Innovations

Paired sample analysis of digital currency trading and selected Nigerian micro economic performance indicators

Amakor, Ifeoma C.[1], Kolawole, Fatimehin[2] Okerekeoti, Chinedu U.[3]

[1]Department of Banking and Finance, Nnamdi Azikiwe University, Awka
[2]University of the West of England, Coldharbour Lane, Frenchay, Bristol, BS16 1QY, United Kingdom
[3]Department of Accountancy, Nnamdi Azikiwe University, Awka

Abstract

This study examined the extent of relationship that exists between the performance of some selected micro economic variables like; Bank Deposits mobilization (BDM), Per Capita Income (PCI) and Gross Domestic Product (GDP) in pre and Post crypto currency trading era in Nigerian from 1997 to 2020. 1997 to 2008 were regarded as pre-crypto currency era while 2009 to 2020 were seen as crypto currency era. The relevant data were sourced from published work like books and journal articles, while the data for analysis were sourced from the Central Bank of Nigeria Statistical Bulletins. The formulated hypotheses were tested using Paired Sample T-test. The findings revealed that crypto currency trading has significantly positively influenced BDM, PCI and GDP. If crypto currency trading has increased bank performance, people's standard of living and Economic growth in Nigeria; the researcher then recommends that instead of placing an outright ban on the crypto currency bank transaction, such transaction in addition to its identified benefits, could as well serve as a good source of income to the government through transaction tax that could be placed slightly above normal tax rate.

Keyword: 1.Crypto currency, 2.Blockchain, 3.Bit-coin, 4.Gross Domestic Product, 5.Per Capita Income

Introduction

The global financial system is no doubt embracing the current transition from physical currency to almost virtual currencies through the medium of technology (David, 2020). Virtual currency was defined by Chris (2015) as a type of unregulated currency which is issued and regulated by the developers, then used and accepted by the members of a particular virtual community. This has ushered in the birth of digital currency which is a type of virtual currency that is technologically created and stored, majority of the digital currencies are crypto currency. Crypto-currency is also seen as a digital currency in which encryption techniques are used to regulate the generation of units of currency and verify the transfer of funds, operating independently of a central bank. This is to say that crypto-currencies are largely designed to operate without sovereign regulation and are protected from being discovered by government authorities for supervision. In early 2009, an anonymous programmer or a

544

group of programmers under an alias Satoshi Nakamoto introduced Bitcoin which is a form of crypto-currency (Chris, 2015). Since the creation of Bitcoin in 2009, numerous private crypto-currencies have been introduced but Bitcoin has been widely seen as the most successful one. Some of the forms of crypto currencies include Bitcoin (BTC), Litecoin (LTC), Ethereum (ETH), Ripple (XRP), Bitcoin Cash, Neo, Iota, Dash, Qtum, Monero and Ethereum Classic. Since the advent of crypto-currency, it has been getting a lot of media attention, more importantly, many central banks started recently to explore the adoption of crypto currency and blockchain technologies for retail and large-value payments.

However, the birth of crypto currency as a virtual currency has been generating waving reactions in the global economy from both developed and developing nature, thus G30 (2020) urges central banks and regulators to take an active role in setting standard and providing market infrastructure for digital currency trading. Again, there has been a lot of positive and negative discussion on the activities of crypto currency trading because the crypto currency market system seems complex and quite difficult to understand, even for the players in the industry and researchers doing studies in that field (Fry & Cheah, 2016). Many researchers have been revealing the benefits of Bitcoin such as security (Bariviera, Basgall, Hasperué & Naiouf; 2017), low transaction cost (Kim, 2016), high return (Ciaian, 2016; Hong, 2017), alternative instrument for a country's bailout mechanism (Bouri, Gupta, Tiwari & Roubaud, 2017)) and use for employees' wages (Angel & McCabe, 2015). Never the less, some researchers pointed out the risk and drawbacks of using this digital coin, in term of lack of regulation (Cheung, Roca, & Su; 2015) & (Böhme, Christin, Edelman, & Moore; 2015), high electricity bill due to energy consumption (Hayes, 2017; Vranken, 2017), lack of security (Bradbury, 2013; Conte, 2017) and other issues such as anonymity (Androulaki, 2013) and switching cost (Luther, 2015).

