

Zeyi Zhang

1586333

# Is Bitcoin A Good Inflation Hedge in the post-COVID-19 Era?

## Abstract:

In order to determine the inflation hedge characteristics of Bitcoin in the post-COVID-19 era, we compare the real rate of return in logarithmic terms of Bitcoin, Gold, and Dow Jones Industrial

Average in periods preceding and during hyper-inflation period after Covid-19 virus. To corporate with the monthly data on Consumer Price Index offered by U.S. Bureau of Labor Statistics, I also converted the pricing datas into monthly rate of return before reformatting the data in terms of real rate of return using Fisher's Equation. Based on the result, bitcoin proved to be a better inflation hedge during the hyper-inflation period following the Covid-19 Pandemic. Moreover, Dow Jones industrial Average is out-performed by both assets as the benchmark for non-inflationary protected index.

## Introduction:

COVID-19 virus first started off in Wuhan, China, and quickly spread throughout the world. In order to control the spread of the virus, the governments around the world started to close their boarders and place restrictive orders on citizens in terms of gathering and working. Businesses are severely damaged by the restrictive orders by the government, and economies around the world faced severe downturn.

In response to the COVID-19, the U.S. Treasury started to stimulate the economy by lowering interest rates. According to data of U.S. Treasury, the one-month interest rate declined starting from February 27th; the one-month rate hit 0.00 on March 25th of the same year ([Daily Treasury Par Yield Curve Rates](#)). To help its citizens, the U.S. congress passed the CARES Act, a 2.2 trillion economic stimulus bill, and president Trump signed this deal on March 27, 2020. This act includes several payments including direct payment to citizens, unemployment benefits, and forgivable loans to small businesses, corporations, and local governments. Later in the same year, president Trump signed another Consolidated Appropriations Act, 2021 which adds an additional 900 billion in relief and stimulus of the economy. In March 2021, President Biden and the congress passed Rescue Plan Act, which is a 1.9 trillion COVID-relief package. The economic stimulus plans aggregated more than 5 trillion dollars of money supply into the economy.

Following the outbreak of COVID-19 virus, the Dow Jones Industrial Average dropped over 9000 points and the S&P 500 dropped over 1000 points. The investors around the world are withdrawing their investments based on the severity of COVID-19. By injecting money into the

economy and lowering interest rates, the U.S. government and central bank successfully saved the financial market from crashing. Starting from March 20, 2020, both the Dow Jones Industrial Average and S&P 500 started to rise consistently for nearly a year and half now. However, inflation also exceeds the targeted 2% inflation. Also, as the pandemic passes, the inflation spiked due to shortage in supply and rising demand.

In this paper, we will analyze the effect of higher inflation on return of bitcoin compared to gold and Dow Jones Industrial Average. Gold is an hypothetical inflationary hedge in the past few recessions, many researchers has tried to prove the relationship between Gold and inflation using different methods. One of the study published on April 2016 shows that Gold can be a good hedge for inflation in certain countries including U.S. ([Is gold a hedge against inflation? New evidence from a nonlinear ARDL approach](#)). However, in this paper, I will only try to examine the relationship between inflation and returns of Bitcoin, Gold, and DJIA through correlation analysis and OLS regressions.

Since only the monthly Consumer Price Index data is available from U.S. Bureau of Labor Statistics, I will adjust the pricing changes of Bitcoin, Gold, and DJIA in terms of monthly average rate of return. In order to determine the inflationary hedge characteristics of different assets, I assume the following:

- (1): The inflation hedging ability of an asset can be indicated by the real rate of return during hyper-inflation. In another word: higher the real rate of return of an asset during an inflation period, higher the ability of that asset to hedge against inflations.
- (2): DJIA has little inflation protection due to the vast industries that it covers and reflection of the real financial market.
- (3): Independent variable, inflation, is not correlated with the error term. However, this is hard to prove in this study because lower interest rates and higher money supply, which could be included in the error term, can be correlated with inflation as well as the price of bitcoin.

## Data:

The dataset that represents inflation will be extracted from U.S. Bureau of Labor Statistics. This dataset shows the 12-month percentage change of Consumer Price Index of all Items ranging from February 2020 to October 2021.

### **Inflation:**

Percentage change of price index of period t to t+1.

Bitcoin prices and Gold prices and Dow Jones Industrial Average points data will be extracted from Google Finance. I will calculate them in terms of Monthly Average Real Return using Fisher's Equation.

