

Empirical Test For The Relationship Between The Bitcoin Using Historical Data With (Inflation Rate, Foreign Trade And GDP) And The Possibility To Use The Bitcoin As Hedge Against Inflation: Evidence From GCC Countries

Anas Al.Qudah, Myriam Aloulou

Abstract: the aim of this paper is to examine the empirical relationship of Bitcoin prices with the inflation rate, foreign trade and Gross Domestic Product (GDP) per capita in GCC countries (Bahrain, Kuwait, Oman, Saudi Arabia, and the United Arab Emirates). To explore this issue, we selected a study period of nine years (2009-2017) and we used the correlation between each of (GDP per capita, foreign trade and Inflation) and (the Bitcoin's Prices). The empirical result obtained using simple regression indicates a negative and significant relationship between the bitcoin price and the inflation rate in GCC countries. Based on this result we suggest a model to hedge against inflation in the GCC countries using the bitcoin returns.

Index Terms: GDP per Capita, Inflation rate, foreign trade, Bitcoin, hedging Portfolio, Crypto-currency

1 INTRODUCTION

In simple form, purchasing power parity (PPPs) is relative prices, which show the proportion of the prices in national currency to same services & goods in many countries. And from the most important examples in the economics literatures in this regard is the BigMacCurrency index it is well known as burgeronomics (OECD, benchmark results, 2002), whereby the BigMac PPP is the conversion rate that would mean hamburgers cost the same in USA as abroad. The significant question in this regard that we can derive from the previous words is how should measures of Gross Domestic Product (GDP) which be converted into a common unit like the burgeronomics did before, but the researchers found that the market exchange rates will be an unsatisfactory solution for many purposes because the exchange rates will reflect so many influences than the direct price comparisons that are required to make volume comparisons. Figure 1 below shows the size of economies as a percentage share of total GDP for selected countries. Figure 1. The Size of economies: Percentage share of total OECD GDP, 1999, selected countries.

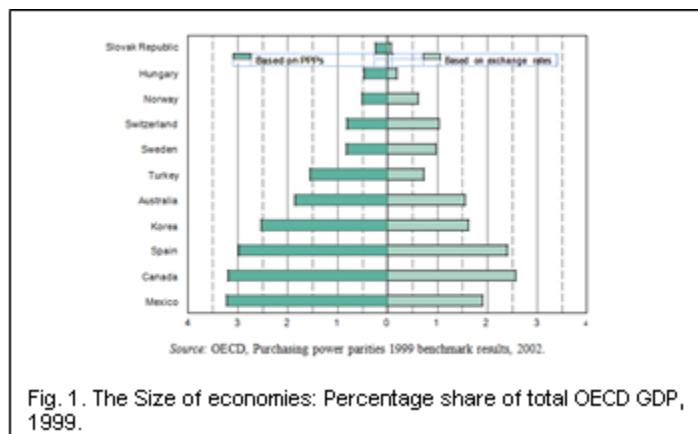


Fig. 1. The Size of economies: Percentage share of total OECD GDP, 1999.

Based on the above; the researchers will try in this article to study a new relationship between the economic variables did not mentioned in economics researches previously, which is mean addressing new model between existing variables to get out results and recommendations in this regard, and the main variables that the researchers trying to test it are the: GDP per capita, inflation Rate and foreign trade and they take also the Bitcoin currency as a new kind of money has a broad impact in the fields of economics.

2 THE STUDY OBJECTIVE

In this study the researchers will try to find the correlation between the Bitcoin Prices and some Macroeconomics variables like GDP per capita, foreign trade and inflation rate in GCC countries, and they want to investigate the effect of extension use of Bitcoin on these variables mentioned before. They will use for this purpose Statistical Package for the Social Sciences (SPSS) to find the correlation between them. And they will review the previous literatures in this regard to find the range they are consistent with these previous studies, and the possibility to use the results that will be founded in the hedging purposes against future inflation risks

- Author: Dr. Anas Al.Qudah, Assistant Professor, Emirates College of Technology, Finance and Banking, College of Business & IT, Email: Anas.alqudah@ect.ac.ae, Abu Dhabi, UAE, P O Box: 41009
- Co- Author: Dr. Myriam Aloulou, Assistant Professor, Emirates College of Technology, Finance and Banking, College of Business & IT, Email: MyriamAloulou@ect.ac.ae, Abu Dhabi, UAE, P O Box: 41009