More also, the People's Bank of China aims to develop a nationwide digital currency based on blockchain technology and the Bank of Canada and Monetary Authority of Singapore are also studying its usage for interbank payment systems. While Nigerian government through its regulatory agencies such as the Central Bank of Nigeria (CBN) and the Securities and Exchange Commission (SEC) has attempted to place a ban on crypto currency, although its legal status remains ambiguous unlike in countries like Morocco and Algeria where there is a clear ban on trading in Bitcoins such that a breach attracts heavy fines. Based on this controversies, this study attempts to ascertain the extent of relationship that exist between some selected Nigerian micro-economic performance indicators like Bank Deposit Mobilization, Per Capital income and Gross Domestic Product before the era of crypto-currency and during the crypto-currency era. So the study seeks to;

  i. To examine the extent of relationship that exists between crypto currencies trading on bank deposit mobilization.
  ii. To ascertain the level of crypto currency trading influence on per capita income in Nigeria
  iii. To analyze the extent of relationship that exists between crypto currency trading and Gross Domestic Product in Nigeria.

The study also hypothesized that:

$H0_1$: Crypto currency trading has no significant relationship with bank deposit mobilization

$H0_2$: Crypto currency trading has not significant influenced per capita income

$H0_3$: Crypto currency trading has no significant relationship with Gross Domestic Product.

Literature Review

Crypto currency (Digital coin)

Crypto currency is a digital asset designed to work as a medium of exchange wherein individual coin ownership records are stored in a ledger existing in a form of a computerized database using strong cryptography to secure transaction records, to control the creation of additional coins, and to verify the transfer of coin ownership. It typically does not exist in physical form (like paper money) and is typically not issued by a central authority. Jake & Michael (2021) defined crypto currency as a digital or virtual currency that is secured by cryptography, which makes it nearly impossible to counterfeit or double-spend. Corbet (2019) in his own way sees crypto-currencies as a financial asset.

Bitcoin

Bitcoin is a digital or electronic currency used online among individuals which was created in January 2009. It is a decentralized digital currency without a central bank or single administrator. It was invented by an unknown person or group of people using the name Satoshi Nakamoto, and released as open-source software in 2009. Unlike government currencies, there is no central bank backing Bitcoin and anyone with a computer or an Application-Specific Integrated Circuit (ASIC), which is a dedicated machine specifically created for the purpose, can create a Bitcoin by a process called mining (Chris, 2015). It follows the ideas set out in a whitepaper by the mysterious and pseudonymous Satoshi Nakamoto. Bitcoin offers the promise of lower transaction fees than traditional online payment mechanisms and it is operated by a decentralized authority and a type of crypto currency.

Blockchains

Blockchains are digital sequences of numbers coded into computer software that permit the secure exchange, recording, and broadcasting of transactions between individual users operating anywhere in the world with Internet access. The development of blockchains drew on and combined several existing technologies such as Algorithms, Time-stamping technologies and digital encryption technologies. Digital encryption technologies mask, to varying degrees, the specific content exchanged as well as the identities of individual users. Algorithms, pre-coded series of step-by-step instructions, are also mobilized in solving complex mathematical equations and arriving at a consensus on the validity of transactions within networks of users. Time-stamping technologies then periodically bundle verified transactions into datasets, or 'blocks'. Linked together sequentially, these 'blocks' form 'chains' that makes up larger 'blockchain' databases of transactions that broadcast a permanent record of transactions whilst maintaining the anonymity of users and specific content exchanged (Malcom, 2018).

Per Capita Income

Per capita income is national income divided by population size and it is also known as average income. It is often used to measure a sector's average income and compare the wealth of different populations. Per capita income is also often used to measure a country's standard of living. It is usually expressed in terms of a commonly used international currency such as the euro or United States dollar, and is useful because it is widely known, is easily calculable from readily available gross domestic product (GDP) and population estimates, and produces a useful statistic for comparison of wealth between sovereign territories. This helps to ascertain a country's development status. It is one of the three measures for calculating the Human Development Index of a country.

