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Macroeconomic Determinants of Bitcoin Prices: An Empirical Investigation Using Ordinary Least Squares Regression

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Abstract

This study aims to determine the correlation between Bitcoin (BTC), Gross Domestic Product (GDP), Foreign Direct Investment (FDI), and Consumer Price Index (CPI) with descriptive and correlational statistics and Ordinary Least Squares (OLS) regression analysis from Jan 1, 2020 to Dec30, 2025. The descriptive analysis showed a significant price volatility of the Bitcoin compared to relatively stable changes of the GDP, FDI and CPI. The findings of correlation showed that there was weak positive correlation between Bitcoin and GDP and CPI respectively as well as there was moderate negative correlation between Bitcoin and FDI. In addition, the independent variables were interrelated positively with no evidence of multicollinearity, thus allowing them to be included in the regression model. The results of OLS regression indicated all explanatory variables are significant in explaining the Bitcoin prices. The positive relationship between GDP and CPI and Bitcoin indicates that economic growth and inflation could further boost investor interest in digital assets, potentially enhancing Bitcoin's inflation hedge function. By contrast, FDI had a marked negative effect, suggesting that the capital of foreign investors is being shifted towards more productive investments because of the increased opportunities for foreign

investment. The model showed good explanatory power (R-squared = 0.771) and was highly significant (F-statistic > 0.05), and therefore reliable. The results underscore the susceptibility of Bitcoin to macroeconomic factors and offer valuable insights for investors, policymakers, and researchers in cryptocurrency markets.

Keywords: Bitcoin, Macroeconomic Factors, OLS Regression, Foreign Direct Investment, Inflation Hedge

1. Introduction

Over the last ten years, the emergence and swift growth of cryptocurrency markets have brought about a sophisticated academic debate regarding macroeconomic determinants of digital asset valuations. The most prominent cryptocurrency to be widely traded, Bitcoin plays a special and important place in this discussion. In this, its decentralized design, hard-coded supply and growing institutional investor participation have all rendered it a genuine, if not necessarily stable, asset class worthy of careful empirical analysis in the context of macroeconomic analysis. Despite the wealth of literature available in the cryptocurrency market, the understanding of the systematic macroeconomic factors of Bitcoin prices remains a missing link. Existing studies have tended to focus on short-term event-driven effects, such as the effect of Federal Open Market Committee (FOMC) announcement (Corbet et al., 2020a, 2020b), or rather on limited and idiosyncratic sets of explanatory variables (Li & Wang, 2017). To date, there is little research to provide empirical evidence to systematically examine the relationship of Bitcoin prices to the fundamental macroeconomic indicators, such as GDP, inflation and FDI, in the long run. To fill the above-given void, this study uses the Ordinary Least Squares (OLS) regression technique to estimate the quantitative relationship between bitcoin price and the considered macroeconomic covariates. The OLS estimator is appropriate and well established for identifying linear association between the dependent variable and the postulated determinants under the classical linear regression assumptions (Gauss-Markov conditions), and has desirable properties of unbiasedness, consistency and efficiency. The empirical model is then put through a battery of empirical diagnostic tests, such as heteroscedasticity tests, multicollinearity tests, serial autocorrelation tests, and normality tests of the residuals to provide a means of ensuring accuracy and validity of the estimated parameters. The rationale behind choosing the macroeconomic variables is firmly

supported by the macroeconomic literature and the cryptocurrency literature. As the most robust indicator of overall economic activity, it is thought that GDP has a positive correlation with the price of Bitcoin because it can increase investor risk appetite and the availability of free money to invest in speculation. Theoretically, inflation, as measured by the Consumer Price Index (CPI), is supposed to be correlated with Bitcoin demand as it is believed to be a hedge against the depreciation of fiat money, but there is still no empirical proof of this correlation. Foreign Direct Investment provides a measure of cross-border mobility of capital and macroeconomic confidence which are in theory transmittable to the markets of speculative assets such as cryptocurrency markets. This study's econometric evidence on these links makes a significant and substantive contribution to the literature. First, it offers long run empirical estimates that go beyond the short run event studies that have been prevalent in the literature. Second important is its use of a clear and replicable regression approach that makes it easy to compare with future studies. Third, it provides practical applications for portfolio managers who are looking for data-based portfolio construction models for the allocation of cryptocurrencies across different macroeconomic environments, and for regulators who are trying to develop a macroprudential policy that takes into consideration the sensitivity of cryptocurrency markets to macroeconomic conditions. The rest of this paper is organized as follows. Section 2 surveys the relevant theory and empirical evidence in order to devise research hypotheses. Section 3 specifies the data sources, operationalization of the variables and the econometric technique. The results of the empirical analysis, represented by OLS estimates and the results of the diagnostic tests, are presented and interpreted in Section 4. The section ends with a discussion on policy implications and research directions in Section 5.