### **Dow Jones Industrial Average Logarithmic Monthly Real Rate of Return:**

$$R_{t, \text{DJIA}} = \ln(P_t / (P_{t-1} (1 + CPI))) - 1$$

### **Bitcoin Logarithmic Monthly Real Rate of Return:**

$$R_{t, \text{Bitcoin}} = \ln(P_t/(P_{t-1}(1+\text{CPI})) - 1)$$

### **Gold Logarithmic Monthly Real Rate of Return:**

$$R_{t, \text{Gold}} = \ln(P_t/(P_{t-1}(1+\text{CPI})) - 1)$$

### **Method:**

We try to determine the relationship between inflation and the real monthly return of Bitcoin, Gold, and DJIA using a linear regression model with OLS estimator.

The following method applies to all Bitcoin, Gold, and DJIA separately.

Diagnostic of the OLS regression will include four graphs:

- (1) Residuals v.s. fitted value: this graph will help to indicate whether the linearity assumption is satisfied. A good indication of Linearity assumption should show a horizontal line without distinct patterns
- (2) Normal Q-Q: this graph will help check if the residuals are normally distributed. A good indication should be a straight line
- (3) Scale-Location: this graph will help to determine the homoskedascity. A good indication should be a horizontal line with equally spread points. If the Scale-location graph shows Heteroskedascity, we will apply heteroskedascity-robusted standard error.
- (4) Residuals v.s. Leverage identifies extreme values that might influence the data results when included or excluded from data.

In the a simply linear OLS estimator, we start with a population model:

$$Y_i = a + bX_i + U_i$$

The Linearity of conditional expectation indicates that:

$$E[U_i|X_i] = 0$$

In this study, the real rate of return will be the dependent variable  $Y_i$ ; and the inflation rate will be the independent variable  $X_i$ .

Since inflation is embedded into the nominal rate of return, we use fisher's equation to calculate the real rate of return given CPI and nominal rate of return.

$$(1 + i) = (1 + r)(1 + p_i)$$

i: nominal rate of return

r: real rate of return

$p_i$ : inflation rate(CPI)

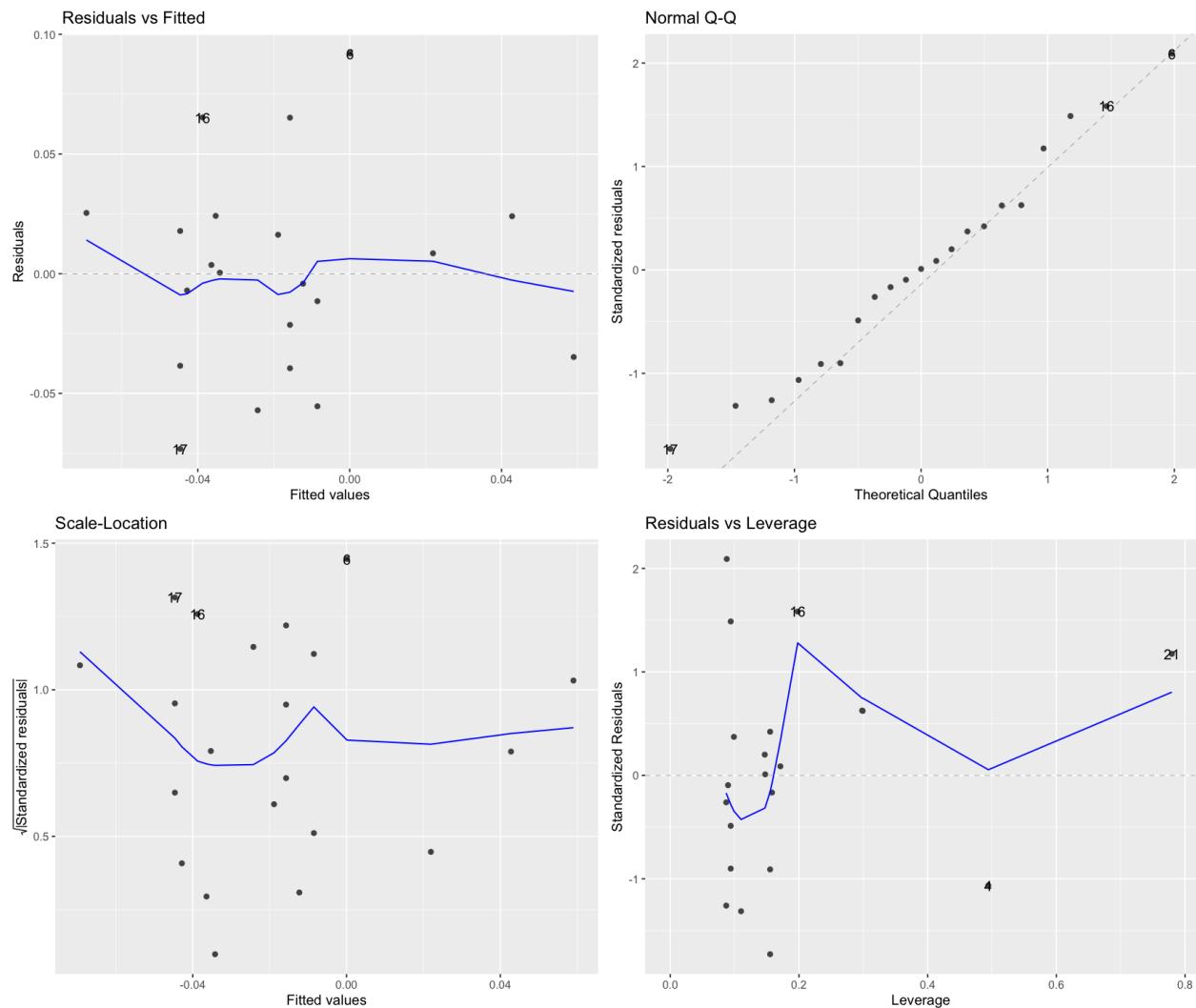
Divide both sides by  $(1 + p_i)$ , then minus both sides by 1, rearrange:

$$r = ((1 + i)/(1 + \pi)) - 1$$

To estimate the effect of inflation on the real return of the three different investments/assets/index, we will first convert data of Gold, Bitcoin, and DJIA into monthly averages starting from February 2020 to October 2021.

## Results:

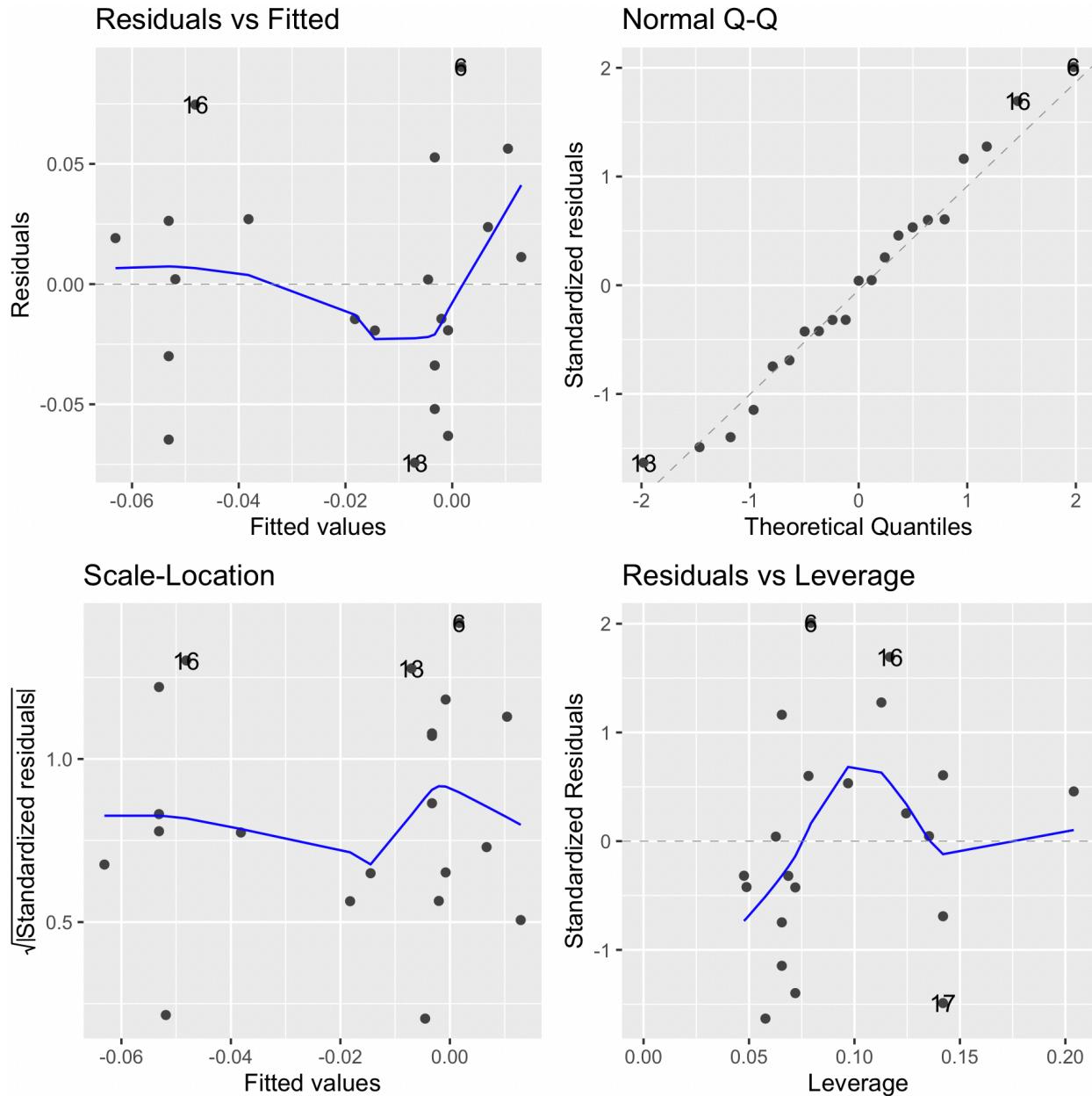
First, I will be analyzing the effect of inflation on the real return of Gold, the hypothetical inflation-hedge in this study. The following table shows the diagnostics of the assumptions of