Gross Domestic Product (GDP)

Gross Domestic Product could be defined as the market value of all final goods and services produced within a country in a given period of time. This implies that Gross Domestic Product takes into account the market value of each good or service rather than adding up the quantities of the goods and services directly. The Gross Domestic

546

Product (GDP) is one of the primary indicators used to measure the healthiness of a country's economy. It is also used to determine the standard of living of individuals in an economy. The components of Gross Domestic Product includes; Consumption, Investment, Government expenditure, Gross export, Gross import etc.

Empirical Review

Chu et al. (2019) investigated the adaptive market hypothesis regarding the markets of two popular crypto-currencies (Bitcoin and Ethereum) against the Euro and the U.S. dollar using data on logged hours with high-frequency Bitcoin and Ethereum prices. The result revealed that sentiment and events are not significant factors in determining the effectiveness of crypto currency markets. So the results appeared to be consistent with the hypothesis, where the efficiency of the markets varied over time. Xu et al. (2019) measured the tail-risk of interdependence among 23 crypto-currencies using quartile regression also known as the Tail-Event driven framework. The study discovered that a significant risk spillover effect exists and that the degree of the total connectedness of all the sampled crypto-currencies increased steadily over time. Grobys (2019) tried to determine the moving average trading strategies employed by 11 by most traded crypto currencies based on the daily data of the price of crypto-currencies from 2016 to 2018. The result indicated that a variable moving average strategy is successful when using a 20-day moving average trading strategy. In addition, the results revealed that crypto currency markets were inefficient. Corbet (2020) studied the effects of cyber criminality on crypto-currency using data from the Bitfinex exchange at a 60-min frequency for the eight most liquid crypto-currencies. The results led to the conclusion that hacking events also increased both the price volatility of the targeted crypto currency and cross-crypto currency correlations. Koerhuis (2019) conducted a forensic analysis of privacy-oriented crypto-currencies and found that criminals used crypto-currencies that had built-in anonymity and privacy features to launder money. Caporale (2019) used a Markov-switching non-linear specification to analyze the effects of cyber-attacks on the returns of four crypto-currencies from 2015 to 2019. The results confirmed the existence of significant adverse effect of cyber-attacks on the probability of crypto-currencies staying in the low volatility regime. Gao, (2017) examined the impact of government regulations on crypto currency 2009-2017. The correlation and regression analysis of the ordinary least square was used to analyze the data. The result showed that government regulation will actually review the impact of crypto currency to an economy. Governments could not control it though they could and would regulate and tax it. Andriole (2017) examined the significance of crypto-currency in avoidance of theft and easy transaction using time-series data which was regressed using OLS. The result showed that theft was essentially impossible with crypto-currency, while money laundering, among other transactions, was easy. Narayanan, et, al. (2016) identified three components of bitcoin's design that could be decoupled and analyzed individually as transactions and scripts, consensus and mining, and the peer-to-peer communication network using Autoregressive Distributed Lags (ARDL) approach Viglione (2015) had proved an inverse relationship between economic freedom and bitcoin price premiums and also concluded that even at early and volatile stages, bitcoin was generating useful macroeconomic data.

Theoretical Review

This study is anchored on Technology Acceptance model as developed by Davis in 1985. The model states that the chances of acceptance of any innovation depend on two concepts; how easy the innovation will be learnt and implemented and the degree of its usefulness to the potential adopters' job related performance (Marcia, 2018). Changes in technology are one of the challenges of ICT based world that has come to stay. The introduction of digital currency has also drawn the interest and attentions of our youths who have mastered the trading system at easy, and comfortably make money at their comfort zone. The best approach to this innovation is to adopt the technique of some developed economies that are working hard to develop a blockchain network through which

547

their fiat currency could be traded in digital form, because it is an innovation that can hardly be stopped by any authority (David, 2020)

