it relies on the shocks (one standard deviation from trend) and it does not assume a rational behavior of investors.

All ADF_t tests are expressed as small variations of the equation below [9]:

$$y_t = \alpha + \theta * y_{t-1} + \sum_{i=1}^n \beta_i * \Delta y_{t-i} + \varepsilon_t \quad (1)$$

Where y_t is the dependent variable – the price of bitcoin expressed in logarithm, α is the intercept, β_i are the coefficients for the lagged first difference

$$H_0: \phi = 1 \text{ and } H_1: \phi > 1$$

The difference between the 2 tests is the window size of the regressions applied for the ADF statistic.

The ADF procedure for bubbles is a basically the right-tailed version of the ADF unit root test. In this situation the window is the whole sample.

The rolling ADF test is the rolling variant of the right tailed ADF test. ADF statistic is computed by using overlapping rolling fixed size subsets. The number of increments between successive rolling subsets is one period. The Rolling ADF statistic is the supremum ADF statistic

among all possible subsets.

The estimated start of a bubble occurs when the values of the time series of the recursive test statistic ADF begin to exceed the corresponding 95% right tailed critical values of the standard ADF test. The ending point is located where the values of the estimated ADF start to be lower than the critical values. We use Rtadf, the Eviews add-in to test the existence of bubbles. The critical values of the 2 tests are obtained from Monte Carlo simulation with 5, 000 replications. The initial window size for Rolling ADF contains 138 observations as we follow the recommended rule [6]: initial window size = $(0.01 + 1.8/\sqrt{T}) * T$, where T is sample size (3363 observations).

The other method that we use to detect bitcoin bubbles is the Hodrick-Prescott filter. Although in literature the one-sided filter is utilized to identify bubbles we will use the classical two-sided filter. The disadvantage of using a one-sided filter for a variable with temporary but persistent increase of the growth rate is that the deviation from its trend will minimize as the trend will catch up with the higher growth rates. This is an error as the variable experiences bubble features.

Smoothing parameter parameter λ penalizes the acceleration in the trend relative to the cycle component. Hodrick and Prescott (1997) suggest $\lambda=1,600$ for quarterly data when studying business cycles [10]. However we do not want to speculate about the length of bitcoin cycle. Bitcoin itself is only around 10 years old and has been considered to be subject to frequent booms and busts, therefore we will utilize the average business cycle of around 7.5 years. Because we use daily observations, the base is 91.25 (365/4) and the exponent is 2 – the frequency rule indicated by Hodrick and Prescott (1997).

λ_{daily} for bitcoin = $91.25^2 * 1600 = 13322500$
The HP trend is estimated by using a minimizing function of equation (2)

$$\text{Min}(\sum_{i=1}^n (Y_t - T_i)^2 + \lambda \sum_{i=2}^n [(T_{i+1} - T_i) - (T_i - T_{i-1})]^2) \quad (2)$$

Y_t – actual data and T_i is the trend component

The bubble starts when the price of bitcoin is above its HP trend + one standard deviation of the cycle and ends when the price falls below the same threshold. The data sample for all methods consists of daily bitcoin close prices expressed in logs over the period 17 July 2010 to 30 September 2019 (3363 observations). All computations are made in Eviews 7.2.

4. Results

4.1 Bubbles

In this subsection we present the outcomes of our empirical investigation: Right tailed ADF test, Rolling ADF and HP filter.

The right tailed ADF test statistics value does not exceed the 90% and 95% and 99% critical values (see figure 1), therefore the null hypothesis of unit root is accepted. The result was predictable as the window size is the whole sample. The rolling ADF test (see figure 2) reveals that 17 bubbles occurred during the analyzed period.

With HP method we found that 377 days out of 3363 presented bubble properties. The last bubble lasted until 12 July 2019 (see figure 3).

Based on models' results we can conclude that Bitcoin is a highly speculative asset.

4.2 Could crypto-assets replace fiat?

To be viable as money, bitcoin needs to fulfill the roles of money: a store of value, a medium of exchange and a unit of account. We agree with Mark Carney's (2019) view that bitcoin is failing as money because is a poor short-term store of value [11].