OLS estimator that estimates the effect of Inflation on the real return of Gold:

- (1) The residuals v.s. the fitted value graphs have some little curves to it, but it does not show data values that have distinct pattern. Since our dataset contains a relatively small number of datapoints, it is possible for the indication to become better as more datapoints are added to the dataset. But as of now, it can be a qualified indicator of linearity assumption.

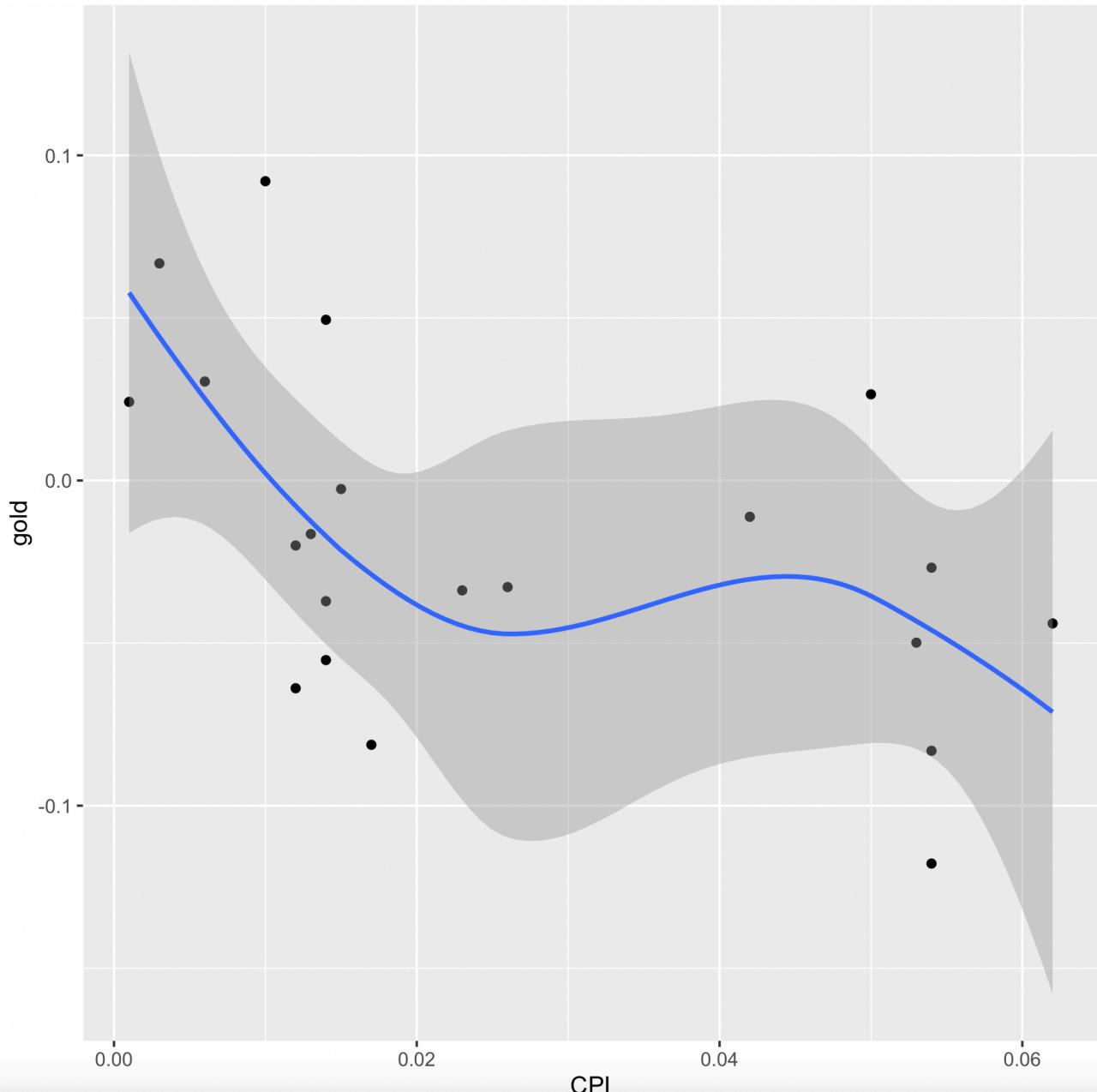
- (2) The standardized residuals shows a linear positive relationship with the theoretical quantiles, which is a good indication for normality of the residuals.
- (3) On the Scale-location graph: although the line fitting through is not a straight line, I originally used OLS estimator to the third polynomial order, I will put the polynomial 1 order below. The scale-location graph of first order polynomial regression does not get better with changes to the polynomial orders. Other graphs also get worse indications. A possible



explanation for this is still the limited amount of data that we have. As the data sets get larger, the line fitting will show a better indication of homoskedascity.