2. Literature Review

2.1. Bitcoin and Cryptocurrency Markets

In 2008, the mysterious Satoshi Nakamoto introduced a new coin called Bitcoin that presented a major turning point in financial innovation. Bitcoin's initial concept of a decentralized, peer-to-peer electronic payment system that acts without the need of any centralized financial intermediaries quickly caught the eye of technologists, economists, and investors alike (Corbet et al., 2020a). Its underlying blockchain technology, a distributed ledger with cryptographic security for all transactions on the network, is inherently different from the fiat currency and financial

instruments in which it is embedded, by means of its attributes of transparency, pseudonymity and decentralization. However, there are some inefficiencies in the Bitcoin market that remain well-established and are not new, despite the novel features Bitcoin has. Urquhart (2016) has been one of the first to provide an empirical analysis of the inefficiency of the Bitcoin market, showing that the price movements of Bitcoin are not consistent with the weak-form Efficient Market Hypothesis (EMH). These findings have been confirmed in subsequent works (Nadarajah & Chu, 2017; Tran & Leirvik, 2020; Shrestha, 2021) and multiple episodes of speculative bubble formation have been found in the Bitcoin and Ethereum markets (Cheah & Fry, 2015; Corbet et al., 2018b). However, the more recent study by Sensoy (2019) indicates that the efficiency of Bitcoin prices has gradually increased over time, especially during the periods of increased market liquidity, which seems to indicate the gradual maturation of the cryptocurrency market. The nature of this relationship with high volatility, speculative trading and changing informational efficiency make Bitcoin an intriguing, but complex, topic for macroeconomic analysis.

2.2. Theories of macroeconomic fluctuations

The importance of the influence of macroeconomic indicators on asset valuation in the traditional financial markets is illustrated by a fundamental body of the larger financial economics literature. The present study's empirical framework is derived from this body of evidence, which serves as the scaffolding for it. Flannery and Protopapadakis (2002) showed that a wide range of macroeconomic variables such as inflation, real economic activity and monetary aggregates have a significant influence on equity market returns generally. To back up this evidence, Birz and Lott (2011) showed that macroeconomic shock news, specifically on GDP and employment, affects stock returns via changes in market expectations of future corporate earnings and macroeconomic conditions. The macroeconomic sensitivity of other asset classes is further confirmed by the empirical evidence on commodity and gold futures markets. Empirical evidence on commodity and gold futures markets further supports the macroeconomic sensitivity of other asset classes. Cai, Cheung, and Wong (2001) found that release of economic data relating to personal income, employment, and the Consumer Price Index (CPI) have a significant impact on the volatility of returns in gold futures markets, an asset class with some store-of-value properties like Bitcoin. Kurov and Stan (2018) expanded this research to monetary policy, finding that macroeconomic uncertainty and interest rate changes have real impacts on commodity futures market dynamics.

These results taken together provide a solid theoretical and empirical basis for the hypothesis that similar macroeconomic patterns exist in the cryptocurrency markets.

2.3. Gross Domestic Product and Bitcoin price

GDP is the largest and most widely used indicator of aggregate economic activity, and is a key variable in financial markets asset pricing models. For traditional equity markets, Birz and Lott (2011) showed that a positive shock to GDP growth positively affects stock returns because it provides investors with additional information about the state of aggregate economic activity. Scholtus, van Hemert and Pelsser (2014) also found a positive correlation between GDP growth and capital market liquidity, and the latter influences cross-asset allocation choices. These mechanisms offer a theoretically sound foundation to hypothesize that there is a positive link between GDP and Bitcoin. As Bitcoin's decentralized and geographically distributed design naturally makes it borderless and global, it has also become part of the global economy, with institutional and retail investors lending or borrowing, allocating their capital, and whose decisions are inevitably influenced by macroeconomic conditions. According to Schilling and Uhlig (2019), strong GDP growth leads to an increase in risk-taking activity and an increase in disposable income for people willing to invest in speculative assets such as cryptocurrencies. This theoretical claim is empirically supported by Corbet et al. (2020b), who reported that the overall macroeconomic environment, which changes over time, impacts Bitcoin market dynamics, specifically in times of general economic optimism. Thus, it is hypothesized that there is a positive statistically significant relationship between GDP and Bitcoin price in this study.