3 LITERATURE REVIEW

There are several areas of interest by researchers in regards of Bitcoin. Yarmouk (2013) studied its economic situation as a money or currency. Ciaian et al (2014) explained the bitcoin exchange prices. Eric Lockard, the Corporate Vice President of Universal Store in Microsoft company considered that the digital currencies like Bitcoin is growing beyond early time enthusiasts, and he expected the continuity of its growth, which allows people to use the digital currencies like Bitcoin to buy their goods and services, and this kind of commercial action will allow to Microsoft to be at the front edge of that trend. XinLi, Chong Alex Wang (2016), found the bitcoin exchange rate is affected by the state of economy and the conditions of the market. Joseph D. Alba, David H. Papell (2005) found considerable evidence of Purchasing Power Parity in the countries which have good commerce, lower rate of inflation and stable nominal exchange rate, and they have close level of development then US Their results demonstrated that the features of each country justify the adherence to and deviations from long term purchasing power parity. Jim Lothian (2016), found that the purchasing power parity affected the price level based on the change of the monetary arrangement. He concludes that there is a correlation between inflation rate, the exchange rate changes and the varied monetary regimes that prevailed. Stephanie Kremer, Alexander Bick, Dieter Nautz (2014) confirmed by using the panel method that in the developed country having a good economic growth, the inflation rate is very low, conversely to the non-industrialized countries with lower economic growth and high rate of inflation. Barro (1995) believed that there is a causal influence between inflation and economic growth. He estimated that the rate of inflation affects negatively the real gross domestic products in the long run which justify the importance of keeping the prices stable. Sandeep Mazumder (2016) found that the benefit of an accelerated inflation occurs in the countries with low Gross Domestic product. But those with high GDP shouldn't expect output gain from an increase in price level. The use of Bitcoin didn't cause inflation. It controls and limits the velocity of money supply which reduces inflation (Burghelea, 2008). Pavel Ciaian, Miroslava Rajcaniova & d'Artis Kanacs (2015) confirmed that there is positive and significant relationship between the supply and demand of bitcoin and its price. Philip Inyeob Ji, Kwang Myung Chun (2016) found a significant and large positive relationship between bitcoin returns and inflation for many countries providing major Bitcoin trading currencies, including Australia, China, and the United Kingdom. They concluded that Bitcoin may have the potential to be an inflation hedge in a limited group of countries. Anna Loseva (2016) found that the Bitcoin has a positive effect on the money stock and a negative one on inflation and the supply of money. In fact, the more the number of bitcoin in the economy, the slower is the inflation. Pal Boug et al (2010), showed that in each of the 13 less developed countries. A rise in the uncertainty and volatility of the real exchange rate in the short run and long run has a significant negative effect on foreign trade. Morten Brandvold, Peter Molnár, Kristian Vagstad, Ole Christian and Andreas Valstad (2015) considered that Bitcoin as a payment system and open source peer-to-peer electronic money is one of the market leaders with very high information share. It is traded at frequent exchanges and

trade data which are publicly available. They showed also how the bitcoin exchanges contribute to price discovery.