Nobel prize winner Friedrich Hayek argued that a system based on competitive currencies would fare much better than national currencies controlled by governments and central banks [12]. Hayek did not envision a system based on Bitcoin and altcoins. Hayek believed that if free enterprises competed in order to provide

stable currencies in reference to a basket of commodities (commodity reserve standard) by regulating the quantity of their note issuing, they would provide good money. Crypto-assets compete in terms of technology, not purchasing power stability. An alternative could be a stablecoin like libra if it will be accepted by the regulatory authorities. Taking into account the Facebook community, it could be headed to mass adoption at least in poorer countries. One advantage could be reduced volatility. Dragoe and Oprean-Stan (2018) prove empirically that EUR/Enlarged SDR fictitious rate would be less volatile than EUR/USD exchange rate by using ARCH-GARCH family [13].

Central banks are worried that libra could affect the efficacy of monetary policy transmission mechanism and substitute the dollar as global currency. This role was rather supposed for Special Drawing Rights. One important advantage for SDR would be that libra could cause a global safe asset shortage and would lower the world natural interest rate [14]. SDR adoption would not have the same effect because central banks would diversify their reserve asset with SDR through a substitution account however it would be reluctant to proceed in the same manner with libra.

Nevertheless, both proposals have an important flaw in the current environment. Almost 27% of global bonds have negative yields therefore Libra Association could be tempted to invest into riskier assets so risks will increase proportionally with demand for libra [14]. In order to not undermine the monetary sovereignty, Libra Association is

considering a series of stablecoins each pegged to a national currency. However a pegged exchange rate is very difficult to maintain. The scandals in which tether was involved and the numerous currency crises prove how challenging this task can be.

But we should also acknowledge that crypto-assets strive to improve the current monetary system with faster and cheaper cross-border funds transfers 24/7, 365 days a year and financial inclusion. The creation of crypto-assets could lead to the development of central bank digital currencies.

5. Conclusions

Currently, Bitcoin has many flaws like price manipulation, vulnerability to hacking and high volatility. Furthermore, we have found empirical evidence that bitcoin is prone to bubbles. Being a highly speculative asset bitcoin can't fulfill the traditional roles of money. We do not believe that crypto-assets correlate with the monetary system envisioned by Hayek as most of the crypto-assets are decentralized and do not compete in terms of stability. If Libra Association will address the concerns of regulators, it could be headed for mass adoption in poorer countries, leading to massive capital outflows. Another risk is that Libra Association could be tempted to invest into riskier assets, thus risks will increase proportionally with demand for libra. Neither Bitcoin nor Libra can improve the current international monetary system, however both highlighted the need for payments that are cheaper, faster and on 24/7 basis including weekends and holidays.

Right Tailed ADF Tests
Sample : 7/17/2010 9/30/2019
Included observations: 3363
Null hypothesis: L_BITCOIN has a unit root
Lag Length: Fixed, lag=0
Window size: 138
Date: 11/02/19 Time: 08:52

	t-Statistic	Prob.*
ADF	-2.879958	0.9520
Test critical values**:		
99% level	0.643733	
95% level	-0.031442	
90% level	-0.428768	

*Right-tailed test
**Critical values are based on a Monte Carlo simulation (run with EVIEWS)