2.4. Inflation (CPI) and Bitcoin Prices

One of the most litigated topics in the economics of bitcoin and other cryptocurrencies is the theoretical connection between inflation and bitcoin prices. The finite supply of only 21 million coins, as dictated by the code, has been a key aspect of Bitcoin's appeal, lending it some inflation-hedging qualities like gold, and making it a potential "store of value" when fiat currencies are depreciating. Schilling and Uhlig (2019) have argued this point in a formalistic way, suggesting that higher inflation pressures will motivate investors to shift their investment toward alternative stores of value, such as cryptocurrencies. But the empirical support for this proposition is still limited and is fragmented. Corbet et al. (2020a) reported that prices of Bitcoin are positively

correlated with expansionary monetary policies, which is also in line with the inflation-hedge thesis. Liu and Tsyvinski (2021) reported that the prices of cryptocurrencies are sensitive to macroeconomic measures, including inflation, but that there is a considerable variation in this sensitivity across different cryptocurrency classes. Other academic research indicates that Bitcoin's inflation-hedging attributes are constrained or short-lived, however. This study uses OLS regression to add empirical evidence to the direction and statistical significance of CPI-Bitcoin relation.

2.5. Foreign Direct Investment (FDI) and Bitcoin Prices

FDI is an important indicator of foreign capital mobility, international economic confidence and world liquidity conditions. Traditional asset markets are connected to changes in risk appetite and capital allocation across asset classes that are associated with FDI flows. Kurov and Stan (2018) confirmed a disproportionate impact of macroeconomic uncertainty, which often becomes visible in the form of turning upside down of foreign direct investments (FDI) flows. Theoretically, such dynamics can be communicated to the cryptocurrency market via investor sentiment channels. Empirical research on the FDI-Bitcoin connection is still quite limited, but indirect evidence suggests that there is a potential link. Corbet et al. (2020a, 2020b) showed that cryptocurrency markets are sensitive to cross-border capital flows-related macroeconomic policies, such as Federal Funds rate shifts in the U.S. which indirectly influence the pattern of FDI. As more capital is flowing into the country through foreign direct investment, global economic confidence and macroeconomic optimism could further drive risk on investor sentiment, leading to more speculative investors chasing digital assets like Bitcoin. On the other hand, a decline in FDI investment in times of geopolitical or macroeconomic turmoil can trigger a risk-off rebalancing of the portfolio, leading to a decrease in exposure to volatile cryptocurrency markets. This work is an empirical examination of the statistical significance of the relation between FDI and Bitcoin prices in an OLS regression model. Theoretical framework and methodology justification is presented. Ordinary Least Squares (OLS) regression estimator is the basic and most popular method in empirical economics for estimating linear relationship between a dependent variable and a group of independent regressors. In the classical linear regression model, which assumes that the parameters are linear, random sampling, the conditional mean of errors is zero, homoscedasticity, and the absence of perfect multicollinearity, the OLS estimator is the Best Linear Unbiased

Estimator (BLUE), according to the Gauss-Markov theorem (Greene, 2018; Wooldridge, 2020). Due to its transparency, computational tractability, and ease of interpretation, this method is especially suited for the goal of the present study, which is to identify the direction of the linear association between Bitcoin prices and the macroeconomic covariates of interest and quantify its magnitude and the statistical significance. In this study, the operationalization of the OLS multiple regression model is Bitcoin prices as a dependent variable, GDP, CPI, and FDI as dependent variables. The model specification goes through a comprehensive set of diagnostic tests to check the validity of the classical linear regression assumptions. These consist of tests for heteroscedasticity (the Breusch-Pagan test), multicollinearity (Variance Inflation Factor (VIF) test), serial autocorrelation (Durbin-Watson test and Breusch-Godfrey test) and residual normality (Jarque-Bera test). In cases where the assumption violations are identified, suitable correction methods are implemented to guarantee the strength of the estimated coefficients.

2.6. Hypotheses Development

Based on the theories and evidence presented in the previous sections, the following formal research hypotheses are tested in this study:

H1: The Gross Domestic Product (GDP) has a statistically significant impact on Bitcoin prices.