- (4) There are only two outliers and no outlines exceeds three standard deviations from the mean.  
 Which means the statistics is not effected much by extreme outliers much.

### The real rate of return v.s. inflation of Gold:



As the graph indicates, there is a clear negative relationship with the real rate of return and CPI based on the data given.

### Regression table with third polynomial order:

Dependent variable:	
	real_return_gold
poly(cpi, 3)1	-0.113** (0.046)
poly(cpi, 3)2	0.056 (0.046)
poly(cpi, 3)3	-0.051 (0.046)
Constant	-0.018* (0.010)
Observations	21
R2	0.340
Adjusted R2	0.223
Residual Std. Error	0.046 (df = 17)
F Statistic	2.915* (df = 3; 17)

Note: \*p<0.1; \*\*p<0.05; \*\*\*p<0.01  
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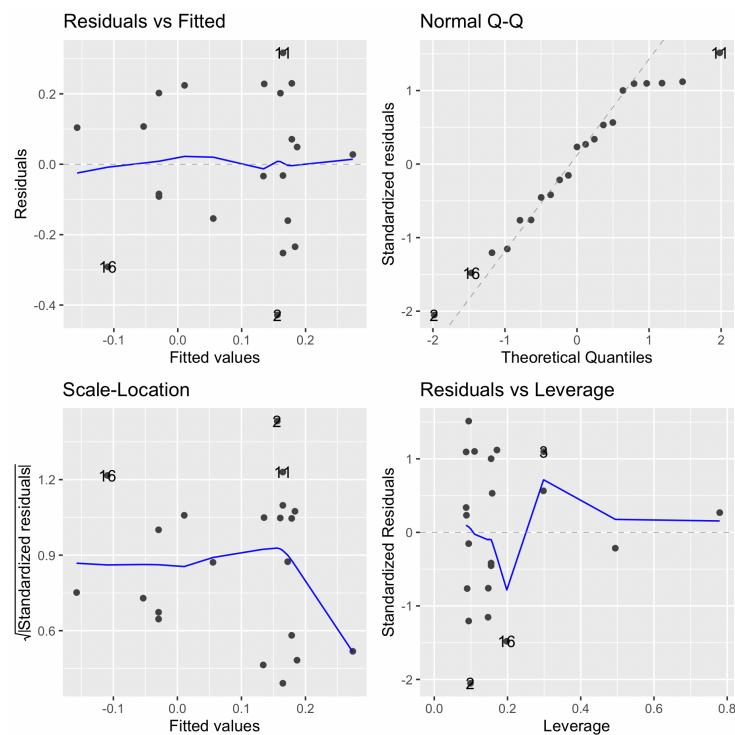
The table indicates that the first order polynomial CPI has a mean effect of -0.113% on the real rate of return 95% of the time.

The effect of the second and the third polynomial order CPIs are not statistically significant.

This can be caused by small dataset. As the dataset gets larger, the line should fit better and we can have better regression results on this object.