4 THE STUDY METHOD

TABLE 1
REVIEW OF THE EMPIRICAL LITERATURE

Authors	Sample	Analysis Period	Methodology	Results
Joseph D. Alba, David H. Papell (2005)	84 countries European and Latin American countries, but not for African and Asian countries	2002-2005	Panel unit root test	The characteristics of each country explained the adherence to and deviations from LR Purchasing power parity.
Jim Lothian (2016)		1870-1914 1921-1939 1959-1998	Panel	There is a correlation between inflation rate, the exchange rate changes and the varied monetary regimes that prevailed.
Stephanie Kremer, Alexander Bick, Dieter Nautz (2014)	124 countries	2005-2009	Panel	The inflation rates are linked to lower economic growth.
Barro (1995)	100 countries	1971-2012	Panel Test	The rate of inflation affects negatively the real gross domestic product in the long run which justifies the importance of keeping the prices stable.
Miroslava Rajcaniova & d'Artis Kanacs(2015)		2009-2015	time-series analytical mechanisms	The market forces have a significant effect on the price of Bitcoin
Philip Inyeob Ji, Kwang Myung Chun (2016)	40 OCDE countries		Panel	Bitcoin may have the potential to be an inflation hedge in a limited group of countries.
Anna Loseva (2016)	Russia		Regression	The number of Bitcoin circulation affects negatively the inflation rate. It reduces the growth rate of price level
XinLi, Chong AlexWang (2016)		two periods separated by the closure of Mt. Gox	co-integration in a mix of stationary and non-stationary time series, autoregressive distributed lag (ARDL) model	For the short term, there is adjustment between the Bitcoin exchange rate and the economic factors. In the long-term period, the sensitivity of Bitcoin exchange rate is higher to economic factors than to technological ones.
Pal Boug et al (2010).	13 less developed countries	1973-1996	Adoption of Johansen's multivariate procedure to estimate the cointegration.	A rise in the in-certainty and volatility of the real exchange rate in the short run and long run has a significant negative effect on foreign trade.

In order to achieve the purpose of this study, it will use the correlation between each of (GDP per capita, Inflation rate and foreign trade) and (the Bitcoin) in the other side, so the study it will be in three sections: The first section: correlation between Bitcoin and GDP per capita in GCC countries. In the second section: correlation between Bitcoin and Inflation Rates in GCC countries. And in the third section: correlation between bitcoin and foreign trade. Figure 2 below shows the sections of the study:

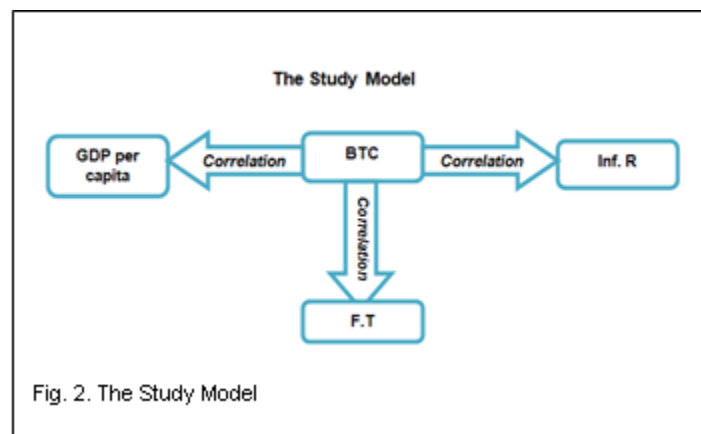


Fig. 2. The Study Model

Where;

- Bitcoin (BTC): Digital Currency created and held electronically using software.
- GDP: Gross Domestic Product per capita.
- Inf.R: Inflation Rate.

- F.T: Foreign Trade
- Correlation coefficient formulas are used to find how strong a relationship is between data. The formulas return a value between -1 and 1, where: 1 indicates a strong positive relationship. -1 indicates a strong negative relationship.

From the Figure (2) above, the researchers create three main hypotheses to test the correlation as the following table shows

TABLE 2
THE STUDY HYPOTHESES

SR	Hx	Variable I (Dependent)	Variable X (Independent)
1	H1: 1 st Hypothesis	Bitcoin	GDP per Capita
2	H2: 2 nd Hypothesis	Bitcoin	Inflation Rate
3	H2: 3 rd Hypothesis	Bitcoin	Foreign Trade

Where;

- H01: there is no correlation between Bitcoin Prices and GDP per capita in GCC countries.
- H02: there is no correlation between Bitcoin Prices and Inflation Rate GCC countries.
- H03: there is no correlation between Bitcoin Prices and Foreign Trade in GCC countries.

5 THE STUDY VARIABLES

5.1 GDP per capita

Amadeo (2017) defined Real Gross Domestic Product per capita as the amount of all goods and services produced divided by the total population and adjusted for inflation, the RGDP allowed the comparison between the standards of living of different countries. This economic indicator presented three concepts. The first one is GDP "gross domestic product." It is the sum of personal consumption (C), business investment (I), government expenditure (G) and net export (X-M). The second is RGDP "Real Gross Domestic Product" valued at constant prices. Real GDP reveals the amount of economic growth. In fact, it differs from the nominal GDP which is valued at the prices that prevailed in that same year. Nominal GDP reveals the amount of inflation. The third concept is "per capita," that means "per person." It is obtained by dividing the Real Gross Domestic Product by the population. This is the most accurate measurement to compare economic indicators like GDP for countries having big differences in population sizes.

$$\text{GDP per capita} = R/P \quad (1)$$

Where;

- P: population
- R: real GDP, $R = C + I + G + (X - M)$,
- C: consumption,
- I: investment,
- G: government expenditure,
- (X-M) = net exports.