H2: Bitcoin price changes are statistically significantly related to Inflation (CPI) changes.

H3: FDI (Foreign Direct Investment) is statistically significantly affecting the price of Bitcoin.

3. Data and Methodology

3.1. Data Description

Monthly time-series data is used for empirical analysis ranging from Jan 1, 2020 to Dec30, 2025, covering the entire history of Bitcoin as a tradable asset. Bitcoin price is dependent variable, while gross domestic product (GDP), Inflation is measured by consumer price index (CPI) and foreign direct investment (FDI) are independent variables. The price for bitcoin is from CoinMarketCap and cross-checked against the Bloomberg Terminal data. The World Bank's World Development Indicators (WDI) database provides the GDP data (in current U.S. dollars) and FDI net inflows (in current U.S. dollars). The data for inflation, measured in terms of the Consumer Price Index (annual percentage change), are from the International Monetary Fund (IMF) World Economic

Outlook database. As usual in macroeconomic time-series analysis (Wooldridge, 2020), all monetary variables are in log form, which helps normalize distributional skewness and facilitates elasticity interpretation of the OLS coefficients.

3.2. Frequency of Data

We have the data with different frequency, high and low. The WDI data has been found on annual basis while the Bitcoin data is available on daily basis; to coordinate the data, we have used frequency conversion (Luther et al., 2000) method and perform in EViews 12 software.

3.3 Research Design

This study used quantitative research as its research methodology. This study uses monthly time series data from January 2020 to December 2025 to empirically investigate the relationship between bitcoin prices and macroeconomic indices. To verify the validity and consistency of the empirical research, the study makes use of secondary data gathered from reputable, globally recognized databases. As is customary in macroeconomic time-series analysis, all monetary variables are expressed in their natural logarithms. In addition to removing distributional skewness and heteroscedasticity, this allows the calculated coefficients to be understood as elasticities, as advised in Introductory Econometrics: "A Contemporary Method". The study uses Ordinary Least Squares (OLS) regression analysis for data analysis and estimation of the impact of macroeconomic indicators on Bitcoin prices. Before regression estimation, descriptive statistics and diagnostic tests are performed to determine the properties of the data. To prevent spurious regression results, the properties of time-series are checked with the help of unit root tests. In addition, correlation analysis is used to determine relations between variables and any potential multicollinearity problems. The chosen study time frame covers crucial events in the cryptocurrency market, such as high volatility, worldwide economic uncertainties, inflation and modifications in foreign investment. The research design then allows for a thorough analysis of how Bitcoin prices and macroeconomic fundamentals affect each other in the given timeframe.

4. Data Analysis and Results

The descriptive statistics is the first step to start data analysis as we need to understand the nature of the data.

Table 1: Descriptive Statistics

Variables	Obs	Mean	Std. Dev.	Min	Max	p1	p99	Skew.	Kurt.
Btc	72	1440000	960000	214000	3578120	214000	3578120	.738	2.508
Gdp	72	6.911	.033	6.815	6.972	6.815	6.972	.034	3.468
Fdi	72	.11	.013	.092	.129	.092	.129	.016	1.566
Cpi	72	.362	.186	-.033	.692	-.033	.692	.173	2.453

Bitcoin (BTC) The standard deviation of Bitcoin values (BTC) is equal to 960,000 while the mean value is 1,440,000, which means that there is quite a bit of variation in Bitcoin during the period studied. The minimum and maximum values are from 214,000 to 3,578,120, indicating a large range and significant volatility in the cryptocurrency market. The skewness value is 0.738 indicating that the BTC distribution is moderately positively skewed, with higher values not being as rare in the distribution as lower extreme values. The value of kurtosis is 2.508, which is less than the norm of 3, meaning the distribution is somewhat flatter than a normal distribution. Gross domestic product (GDP) The mean value of GDP is 6.911 with a relatively small standard deviation of 0.033 which means that the GDP was relatively stable over the observations. The minimum and maximum values are 6.815 and 6.972 respectively implying economic growth was not very volatile in the sample period. The skewness value is 0.034 which is very close to zero, indicating that GDP is approximately symmetrically distributed. The kurtosis value is 3.468, which is a slightly leptokurtic distribution (data is somewhat more peaked than a normal distribution). Foreign Direct Investment (FDI) The variability of the observations is relatively low, with FDI having a mean value of 0.110 and a standard deviation of 0.013. The values are between 0.092 and 0.129, indicating a consistency in foreign investment inflows during the study period. The skewness value of 0.016, almost zero, shows that the distribution is nearly symmetric. The kurtosis value is 1.566 which is less than 3, suggesting a platykurtic distribution, meaning the tails of the distribution are less extreme. Consumer Price Index (CPI) The mean value of CPI is 0.362 with a standard deviation of 0.186, which indicates moderate variability in inflation rate. It can be seen that there were negative and positive changes in inflation during the study period as the minimum value is -0.033 and the maximum value is 0.692. The skewness value of 0.173 shows that there is slight positive skewness, meaning that some values of inflation are higher. Note that the value of kurtosis equals 2.453 which is slightly less than 3, indicating a flatter-than-normal distribution.