## Bitcoin:

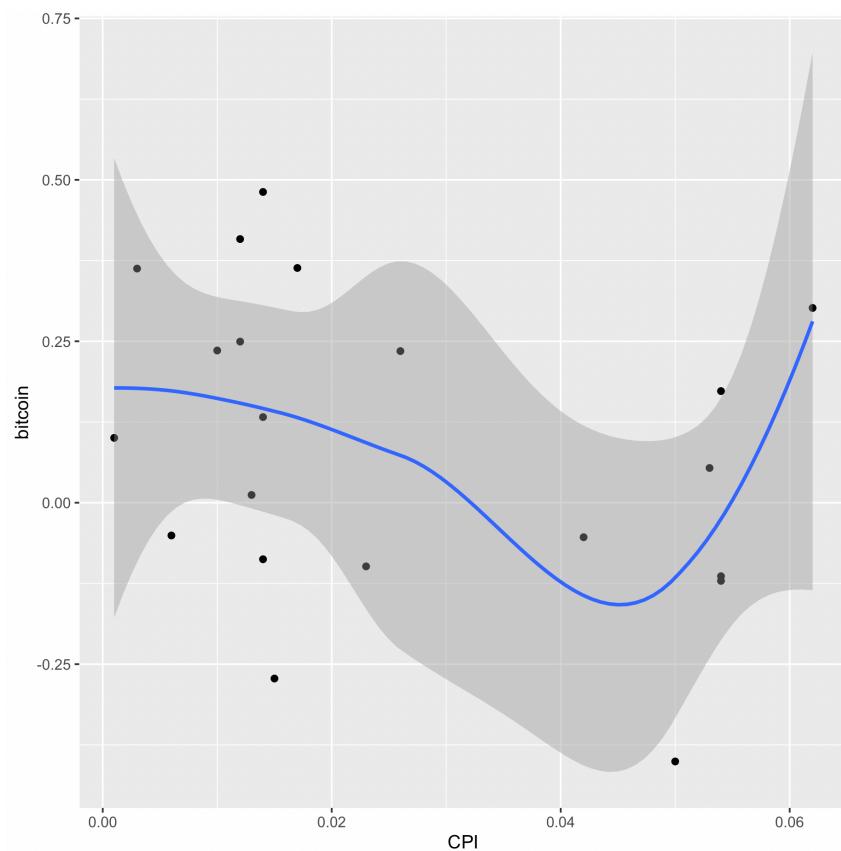
### The assumption diagnostic of Bitcoin:



- (1) The residuals vs. fitted value graph indicates good linearity as it shows a straight line.

- (2) The Normal Q-Q indicates a acceptable normality of the residuals. The more theoretical quantiles at higher standardized residuals may indicate the high volatility of Bitcoin.
- (3) The standardized residuals shows a straight-line before the fitted value reach 0.15. then it runs down. However, since the data only shows values up to October 2021, as the price of Bitcoin climbs back to over 50,000. We can assume a straight line on the scle-location graph. Thus homoskedascity.
- (4) There are several outliers that ranges over 1 to 2 standardized residuals, this indicates that there are outliers influencing the line.

### **The real rate of return of Bitcoin v.s. inflation:**



The real return of bitcoin does not seem to vary with inflation, which indicates strong ability of inflationary hedge.

### **Regression table of real rate of return of Bitcoin v.s. CPI:**

None of the coefficients in the below regression table shows a statistically significant indication that inflation has any effect on the real rate of return of Bitcoin.

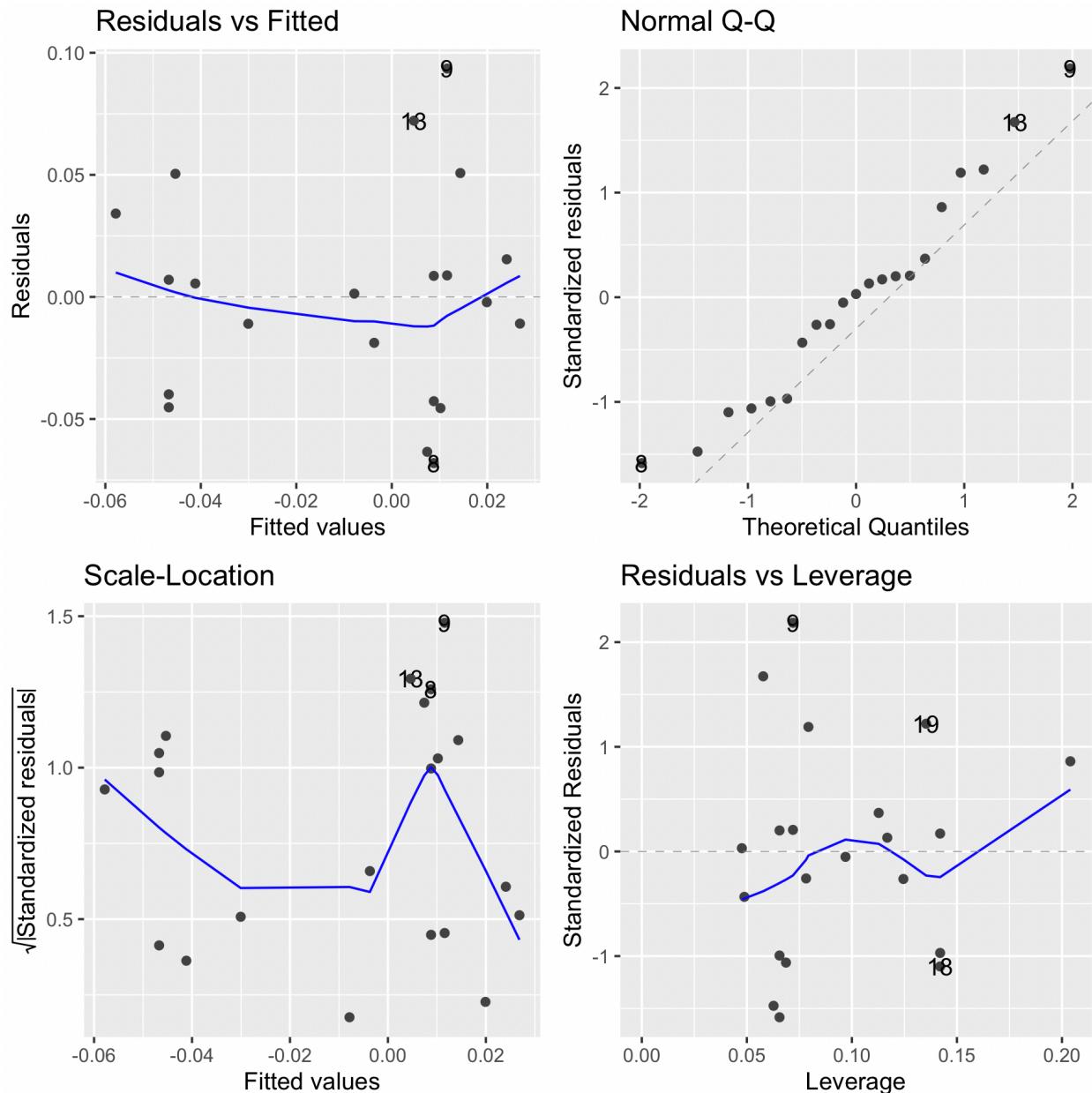
Dependent variable:	
real_return_bitcoin	
poly(cpi, 3)1	-0.325 (0.220)
poly(cpi, 3)2	0.200 (0.220)
poly(cpi, 3)3	0.362 (0.220)
Constant	0.091* (0.048)
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Observations	21
R2	0.252
Adjusted R2	0.120
Residual Std. Error	0.220 (df = 17)
F Statistic	1.905 (df = 3; 17)
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Note:	*p<0.1; **p<0.05; ***p<0.01