5.2 Inflation rate

Inflation is the percentage change in the value of Price level from one year to the next. It measures the variation in the prices of a basket of goods and services for a year.

$$\text{The inflation rate} = \frac{\text{CPI}_{x+1} - \text{CPI}_x}{\text{CPI}_x} \quad (2)$$

Where; CPI: Initial Consumer Price index (Changes in the CPI are used to assess price changes associated with the cost of living; the CPI is one of the most frequently used statistics for identifying periods of inflation or deflation (Ball, Laurence M., and N. Gregory Mankiw.1992))

6 EMPIRICAL TEST

6.1 The 1st section: Correlation between Bitcoin and the Gross Domestic Product (GDP per capita) in GCC countries

Depend on the data published at the official site: economics trading (GCC countries | Economic Indicators) GDP per capita in GCC countries (Gulf Cooperation Council) has been recorded as the following in the end of fiscal year 2017, when modified by purchasing power parity (PPPs).

TABLE 3
GDP PER CAPITA IN GCC COUNTRIES CALCULATED BY U.S DOLLARS (BILLIONS)*

Year	GDP in UAE	GDP in KSA	GDP in Oman	GDP in Bahrain	GDP in Kuwait	GDP in GCC Countries
2017	378.66	678.54	71.93	33.87	118.27	1281.27
2016	348.74	646.44	66.29	31.86	110.87	1204.2
2015	357.95	654.27	69.83	31.13	114.61	1227.79
2014	403.2	756.35	81.03	33.39	162.7	1436.67
2013	390.43	746.65	78.94	32.54	174.18	1422.74
2012	374.82	735.98	76.69	30.75	174.07	1392.31
2011	350.91	671.24	67.94	28.78	154.02	1272.89
2010	289.88	526.81	58.64	25.71	115.4	1016.44
2009	253.55	429.1	48.39	22.94	105.99	859.97
2008	315.48	519.8	60.91	25.71	147.4	1069.3
2007	257.92	415.69	42.09	21.73	114.68	852.11

* World Data Atlas: Key Indicators, Economy. (<https://knoema.com/atlas>)

And it is significant in this regard to mention that we translated the numbers from this site by US dollar, because all trading transactions that happened by the Bitcoin were in the same currency (USD). And the figure below shows the GDP per capita in GCC countries the last ten years.

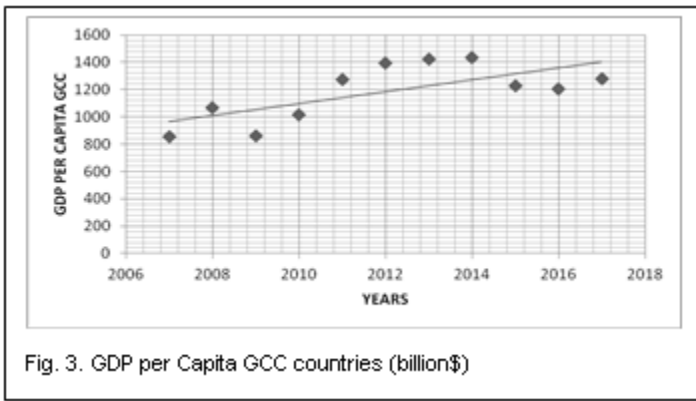


Fig. 3. GDP per Capita GCC countries (billion\$)

On the other side we found the Historical Bitcoin Price for the study period (2010-2017) and the following table and chart show the closing prices for bitcoin, and any economist can see the differences between the periods down, where the bitcoin price was register the highest level at the end of (2014, 2016) respectively, it reached to (770 USD and 990 USD) for each unit. But it started trading at (0.06 USD) at the beginning of 2010 as shown in the figure below:

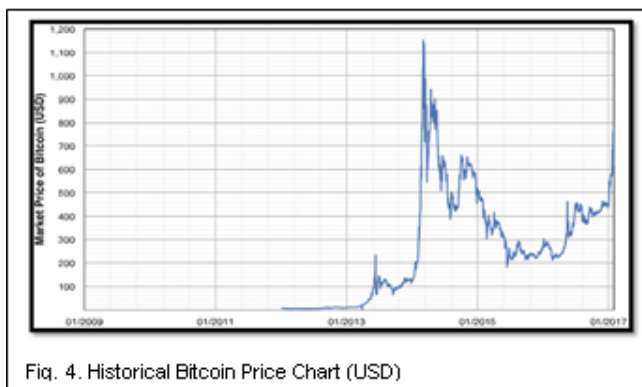


Fig. 4. Historical Bitcoin Price Chart (USD)

The table below shows the closing price for Bitcoin Currency in the last 9 Years which is considered as the study period:

TABLE 4
BITCOIN CLOSING PRICES AT THE END OF 2017

S.R	Date	Close Price (USD)
1	7/01/2010	0.09
2	1/1/2011	0.3
3	1/1/2012	5.27
4	1/1/2013	13.3
5	1/1/2014	770.44
6	1/1/2015	313.92
7	1/1/2016	434.46
8	1/1/2017	997.69
9	12/21/2017	16988.49

*Coin Desk, official site: (<http://www.coindesk.com/price/>)

We believe in this regard that the bitcoin will continue in volatility behavior in the next few years, because many countries are moving towards electronic commerce today, and this is significant reason to push up the bitcoin prices in the future, and here we are not talking about the using bitcoin safely, but we looking to the bitcoin from the economist eye of view, actually the trading price for this coin reached in June 2017 more than (2300 USD) for each unit. And table below shows sample from trading prices for the Bitcoin currency by

USD.

TABLE 5
*BITCOIN TRADING PRICES 2017**

Date	Price (USD)	Open	High	Low
Jun 17	2,329.0	2,303.6	3,000.0	2,050.2
May 17	2,303.3	1,384.6	2,806.0	1,371.0
Apr 17	1,384.6	1,089.0	1,394.5	1,089.0
Mar 17	1,089.0	1,194.5	1,360.0	890.0
Feb 17	1,195.1	970.0	1,221.9	925.0
Jan 17	970.0	973.4	1,175.0	734.6

*Investing.com (2017) (<https://www.investing.com/currencies/btc-usd-historical-data>)

According to the Study Objectives, the Data needed to test Correlation using SPSS should be the data mentioned in table 3 and table 4 which include the GDP per capita & bitcoin prices for the period 2009 until 2017 in GCC countries.

6.1.1 The result of correlation test between the GDP per Capita in GCC & bitcoin prices for the period 2009 until 2017:

The table below (6) shows the result of correlation test between the GDP per capita in GCC & bitcoin prices depend on Pearson, Spearman's Rho and Kendall's rank respectively:

TABLE 6
THE RESULT OF CORRELATION TEST BETWEEN THE GDP IN GCC & BITCOIN PRICES FOR THE PERIOD 2009 UNTIL 2017

Item	Pearson Correlation	Spearman's Rho Correlation	Kendall's rank correlation tau
GDP in GCC and Bitcoin Prices	Pearson correlation coefficient is $r = 0.1129$ p-value = 0.7724	Spearman correlation coefficient is $r_s = \rho(\text{rho}) = 0.4333$ p-value = 0.2499	Kendall correlation coefficient is $\tau(\text{tau}) = 0.3333$ p-value = 0.2595

Pearson correlation coefficient is the most commonly used method, although it is very sensitive to outliers. Spearman and Kendall correlation coefficients are not sensitive to outliers but their explanatory power is lower. From table above; A Pearson's rank-order correlation was run to define the relationship between 9 years GDP per capita and Bitcoin Prices in GCC countries. The numbers above ($r_s(9) = 0.1129$, $p = 0.77$). And from the table above; the Spearman's rank-order correlation was run to determine the relationship between 9 years GDP per capita and Bitcoin Prices in GCC countries. There was a ($r_s(9) = 0.4333$, $p = 0.2499$). Also a Kendall's rank-order correlation was run to determine the relationship between the same 9 years GDP per capita and Bitcoin Prices in GCC countries. There was a ($r_s(9) = 0.3333$, $p = 0.2595$). Depend on the table above; the researchers cannot accept that there is a relationship between GDP per Capita in GCC countries and the Bitcoin Prices. It is clear that the R-score was very low and the P-value was very high.

