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# IS BITCOIN'S PRICES AFFECTING KEY FOREIGN EXCHANGE RATE? A STATISTICAL RESEARCH ON BITCOIN AND USD AND EURO.

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## ABSTRACT

Bitcoin is becoming more important. Cryptocurrency world need more and more studies. While they are taking a good interest all over the world, and as the economic and financial system need more and more improvement by the time. This study tries to clarify and conduct an analysis to reveal the interaction between Bitcoin and key Exchange rate (USD & Euro) to find out whether Bitcoin's prices fluctuation can affect the key foreign exchange rates. This study used unit root test, VAR analysis and Granger Causality**.** The result of this study showed that USD prices can cause the movement of the Bitcoin prices, while the Bitcoin prices cannot cause the movement of USD prices. More so, it showed that the Euro prices can cause the movement of Bitcoin while Bitcoin prices cannot cause the movement of Bitcoin prices.
KEYWORDS: Bitcoin, USD, EURO, CRYPTOCURRENCY, FOREIGHN EXCHANGE RATE.

## 1. INTRODUCTION

Bitcoin is an independent digital currency, not subject to the control of central authorities and without inflation. It is belt on a peer to peer network which is called Blockchain. This system has been founded by a computer scientist known under the alias Satoshi Nakamoto in 2009 and his real name is still unknown. Bitcoin relies on cryptography and on a consensus protocol for the network instead of traditional banking transactions. Bitcoin and cryptocurrencies in general have many advantages like that they transfer the funds more easily between two parties in the transaction, and these transfers done with minimal processing costs. While Fiat currencies transfers are done with a need to intermediates (banks or financial Institutions) with some complications and large fees charged for those banks. (Salman & Abdul Razzaq, August 2019) Bitcoin's Importance nowadays in a lot of area. Some of these areas it's price movement or fluctuations, and it is disturbing conventional payment methods and ultimately has affected all financial systems. (Ozyesil, 2019)

### 1.1 Purpose of Research

This study conducts an analysis to reveal the interaction between Bitcoin and Exchange Rates to find out whether Bitcoin is becoming a substitution for the exchange rates

## 2. LITERATURE REVIEW

According to (Ozyesil, 2019) while he did a study to expose the interaction between Bitcoin and Exchange Rates of USD and EURO to find out whether Bitcoin is becoming a substitution for these exchange rates. He Found that Bitcoin and Exchange Rates of USD and EURO have not become an alternative tool for each other yet. In more explanation he founded that USD prices not significantly affected Bitcoin and Euro prices, while he founded that USD exchange rate was found to be significantly sensitive to the Euro. He used daily data between 27.10.2017-25.02.2019. and He used Unit root test, VAR Analysis, and Variance Decomposition method for his study.

(Li & Wang , 2016) conducted an empirical theory-driven analysis of the determination of the Bitcoin exchange rate (against USD), Bitcoin's exchange rate, according to their report, is responding to shifts in economic dynamics and business conditions in the short term. In the long term and after Mt. Gox (one of the largest Bitcoin exchange markets) closed, they found that Bitcoin exchange rate becomes more responsive to economic conditions and less prone to technology factor.

## 3. RESEARCH METHODOLOGY

To investigate the mutually interaction between the exchange rates and the Bitcoin, the interaction (relationship) between monthly closing price of both exchange rates and Bitcoin was analyzed through the Var model. Thus, it was tried to show the sensitivity of the values of Bitcoin to the changes occurred in the exchange rates.

In this study as cryptocurrency Bitcoin and as exchange rates USD and EUR were used. The study was carried out with monthly data for the period between 08.2010 - 06.2020.

In this study, the stationary of the series was analyzed with ADF (Augmented Dickey Fuller) unit root test. Interactions between the series were analyzed by the Impulse-Response Function and Variance Decomposition methods based on the VAR (Vector Autoregressive) method.

## 4. ANALYSIS AND DISCUSSION

### 4.1 Unit Root Test

**Table 1: ADF Unit Root at Level**

| Variable | ADF Test Statistic | 95% Critical ADF Value | |
|---|---|---|---|
| BTCP | -1.044230 | -2.886074 | Non-Stationary |
| USDP | 0.894510 | -2.886074 | Non-Stationary |
| EURP | 0.730046 | -2.886074 | Non-Stationary |

*Source*: Author's Computation.