Overall, the descriptive statistics show that BTC has the highest volatility among the variables whilst GDP and FDI shows relatively less volatility. All variables have skewness within the acceptable range of ±1, with no significant skewness issues. Likewise, the kurtosis values are near the value of 3 considered to be the normality value, indicating a roughly normal distribution in general. Hence the data set is deemed to be appropriate for further econometric and regression analysis.

Table 2: Correlation Matrix

Pairwise correlations							
Variables	-1	-2	-3	-4	-5	-6	-7
(1) gdp	1						
(2) cpi	0.378	1					
(3) btc	0.133	0.163	1				
(4) gdp	1	0.378	0.133	1			
(5) cpi	0.378	1	0.163	0.378	1		
(6) btc	0.133	0.163	1	0.133	0.163	1	
(7) fdi	0.489	0.523	-0.571	0.489	0.523	-0.571	1

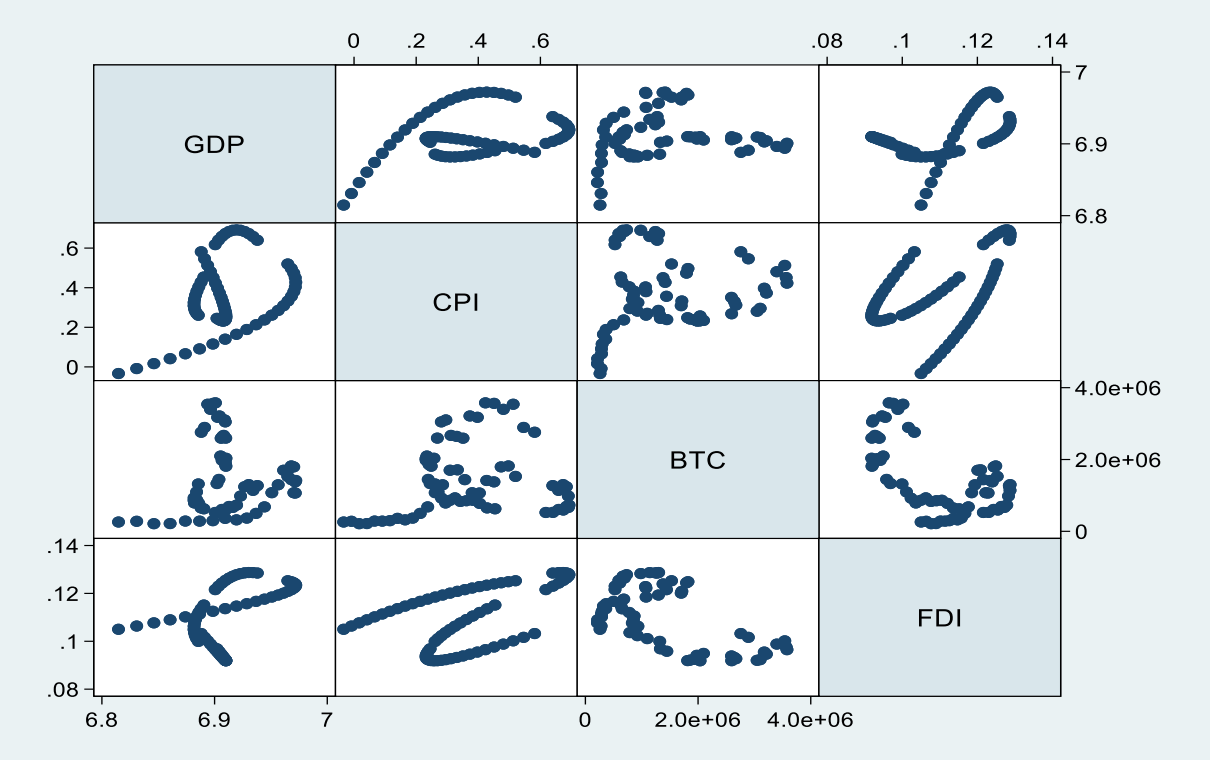

Figure 1: Correlation Matrix

Table 2 displays the Pearson association coefficients for Bitcoin (BTC), GDP, FDI, and the Consumer Price Index (CPI). Understanding the direction and intensity of the linear relationship between the study variables is made easier by the correlation matrix. A positive correlation coefficient indicates a direct association, a negative correlation indicates an inverse relationship, and a number close to zero indicates a weak relationship. Correlation coefficients range from -1 to +1. The connection between GDP and Bitcoin BTC and GDP have a weak but positive link, as seen by the two variables' correlation coefficient of 0.1328. This indicates that the expansion of GDP is linked to slightly higher Bitcoin prices. The relationship, however, is not strong, suggesting that the movements of BTC are not strongly driven by GDP during the study period. Relationship between BTC and FDI There is a moderate negative correlation between BTC and FDI with a correlation coefficient of -0.5711. The more FDI the more the Bitcoin value is decreasing. The inverse relationship could suggest that as investors are more interested in traditional investment avenues like FDI, there is a corresponding reduction in interest in Bitcoin as an alternative investment. Relationship between BTC and CPI There is a weak positive association between BTC and CPI, with a correlation of 0.1635. That means that rise in CPI is marginally correlated with rise in bitcoin values. The finding might suggest that at times, Bitcoin can be considered an inflation hedge, but the connection is weak. GDP is positively related to FDI. There is a positive relationship between GDP and FDI. GDP and FDI have a correlation coefficient of 0.4888, reflecting a moderate positive relationship. This suggests that economic growth will be followed by increased FDI. Countries that have more robust GDP performance tend to develop good conditions for foreign investors, and welcome more capital inflows. What was the relation between GDP and