Methodology

This is a developmental research that seeks to examine the extent of relationship that exists between crypto-currency trading and selected Nigerian micro economic performance indicators for 24 years from 1997 to 2020, using secondary data sourced from CBN statistical bulletin and World Bank development. The scope was grouped into two; 1997 to 2008 as pre crypto-currency trading era and 2009 to 2020 as crypto-currency era. The formulated hypotheses were tested using Paired Sample t Test. The Paired Samples t Test compares the means of two measurements taken from the same individual, object, or related units. These "paired" measurements can represent things like: A measurement taken at two different times (e.g., pre-test and post-test score with an intervention administered between the two time points)

Model Specification

The model for this study is presented in an econometric form as;

$BDPM = \beta_0 + \beta_1 CRYPT + \mu$........... (1)
$PCI = \beta_0 + \beta_1 CRYPT + \mu$........... (2)
$GDP = \beta_0 + \beta_1 CRYPT + \mu$........... (3)

Where:
CRYPT= Crypto currency
DPM= Deposit Mobilization
PCI= Per Capita Income
GDP= Gross Domestic Product
$\beta_1 \beta_2 \beta_3$ = Coefficients of the independent variables
μ= error term

Data Presentation
Table 1a. BDEP, PCI, GDP (1997-2008)

Time 1	BDEP_PRE	PCI_PRE	GDP_PRE
1997	269.85	38,945.88	4,111.64
1998	314.30	41,309.89	4,588.99
1999	476.35	45,969.74	5,307.36
2000	702.10	57,757.02	6,897.48
2001	947.18	65,668.90	8,134.14
2002	1,157.11	89,438.58	11,332.30
2003	1,337.30	102,781.70	13,301.60
2004	1,661.48	133,934.40	17,321.30
2005	2,036.09	166,506.20	22,270.00
2006	3,245.16	213,101.90	28,662.50
2007	5,001.47	236,954.70	32,995.40
2008	7,960.17	265,883.50	39,157.90

Source: *CBN statistical Bulletin, 2020*

548

Table 1a contains time series data on bank deposits (BDEP), per Capita income (PCI) and Gross Domestic Product (GDP) before the introduction of crypto currency.

Table 1b: BDEP PCI, GDP (2008-2020)

Time 2	BDEP_POST	PCI_POST	GDP_POST
2009	9,150.04	281,623.10	44,285.60
2010	9,784.54	344,549.90	54,612.30
2011	11,452.76	387,793.40	62,980.40
2012	13,132.10	432,649.60	71,713.90
2013	13,767.46	471,630.40	80,092.60
2014	17,185.80	510,966.40	89,043.60
2015	17,276.67	525,444.80	94,145.00
2016	18,326.96	551,598.50	101,489.00
2017	18,025.67	601,966.10	113,711.60
2018	21,430.85	659,159.10	127,736.83
2019	23,465.12	693,117.08	144,210.49
2020	31,456.96	701,223.71	152,324.07

Source: *CBN Statistical Bulletin, 2020*

The other hand, table 1b shows time series data on the aforementioned variables after the introduction of crypto currency.

Table 2: Descriptive Statistics (Pre-Crypto Currency Introduction)

Descriptive Statistics

	N	Minimum	Maximum	Sum	Mean	Std. Deviation
BDEP_PRE	12	269.84	7960.16	25108.56	2092.38	2300.11
PCI_PRE	12	38945.88	265883.50	1458252.41	121521.0342	81047.96740
GDP_PRE	12	4111.64	39157.90	194080.61	16173.3842	12006.97548
Valid N (listwise)	12					

Source: SPSS Descriptive Statistics Output, 2021

The Pre-descriptive statistics revealed that from 1997 till just before the introduction of crypto currency in 2009, bank deposit averaged ₦2,092 billion annually and had recorded a total of ₦25,108 billion over the period. Also GDP and PCI averaged ₦16,173 billion naira and ₦121,521 billion naira respectively.