The report of the ADF unit root at level reveals that bitcoin price (BTCP) has the ADF stat of -1.044230 with the critical value of -2.886074, the USD price (USDP) has the ADF stat value of 0.894510 with critical value of -2.886074, the euro price (EURP) reveals the ADF value of 0.730046with critical value of -2.886074. This indicates that all the variables are not stationary at level.

**Table 2: ADF Unit Root at First Difference**

| Variable | ADF Test Statistic | 95% Critical ADF Value | |
|---|---|---|---|
| BTCP | -10.74264 | -2.886290 | Stationary |
| USDP | -10.16042 | -2.886290 | Stationary |
| EURP | -10.62931 | -2.886290 | Stationary |

*Source*: Author's Computation

Table 3 reported the ADF unit root at first difference and reveals that bitcoin price (BTCP) has the ADF stat of -10.74264 with the critical value of -2.886290, the USD price (USDP) has the ADF stat value of -10.16042 with critical value of -2.886290, the euro price (EURP) reveals the ADF value of -10.62931 with critical value of -2.886290. This indicates that all the variables become stationary at first difference.

**Table 3: Integration Order**

| Variable | Integration Order |
|---|---|
| BTCP | I(1) |
| USDP | I(1) |
| EURP | I(1) |

*Source*: Author's Computation

The above table shows the integration order of the unit root report and its revealed that all the variables became stationary at order 1.

### 4.2 VAR Analysis

**Table 10: Report of VAR**

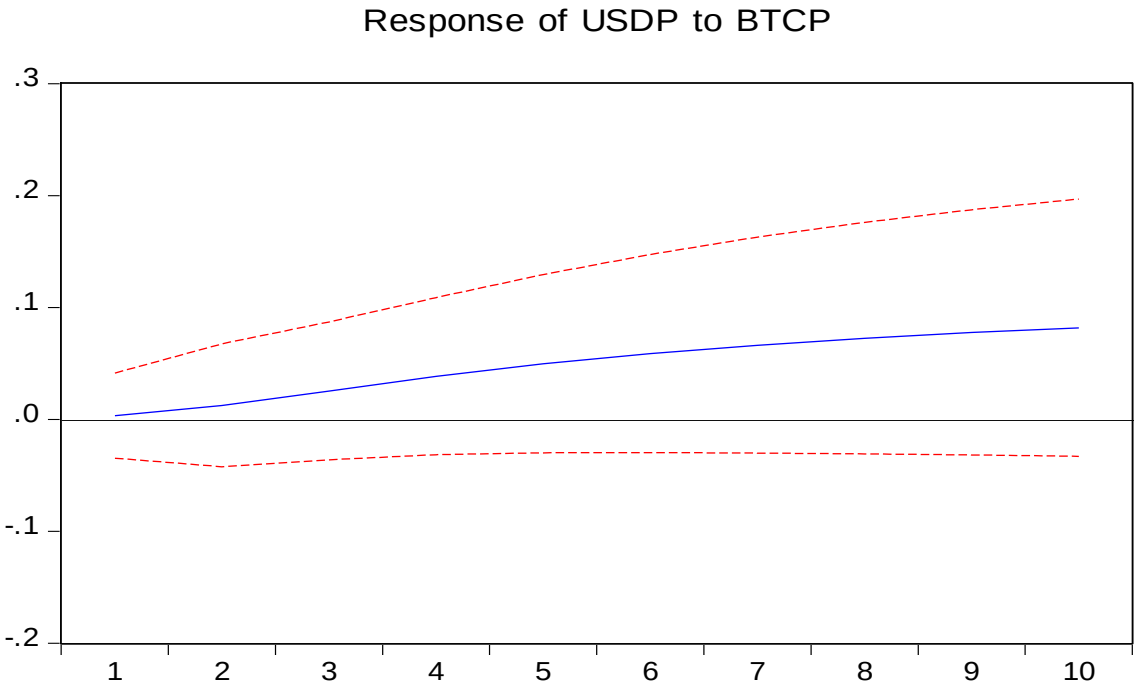