CPI? What would be the relation between GDP and CPI? The correlation coefficient between GDP and CPI is 0.3780 which is a moderate positive correlation. This is an indication that increased economic growth comes along with rising price levels or inflation. Consumer demand may increase with economic expansion, thereby adding to inflationary pressures in the economy. Relationship between FDI and CPI The correlation coefficient between FDI and CPI is 0.5227, which indicates a moderate positive correlation. This suggests that an increase in inflation rate is correlated with an increase in FDI inflows. This interpretation is that moderate inflation could be a sign of growing economic activity and expansion of markets, which in turn can draw

foreign capital. Overall Interpretation In general, the correlation matrix suggests that the majority of the variables are moderately correlated with some being less strongly correlated. Importantly, none of the correlation coefficients are above the commonly accepted limit of +/- 0.80 for the presence of multicollinearity. Hence, there seems to be no considerable multicollinearity in the data set, which facilitates regression and further econometric analysis. Figure 1, presents the pictorial form of correlation matrix.

Table 3: OLS Regression

Variables	Coefficient	Std. Error	t-value	p-value	Significance
GDP	13,216,500	1,977,699.7	6.68	0.000	***
FDI	-82,095,244	5,551,481.5	-14.79	0.000	***
CPI	2,888,323.5	356,566.15	8.10	0.000	***
Constant	-81,942,583	13,431,360	-6.10	0.000	***

The Ordinary Least Squares (OLS) regression findings demonstrate the relationship between Bitcoin (BTC) and the GDP, FDI, and CPI. The direction, strength, and statistical significance of the correlations between the independent variables and BTC are shown by the regression coefficients, standard errors, t-values, and p-values. GDP, or gross domestic product The GDP coefficient value is 13,216,500, indicating a positive association between GDP and Bitcoin. This shows that, if all other factors remain unchanged, an increase of 13,216,500 BTC units is anticipated for every unit increase in GDP. This positive correlation suggests that an increase in economic growth improves Bitcoin's performance. The variable GDP can explain the model pretty well, as evidenced by its high t-value of 6.68. Furthermore, its p-value is below the 1% significance level, indicating that GDP has a statistically significant effect on Bitcoin. As a result, the null hypothesis—that GDP and BTC are unrelated—is rejected. Economically speaking, this result might encourage investors to increase their investments and increase trust in the use of digital financial products like Bitcoin. FDI, or foreign direct investment A negative correlation between FDI and Bitcoin is indicated by the coefficient for FDI, which is -82,095,244. This indicates that