### Dow Jones Industrial Average:

#### Assumption Diagnostic:

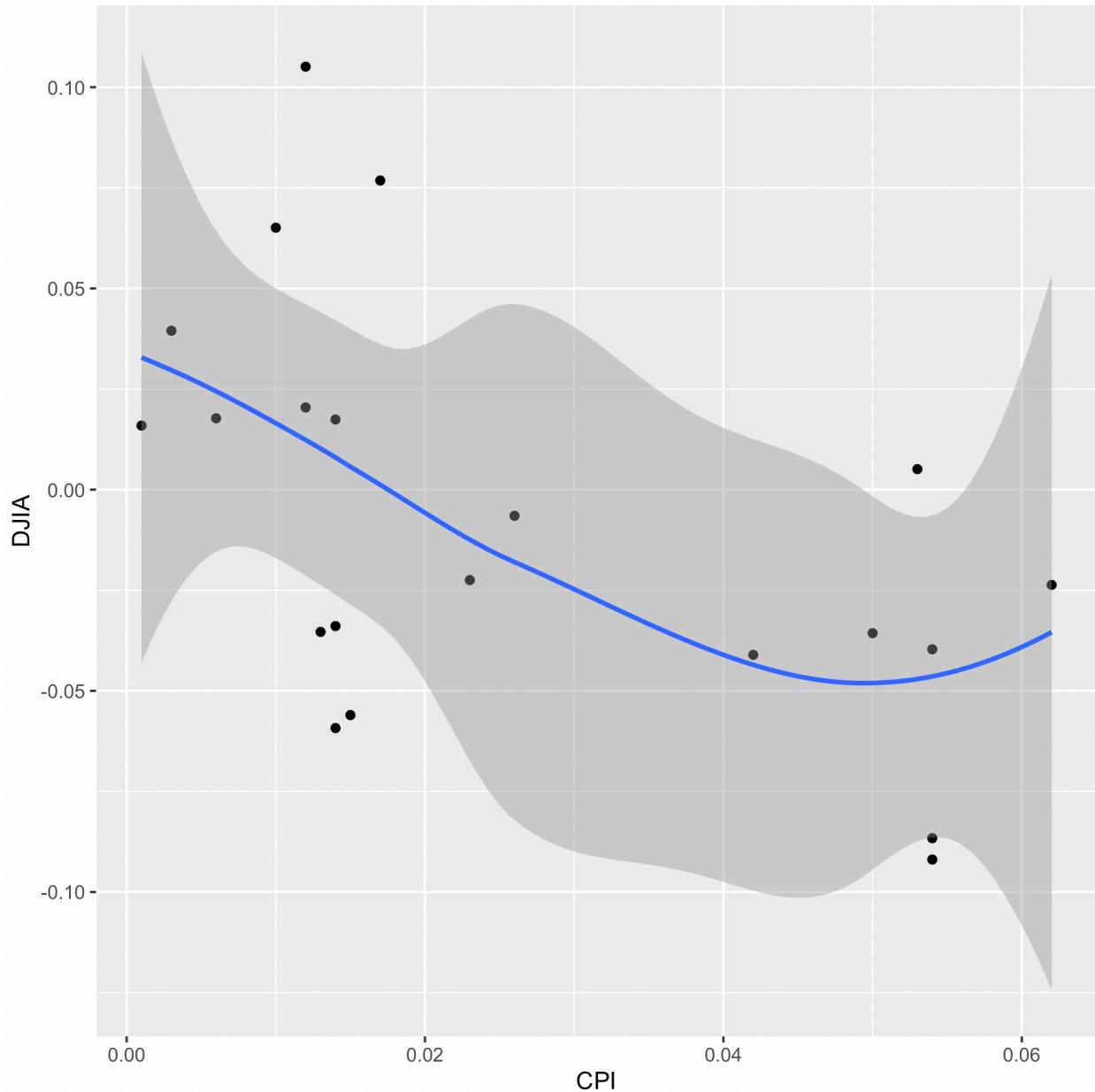
- (1) The residuals v.s. fitted value shows a good indication of linearity assumption as it shows a straight line .
- (2) The Normal Q-Q shows an acceptable indication of normality of the residuals as standardized residuals shows a positive linear relationship with theoretical quantiles.
- (3) The scale-location however shows heteroskedascity since there is nothing straight about the line. So we use heteroskedascity-robusted standard error as will be indicated later.