| Standard errors in ( ) & t-statistics in [ ] | | | |
|---|---|---|---|
| | BTCP | USDP | EURP |
| BTCP(-1) | 0.918897 | 1.09E-05 | 2.51E-05 |
| | (0.09270) | (2.0E-05) | (2.3E-05) |
| | [ 9.91292] | [ 0.55112] | [ 1.10503] |
| BTCP(-2) | -0.073745 | 7.05E-06 | 4.84E-07 |
| | (0.09386) | (2.0E-05) | (2.3E-05) |
| | [-0.78569] | [ 0.35194] | [ 0.02105] |
| USDP(-1) | -2614.075 | 1.355800 | 0.515396 |
| | (1447.80) | (0.30904) | (0.35449) |
| | [-1.80555] | [ 4.38709] | [ 1.45391] |
| USDP(-2) | 2574.199 | -0.301147 | -0.359420 |
| | (1424.95) | (0.30417) | (0.34890) |
| | [ 1.80652] | [-0.99008] | [-1.03017] |
| EURP(-1) | 3185.164 | -0.295726 | 0.545528 |
| | (1264.96) | (0.27001) | (0.30972) |
| | [ 2.51799] | [-1.09522] | [ 1.76134] |
| EURP(-2) | -2840.172 | 0.217903 | 0.265121 |
| | (1235.58) | (0.26374) | (0.30253) |
| | [-2.29865] | [ 0.82619] | [ 0.87635] |
| C | -727.6955 | 0.117161 | 0.196390 |
| | (454.758) | (0.09707) | (0.11135) |
| | [-1.60018] | [ 1.20696] | [ 1.76378] |
| R-squared | 0.931128 | 0.983558 | 0.980058 |
| Adj. R-squared | 0.927371 | 0.982661 | 0.978970 |
| Akaike AIC | 16.64067 | -0.263483 | 0.010919 |
| Schwarz SC | 16.80593 | -0.098224 | 0.176178 |
| Mean dependent | 2539.081 | 3.202028 | 3.777885 |
| S.D. dependent | 3581.773 | 1.564762 | 1.629785 |
| Determinant resid covariance (dof adj.) | | 207.3840 | |
| Determinant resid covariance | | 172.3438 | |
| Log likelihood | | -799.2927 | |
| Akaike information criterion | | 14.02210 | |
| Schwarz criterion | | 14.51787 | |