an increase in one unit of FDI would result in a fall in BTC of about 82,095,244 units, all other things being equal. The negative indicator suggests that investors may avoid alternative assets like bitcoin if they have greater access to foreign investment. The t-value's absolute value of -14.79 is rather large, suggesting that FDI significantly affects Bitcoin. The link is statistically significant at the 1% level, as indicated by the p value of 0.000. This indicates that FDI is one of the model's most significant factors. The negative connection may indicate that investors shift their money to profitable economic activities when overseas investments become more appealing, hence reducing the demand for cryptocurrency investments. Index of Consumer Prices (CPI) Inflation and Bitcoin have a positive link, as seen by the CPI coefficient value of 2,888,323.5. That is, ceteris paribus, the amount of Bitcoin will increase by around 2,888,323 units if the price index for all items rises by one unit. The influence of CPI on BTC is significant at the 1% significance level, as indicated by the t value of 8.10, which indicates a strong statistical strength, as well as the 0.000 p value. The positive correlation implies that Bitcoin could be seen as an inflation hedge since investors are more inclined to invest in cryptocurrencies when the purchasing power of their fiat currency is decreasing. Constant Term: When all independent variables are zero, the anticipated value of Bitcoin is -81,942,583, which is the constant coefficient. In this instance, the intercept is not necessarily a value with economic significance, but its sign indicates that, in the absence of GDP, FDI, and CPI influences, the amount of Bitcoin is truly at the baseline level. The constant term has a p-value of 0.000 and a t-value of -6.10, meaning that it is statistically significant. In general, the regression results confirm that GDP, CPI positively affect bitcoin and FDI negatively affect bitcoin. The independent variables are statistically significant at 1% level, which provides the strong evidence on the importance of the macroeconomic factors in determining the movements of Bitcoin. The highest absolute t-value is for the variable FDI, suggesting that it might have the greatest impact. The results indicate that economic growth and inflation positively affect bitcoin transactions, while foreign investment inflows have a negative impact.

Table 4: Model Summary

Statistic	Value	Statistic	Value
Mean Dependent Variable	1,437,536.612	SD Dependent Variable	960,358.834
R-squared	0.771	Number of Observations	72
F-statistic	76.115	Prob > F	0.000

Statistic	Value	Statistic	Value
Akaike Information Criterion (AIC)	2088.944	Bayesian Information Criterion (BIC)	2098.051

The model summary statistics give the information on overall model performance, explanatory power, and reliability of the Ordinary Least Squares (OLS) regression model used in the study. These statistics can help assess the effectiveness of the independent variables in explaining the variations in the dependent variable, Bitcoin (BTC). Mean Dependent Variable The average value of dependent variable (BTC) is 1,437,536.612. This means the average price of Bitcoin over the study period is around 1.44M USD. The mean is a measure of central tendency and indicates the average value of all the values in the set of observations, or the general level of Bitcoin in the entire set of observations. Standard Deviation of Dependent Variable The standard deviation of BTC is 960,358.834, representing a significant level of variation in Bitcoin's values. The high standard deviation indicates that there was a considerable amount of variation in BTC prices during the sample period, which aligns with the volatility of cryptocurrency markets. R-squared (Coefficient of Determination) The R squared value is 0.771, indicating that approximately 77.1% of the variations in Bitcoin can be explained by the independent variables in the model, namely GDP, FDI and CPI. This means that the regression model has a high explanatory power. The remaining 22.9% of the variation in BTC is not accounted for by the analysis and may be due to other external factors not considered in the analysis. In social science and economic studies, an R2 greater than 0.70 is considered to be good model fit. Number of Observations The regression analysis is based on 72 observations which means that the number of observations used is adequate for the regression analysis estimation. The more observations the more reliable and more stable are the regression estimates and the more valid are the statistical results. F-statistic The overall significance of the regression model is given by the F-statistic value of 76.115. The high F-value suggests that the independent variables, as a group, are significant in explaining the dependent variable (BTC). That is, as a whole the model is statistically significant and gives a closer fit than a model without any explanatory variables. Probability of F-statistic (Prob > F) The probability value of the F-statistic is 0.000, which is lower than the conventional significance level of 0.05. This means that the overall regression model is statistically significant at 1% level. Hence, the null hypothesis of all the slope coefficients being zero is rejected. This finding suggests that the joint contribution of GDP, FDI and CPI accounts for substantial shifts in Bitcoin. Akaike Information