549

Table 3: Descriptive Statistics (Post-Crypto Currency Introduction)

Descriptive Statistics

	N	Minimum	Maximum	Sum	Mean	Std. Deviation
BDEP_POST	12	9150.04	31456.96	204454.93	17037.91	6347.56
PCI_POST	12	281623.10	701223.71	6161722.09	513476.84	136364.79
GDP_POST	12	44285.60	152324.07	1136345.39	94695.45	34640.48
Valid N (listwise)	12					

Source: *SPSS Descriptive Statistics Output, 2021*

Table 3: reveals that after the introduction of crypto currency up until 2020, bank deposits have averaged ₦17,037 billion while GDP and PCI recording average values of ₦94,659 billion naira and ₦513,476.84 billion naira. Since the inception of the crypto currency deposit money banks have accumulated deposits of over ₦204, 454.93 billion.

Re-statement and test of Hypotheses

The formulated are thus re-stated in null form and tested using the probability values (p-value) of the correlation procured in the Pair Sample t-test

$H0_1$: Crypto currency trading has no significant relationship with bank deposit mobilization

$H0_2$: Crypto currency trading has not significant influenced per capital income

$H0_3$: Crypto currency trading has no significant relationship with Gross Domestic Product.

Table 4: Mean Difference of Paired Sample t-test

Variables	Pre Crypto Currency Mean	Post Crypto Currency Mean	Mean Difference	t-statistic	p-value
BDEP	2092.38	17037.91	-14945.5	-12.28	0.000
PCI	121521.03	513476.84	-391955.81	-20.89	0.000
GDP	16173.38	94695.44	-78522.07	-11.800	0.000

Source: Author's Compilation from SPSS Paired Sample t-test Output, 2021

Table 4: reveals that the mean differences for all three economic variables were negative indicating that the values of each variable after the introduction of crypto currency were greater than the values of these variables before the introduction of crypto currency. The t-statistics and p-values also revealed that the difference between the mean is significant. It can therefore be said that bank deposits, per Capita income and GDP in Nigeria improved significantly after the introduction of crypto currency.

Findings, Conclusion and Recommendation

The findings of the study showed that banks' deposits, PCI and GDP in Nigeria have significantly increased after the advent of crypto currency compared to the values before the introduction of crypto currency. This shows that banks have been able to record significantly higher value of deposits since crypto currency was introduced, Capita income in Nigeria also increased significantly since the introduction of crypto currency and GDP values after the introduction of crypto currency were significantly better than the values recorded before the emergence of crypto

550

currency in Nigeria. If crypto currency trading has increased bank performance, people's standard of living and Economic growth in Nigeria; the researcher then recommends that instead of placing an outright ban on the crypto currency bank transaction, such transaction in addition to its identified benefits, could as well serve as a good source of income to the government through transaction tax that could be placed slightly above normal tax rate.