*Source*: Author's Computation

The VAR analysis presented in the above table shows the two lags moving variation against each other. The standard errors and the t-statistics were presented and revealed that the standard errors were not significant to one another.

### 4.2.1 Impulse Response Function

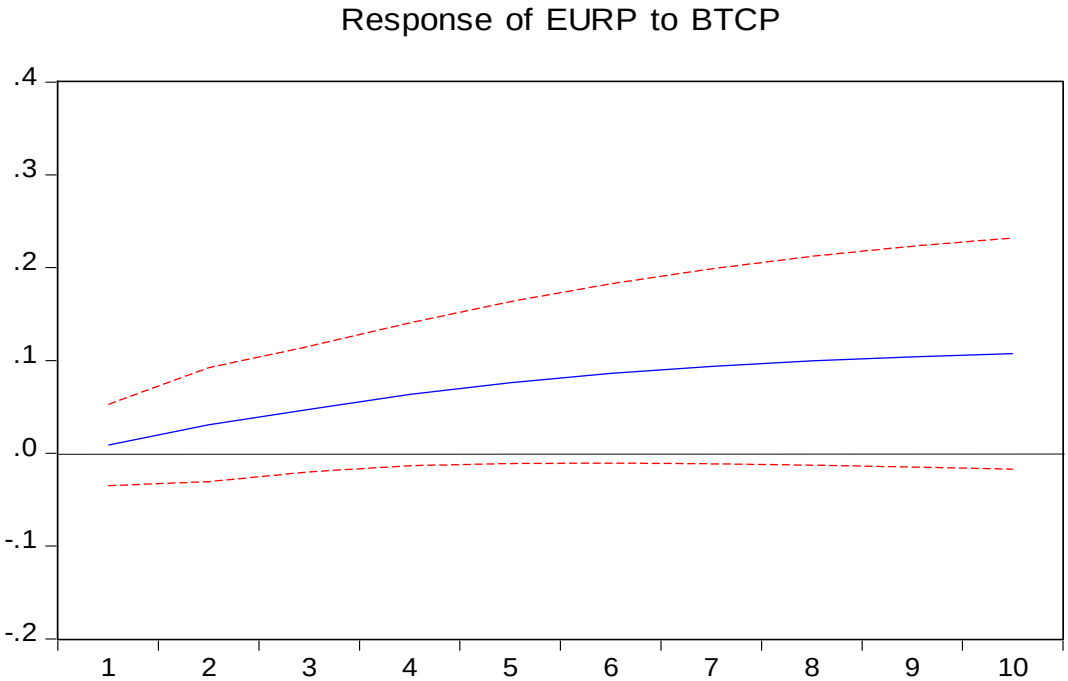
**Figure 2**: BTCP Impulse Response




*Source*: Author's Design

The responses of USDP to BTCP at the beginning of quarter 1 oscillated from a positive direction and move significantly at the early stage of quarter 2 to quarter 10. This implies that the response of USDP to BTCP has been moving positively significant from 2010M08 to 2020M06.

**Figure 3**: BTCP Impulse Response




The response of EURP to BTCP oscillated from positively significant from the beginning of quarter 1 and till experiencing an upward moving direction during the study period.

### 4.2.2 Variance Decomposition

#### 4.2.2.1 BTCP=f(USDP, EURP)

Table 11: Variance Decomposition of BTCP

| Variance Decomposition of BTCP: | | | | |
|---|---|---|---|---|
| Period | S.E. | BTCP | USDP | EURP |
| 1 | 965.2767 | 100.0000 | 0.000000 | 0.000000 |
| 2 | 1355.623 | 95.39053 | 1.714500 | 2.894974 |
| 3 | 1606.755 | 93.34551 | 3.223472 | 3.431018 |
| 4 | 1782.126 | 91.64370 | 4.759524 | 3.596778 |
| 5 | 1913.499 | 90.06392 | 6.348703 | 3.587380 |
| 6 | 2017.420 | 88.48763 | 8.007931 | 3.504443 |
| 7 | 2103.392 | 86.88410 | 9.728933 | 3.386969 |
| 8 | 2177.243 | 85.24873 | 11.49632 | 3.254947 |
| 9 | 2242.717 | 83.58793 | 13.29281 | 3.119260 |
| 10 | 2302.299 | 81.91186 | 15.10199 | 2.986141 |

*Source*: Author's Computation

The table above shows the variation from one variable to the other. In the short-run period 2, aside the own shock (BTCP shock) which has the value of 95.39053, EURP has the highest value of 2.894974 followed by USDP with the value of 1.714500. However, in the long-run period 9, aside the own shock, USDP has the highest variation value of 13.29281, indicating that EURP has the higher variation in the short-run while USDP has the higher variation to BTCP in long-run.

#### 4.2.2.2 USDP=f(BTCP, EURP)

Table 12: Variance Decomposition of USDP

| Variance Decomposition of USDP: | | | | |
|---|---|---|---|---|
| Period | S.E. | BTCP | USDP | EURP |
| 1 | 0.206045 | 0.025466 | 99.97453 | 0.000000 |
| 2 | 0.297266 | 0.186240 | 99.29478 | 0.518977 |
| 3 | 0.365402 | 0.604341 | 98.67564 | 0.720020 |
| 4 | 0.422557 | 1.282293 | 97.90420 | 0.813508 |
| 5 | 0.473338 | 2.119921 | 97.02354 | 0.856541 |
| 6 | 0.519896 | 3.034259 | 96.08768 | 0.878066 |
| 7 | 0.563419 | 3.966840 | 95.14314 | 0.890020 |
| 8 | 0.604632 | 4.880191 | 94.22182 | 0.897991 |
| 9 | 0.644015 | 5.751744 | 93.34357 | 0.904686 |
| 10 | 0.681903 | 6.569131 | 92.51943 | 0.911442 |

**Source:** Author's Computation

Aside the impulse of USDP in the short-run period 3, EURP has the highest variation value of 0.720020, followed by BTCP with the value of 0.604341 while in the long-run period 10, BTCP has the highest impulse to USDP with the value of 6.569131 followed by EURP with the variation value of 0.911442. This implies that BTCP could influence USDP in the long-run while EURP influence in the short-run.