Figure 1: Right tailed ADF test

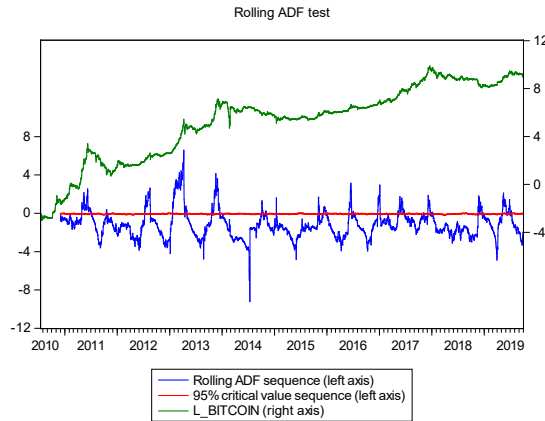


Figure 2: Rolling ADF test

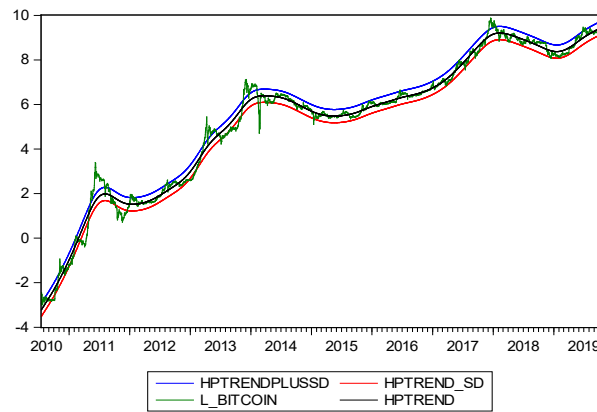


Figure 3: HP trend $\pm$ one standard deviation

References

- [1] Distributed Ledger Technology (DLT) and Blockchain, public Disclosure Authorized, FinTech Note, No. 1, World Bank Group, 2017.
- [2] Financial Stability Board, Crypto-asset markets. Potential channels for future financial stability implications, 2018, available online at: <https://www.fsb.org/wp-content/uploads/P101018.pdf>
- [3] Griffin, J. M. and A. Shams, *Is Bitcoin Really Un-Tethered?* June 13, 2018. Available at SSRN: <https://ssrn.com/abstract=3195066>.
- [4] Phillips, P.C.B., Wu, Y., and Yu, J., *Explosive behavior in the 1990s Nasdaq: When did exuberance escalate asset values?*, International Economic Review, 52, 201-226, 2011.
- [5] Phillips PCB, Shi S, Yu J, *Testing for Multiple Bubbles: Historical Episodes of Exuberance and Collapse in the S&P 500*, International Economic Review, 56(4), 1043 – 1078, 2015.
- [6] Philip Lowe, Claudio Borio, *Asset prices, financial and monetary stability: exploring the nexus*, BIS Working Papers 114, Bank for International Settlements, 2002.
- [7] Krugman, Paul, *Bubble, Bubble, Fraud and Trouble*, The New York Times, 29 January 2018

- [8] Cheung, Adrian & Roca, Eduardo & Su, Jen-Je, *Crypto-currency bubbles: an application of the Phillips–Shi–Yu (2013) methodology on Mt. Goxbitcoin prices*, Applied Economics. 47. 2348-2358. 10.1080/00036846.2015.1005827, 2015.
- [9] CASPI, Itamar. *Rtadf: Testing for Bubbles with EViews*, Journal of Statistical Software, [S.l.], v. 81, Code Snippet 1, p. 1 - 16, nov. 2017.
- [10] Hodrick, Robert; Prescott, Edward C., *Postwar U.S. Business Cycles: An Empirical Investigation*, Journal of Money, Credit and Banking, Vol. 29, No. 1, pp. 1-16, (Feb., 1997).
- [11] Carney, Mark, *The Future of Money*, Speech at the inaugural Scottish Economics Conference, Edinburgh University, 2 March 2018
- [12] Hayek, F.A., *Denationalisation of Money -The Argument Refined An Analysis of the Theory and Practice of Concurrent Currencies*, THE INSTITUTE OF ECONOMIC AFFAIRS, London, 1990, pp. 130-131
- [13] Dragoie, Sebastian-Ilie, Oprean-Stan, Camelia, *A New International Monetary System on the Horizon*, Economic Computation and Economic Cybernetics Studies and Research, Issue 1, Vol. 52, pp. 89-105, 2018.
- [14] Obstfeld, Maurice, Worrying Implications of “Libra” for the International Monetary System, Conference on “The Future of the international Monetary System,” Banque Centrale du Luxembourg, September 17, 2019.