- (4) There are several outliers that are 1 to 2 standardized residuals away. Data might be influenced by outliers



### The real rate of return of DJIA v.s CPI:

There is a clear negative relationship between the DJIA and CPI as the real return continues to fall as inflation increases. DJIA can be our good benchmark for the non-inflation protected index.



#### Regression Table of DJIA v.s. CPI:

As indicated below, the regression table shows that CPI has a negative effect of 1.388 on the real rate of return of DJIA 95% of the time. However, as the assumption test indicated above, the scale-location graph shows sign of heteroskedascity, thus we re-calculate using heterodaskecity-robusted standard error:

Dependent variable:		t test of coefficients:				
	real_return_DJIA	(Intercept)	Estimate	Std. Error	t value	Pr(> t )
cpi	-1.388** (0.490)	0.028237	0.016974	1.6636	0.112609	
Constant	0.028*	-1.387995	0.462228	-3.0028	0.007316	**
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Observations	21	Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1				
R2	0.297					
Adjusted R2	0.260					
Residual Std. Error	0.044 (df = 19)					
F Statistic	8.026** (df = 1; 19)					
Note: *p<0.1; **p<0.05; ***p<0.01						

We get a pretty similar result which indicates we are 95% confident that there is only 0.7316% of the time that we have a t-value greater than the significance level. The negative relationship between DJIA and inflation is statistically significant.

Comparing the real rate of return of Gold, Bitcoin, and DJIA, we are statistically confident that both the real rate of return of Gold and DJIA shows a negative relationship with rising inflation. However, the real rate of return of Gold seems to be less effected by rising inflation, indicating that Gold does have a better inflation hedge ability compared to DJIA. The real rate of return of Bitcoin however, shows no relationship with the rising inflation. Which indicates a very strong ability to hedge against inflation. If we rank the inflation hedging ability of these three items in depending order: Bitcoin > Gold > DJIA.

## Conclusion:

I started with the idea on what I can invest in during rising inflation periods to preserve my purchasing power. After the COVID-19 pandemic, both S&P 500 and DJIA have been rising high. Stock markets experienced an unrealistic bullish period. However, as I indicated above, the actual purchasing power of investors does not increase as their money on paper shows.

There is a lot of debate going on with the price of bitcoin due to its characteristics and volatility as an investment, never mind safe-heaven under a hyper-inflation period. However, my results shows otherwise as the average return of bitcoin does exceeds gold, our hypothetical hedge for inflation.

There are a lot of important variables that should be included into the regression as we try too determine what factors affect Bitcoin price. One that I can think of is the rising technologies on telecommunication sector and the evolving speed of internet(5G). During the pandemic, more and more businesses turned to remote working as well as taking their businesses online. As a result, I believe the future demand for cryptocurrency will also rise.

With many more reasons combined, Bitcoin proved itself to be a better hedge for inflation compared to Gold. Will it continue to do so? I don't know. But I believe that products evolves

with era. There may be new products in the future to out-tech bitcoin, but now it is the time for Cryptocurrency.

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