#### 4.2.2.3 EURP=f(BTCP, USDP)

Table 13: Variance Decomposition of EURP

| Variance Decomposition of EURP: | | | | |
|---|---|---|---|---|
| Period | S.E. | BTCP | USDP | EURP |
| 1 | 0.236345 | 0.136691 | 90.47548 | 9.387826 |
| 2 | 0.332745 | 0.918596 | 92.93562 | 6.145784 |
| 3 | 0.405765 | 1.985398 | 93.11641 | 4.898192 |
| 4 | 0.467183 | 3.338697 | 92.53148 | 4.129818 |
| 5 | 0.521838 | 4.799093 | 91.62391 | 3.576993 |
| 6 | 0.571917 | 6.254277 | 90.60503 | 3.140692 |
| 7 | 0.618632 | 7.635945 | 89.58307 | 2.780982 |
| 8 | 0.662728 | 8.908620 | 88.61348 | 2.477899 |
| 9 | 0.704704 | 10.05731 | 87.72275 | 2.219934 |
| 10 | 0.744919 | 11.07953 | 86.92097 | 1.999502 |

*Source*: Author's Computation

In the short-run period 2, USDP has the highest variation of 92.93562 followed by the own shock (EURP) with the value of 6.145784 and BTCP with the value of 0.918596. In the long-run period 9, USDP has the highest variation of 87.72275, followed by BTCP and EURP indicating that USDP has the highest variation in the short-run and in the long-run to EURP.

### 4.3 Granger Causality

Table 14: Pairwise Granger Causality Tests

| Sample: 2010M08 2020M06 | | | |
|---|---|---|---|
| Lags: 2 | | | |
| Null Hypothesis: | Obs | F-Statistic | Prob. |
| USDP does not Granger Cause BTCP | 117 | 4.49436 | 0.0133 |
| BTCP does not Granger Cause USDP | | 0.91903 | 0.4019 |
| EURP does not Granger Cause BTCP | 117 | 6.07692 | 0.0031 |
| BTCP does not Granger Cause EURP | | 1.28351 | 0.2811 |
| EURP does not Granger Cause USDP | 117 | 0.38286 | 0.6828 |
| USDP does not Granger Cause EURP | | 0.70408 | 0.4967 |

*Source*: Author's Computation

The report of granger causality test presented in Table 14 shows that USDP to BTCP has the F-stat value of 4.49436 with p-value 0.0133 while BTCP to USDP has the F-stat value of 0.91903 with p-value of 0.4019, indicating that the null hypothesis that USDP does not granger cause BTCP is rejected that is USDP can cause the movement of BTCP though BTCP cannot cause the movement of USDP. More so, EURP to BTCP has the F-stat value of 6.07692 with p-value of 0.0031 while BTCP to EURP has the F-stat value of 1.28351 with p-value of 0.2811, implying that EURP can granger BTCP though BTCP cannot granger cause EURP. Furthermore, the granger causality result between EURP and USDP reveal that there is no causality between EURP and USDP because the p-values are more than 5% alpha level.

## 5. FINDINGS AND CONCLUSIONS

In this study, the interaction between the closing prices of the Bitcoin and the closing values of the exchange rates (USD and EUR) was analyzed using the monthly data for the period between August 2010 to June 2020 period which in total 120 months.

The Unit root test showed that the all the variables become stationary at first difference. While Granger Causality test showed that USD prices can cause the movement of the Bitcoin prices, while the Bitcoin prices cannot cause the movement of USD prices. More so, it showed that the Euro prices can cause the movement of Bitcoin while Bitcoin prices cannot cause the movement of Bitcoin prices. Furthermore, the granger causality result between EURP and USDP reveal that there is no causality between EURP and USDP because the p-values are more than 5% alpha level.

Based on the findings obtained from this study, it can be understood that there are some significant interactions between Bitcoin, USD and EUR. The result may be beneficial for investors to consider diversification their portfolios.

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