Criterion (AIC) The value of the Akaike Information Criterion (AIC) is 2088.944. AIC is used to evaluate the regression model's quality of fit while accounting for model complexity. The model fits better when the AIC value is smaller. This is because the reported AIC value may be helpful for comparing this model with other models estimated with different variables or specifications. Bayesian Information Criterion (BIC) The value of the Bayesian Information Criterion (BIC) is 2098.051. BIC is like AIC but places a higher penalty for model complexity. Smaller BIC values are desirable. AIC and BIC are usually used to determine the most suitable econometric model among alternative econometric models and to select the best model specification. In general, the summary statistics of the model show that the regression model is statistically strong and reliable. The value of the R-squared indicates that the model contains a lot of information, and the F statistic is significant, indicating that the overall model is valid. The sample size is sufficient and AIC and BIC values are useful to compare models. All the results put together indicate that, based on the selected macroeconomic variables, studying their variations is a good indicator for the variations of Bitcoin during the study period.

5. Conclusion

In this study, descriptive analysis, correlation analysis, and Ordinary Least Squares (OLS) regression analysis were used to analyse the relationship between Gross Domestic Product (GDP), Foreign Direct Investment (FDI), Consumer Price Index (CPI), and Bitcoin (BTC). The results offer valuable insights into the behavior of Bitcoin when economic indicators change and will find applications in the growing body of literature on cryptocurrencies and macro variables. The descriptive statistics showed that Bitcoin had a significantly high range of values from minimum to maximum and standard deviation during the study period, indicating significant volatility. GDP and FDI showed slight fluctuations, however, whereas CPI showed moderate fluctuation. The skewness and kurtosis values showed that the variables were normally distributed, thus appropriate for econometric analysis. The correlation analysis revealed different levels of association between the variables. GDP and CPI showed only a small positive correlation with Bitcoin, meaning that the rise of economic growth and inflation slightly helps the Bitcoin value. Bitcoin, conversely, displayed a moderate negative relationship with FDI suggesting that higher foreign investment flows could lead to a decline in investor preference for Bitcoin as an alternative investment asset. Moreover, GDP, FDI, and CPI were positively associated with each other, indicating the

interdependence of the macroeconomic behavior of these components in the economy. Important to note here, however, was that none of the correlation coefficients were above the critical value for multicollinearity, thus ensuring that the independent variables could be safely used in the regression model. These findings were further reinforced by the OLS regression results that showed all the explanatory variables to be significant in determining the price of bitcoin. The positive and statistically significant relationship between GDP and Bitcoin suggests that economic growth can boost investor trust and stimulate market activity in the digital asset sector.This positive and statistically significant correlation between GDP and Bitcoin indicates that an economy's growth can positively affect investor confidence and drive market participation in digital financial markets. CPI was also positively and significantly associated with Bitcoin which aids the hypothesis that Bitcoin can be used to hedge against inflation when prices increase and purchasing power of traditional currency decreases. Conversely, FDI had a significant negative effect on Bitcoin with a negative value. This indicates that as foreign direct investment opportunities expand, investors might re-allocate their funds to productive investments instead of speculative investments like Bitcoin. All variables, except for FDI, showed a positive absolute t-value, with FDI having the highest t-value amongst all variables in the study. The performance of the overall model was very good. The R-squared value of the model was 0.771, which indicates the high explanatory power of the regression model. In addition, the large F-Statistic proved that the overall regression model was valid and reliable. Moreover, the values of the Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) indicated the selected model specification to be adequate. Overall, the study suggests that the macroeconomic indicators have a major effect on the behavior of Bitcoin. Economic growth and inflation have a positive impact on Bitcoin while foreign direct investment has a negative impact. These results suggest that Bitcoin is not immune to macroeconomic factors and that it is also linked to the rest of the financial system. The study offers insightful implications for policymakers, investors, financial analysts, and researchers interested in examining the relationship between cryptocurrencies and macro-economic variables. Last but not least, the study suggests that further studies should include other macroeconomic and financial factors like exchange rates, interest rates, stock market performance, and monetary policy indicators in order to gain a wider perspective on the workings of cryptocurrencies. Long-term research could also utilize more sophisticated econometric methods and larger sample sizes to further strengthen the findings and enhance their generalizability.

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