References

1. *Androulaki, E., Karame, G. O., Roeschlin, M., Scherer, T., & Capkun, S. (2013) Evaluating user privacy in bitcoin. In: International Conference on Financial Cryptography and Data Security (pp. 34-51). Berlin/Heidelberg, Germany: Springer*
2. *Angel, J. J., & McCabe, D. (2015). The ethics of payments: Paper, plastic, or Bitcoin? Journal of Business Ethics, 132(3), 603- 611.*
3. *Bariviera, A. F., Basgall, M. J., Hasperué, W., & Naiouf, M. (2017). Some stylized facts of the Bitcoin market. Statistical Mechanics and its Applications, 484, 82-90.*
4. *Böhme, R., Christin, N., Edelman, B., & Moore, T. (2015). Bitcoin: Economics, technology, and governance. The Journal of Economic Perspectives, 29(2), 213-238. h*
5. *Bouri, E., Gupta, R., Tiwari, A. K., & Roubaud, D. (2017). Does Bitcoin hedge global uncertainty? Evidence from wavelet- based quantile-in-quantile regressions. Finance Research Letters, 23, 87-95.*
6. *Bradbury, D. (2013). The problem with Bitcoin. Computer Fraud & Security 11; 5-8*
7. *Caporale, G., Maria, Wo., Spagnolo, F., & Spagnolo, N. (2019) Non-Linearities, Cyber Attacks and Crypto-currencies. Finance Research Letters 32: 101297.*
8. *Cheung, A., Roca, E., & Su, J. J. (2015). Crypto-currency bubbles: an application of the Phillips–Shi–Yu methodology on Mt. Gox bitcoin prices. Applied Economics, 47(23), 2348-2358.*
9. *Chris, R. (2015). The evolution of digital currency; bitcoin a crypto currency causing a monetary revolution. International Business Economic Research Journal 14 (4) 617-622.*
10. *Chu, J., Yuanyuan, Z. & Stephen, C. (2019) The Adaptive Market Hypothesis in the High Frequency Crypto currency Market. International Review of Financial Analysis 64: 221–31. CrossRef*
11. Ciaian, P., Rajcaniova, M., & Kancs, D. A. (2016). The economics of Bitcoin price formation. Applied Economics, 48(19), 1799- 1815.
12. Conte de Leon, D., Stalick, A. Q., Jillepalli, A. A., Haney, M. A., & Sheldon, F. T. (2017). Blockchain: properties and misconceptions. Asia Pacific Journal of Innovation and Entrepreneurship, 11(3), 286-300.
13. Corbet, S., Douglas, J., Cumming, B. M. L., & Peat, M. (2019). The destablishing effects of Crypto currency Cybercriminality. Economics Letters 191: 108741.
14. Corbet, S., Larkin, C., & Lucey, B. (2020) The contagion effects of the COVID-19 Pandemic: Evidence from Gold and Cryptocurrencies. Finance Research Letters 35: 101554.CrossRef
15. David, B. (2020) The digital currency revolution. Center for the study of financial innovation (CSFI) Heron Dawson and Sawyer; U.K. ISBN 978-1-9997174-8-3
16. Fry, J., & Cheah, E. T. (2016). Negative bubbles and shocks in crypto currency markets. International Review of Financial Analysis, 47, 343-352.
17. Gao, K. (2017). The crypto currency funds have arrived, and they're bringing wall street money. Long only, ETF investing, commodities, tech.
18. Grobys, K., Ahmed, S. & Sapkota, N. (2019) Technical Trading Rules in the Crypto currency Market. Finance Research Letters 32: 101396. CrossRef
19. G30 paper (2020). Digital currencies and stablecoins: Risk, opportunities and challenges ahead. 701k Street, N.W. Suite 950, Washington DC

20. Hayes, A. S. (2017). Crypto currency value formation: An empirical study leading to a cost of production model for valuing bitcoin, Telematics and Informatics, 34(7), 1308-1321.
21. Hong, K. (2017). Bitcoin as an alternative investment vehicle. Information Technology and Management, 18(4), 265-275.
22. Jake,F. & Michael, S. (2021) Definition of crypto currency. Retrieved from www.investopedia.com

23. Koerhuis, W,, Kechadi, T. & Le-Khac, N (2019) Forensic Analysis of Privacy-Oriented Crypto-currencies. Forensic Science International: Digital Investigation 33: 200891.
24. Luther, W. J. (2015). Crypto-currencies network effects, and switching costs. Contemporary Economic Policy, 34(3), 553- 571.
25. Malcom, C.V. (2018). Bitcoin and beyond: Crypto currencies, blockchains and global governance. RIPE series in global political Economy. Routledge Taylor and Francis group London and New York.
26. Marcia, H. (2018). Theories of innovation adoption and real World case Analysis. PB Pressbook, Ohio State University Columbus
27. Narayanan, E. (2016) Bitcoin and crypto currency technologies: a comprehensive introduction. Boston University.
28. Viglione, R. (2015) Does governance have a role in pricing? Cross-country evidence from bitcoin markets. University of South Carolina: Department of Finance.
29. Vranken, H. (2017). Sustainability of bitcoin and blockchains. Current Opinion in Environmental Sustainability, 28, 1-9.
30. Xu, Q., Yixuan Z. & Ziyang, Z. (2019) Tail-Risk Spillovers in Crypto currency Markets. Finance Research Letters in press. CrossRef .