6.2 The 2nd section: Correlation between Bitcoin and the

Inflation Rate in GCC countries

Depend on the data published at the official site: economics trading (GCC countries | Economic Indicators) Inflation Rate in GCC countries (Gulf Cooperation Council) has been recorded as the following in the end of fiscal year 2017:

TABLE 7
THE INFLATION RATE IN GCC COUNTRIES CALCULATED (%)*

Year	Inf. Rate in UAE	Inf. Rate in KSA	Inf. Rate in Oman	Inf. Rate in Bahrain	Inf. Rate in Kuwait	Inf. Rate in GCC Countries
2017	2.5	0.9	3.2	2.1	-0.2	8.5
2016	3.5	2.8	1.1	1.8	3.5	12.7
2015	3.7	1.8	0.1	4.1	2.2	11.9
2014	3.1	2.7	1	2.3	2.7	11.8
2013	2.7	3.3	1.2	1.1	3.5	11.8
2012	3.2	2.8	2.9	0.7	2.9	12.5
2011	4.9	-0.4	4	0.9	3.7	13.1
2010	4.5	2	3.3	0.9	3.8	14.5
2009	4.6	2.8	3.5	1.6	4.1	16.6
2008	6.3	3.5	12.6	12.3	6.1	40.8
2007	5.5	3.3	5.9	11.1	5	30.8

* World Data Atlas: Key Indicators, Economy. (<https://knoema.com/atlas>)

The figure below also shows the Inflation Rate in GCC countries the last ten years.

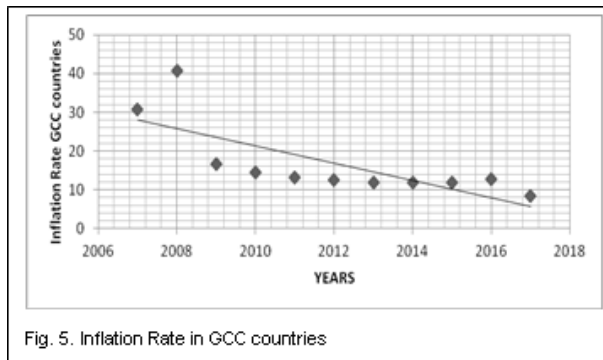


Fig. 5. Inflation Rate in GCC countries

6.2.1 The result of correlation test between the Inflation Rate in GCC & bitcoin prices for the period 2009 until 2017

The table below (NO.8) shows the result of correlation test between the Inflation Rate in GCC & bitcoin prices depend on Pearson, Spearman's Rho and Kendall's rank respectively:

TABLE 8
THE RESULT OF CORRELATION TEST BETWEEN THE INFLATION RATE IN GCC & BITCOIN PRICES FOR THE PERIOD 2009 UNTIL 2017

Item	Pearson Correlation	Spearman's Rho Correlation	Kendall's rank correlation tau
Inflation Rate in UAE and Bitcoin Prices	Pearson correlation coefficient is $r = -0.7240$ p-value = 0.0274	Spearman correlation coefficient is $r_s = \rho(\text{rho}) = -0.8034$ p-value = 0.0091	Kendall correlation coefficient is $\tau(\text{tau}) = -0.7043$ p-value = 0.0088

From table above; A Pearson's rank-order correlation was run to determine the relationship between 9 years Inflation Rate

and Bitcon Prices in GCC countries. The numbers above shows it is a strong relationship and Negative correlation between Inflation Rate and Bitcon Price, which was statistically significant ($r_s(9) = -0.724$, $p = 0.02$). And from the table above; the Spearman's rank-order correlation was run to determine the relationship between 9 years Inflation Rate and Bitcon Prices in GCC countries. There was a strong, Negative correlation between Inflation rate and Bitcon Prices, which was statistically significant ($r_s(9) = -0.803$, $p = 0.0091$). Also a Kendall's rank-order correlation was run to determine the relationship between the same 9 years Inflation Rate and Bitcon Prices in GCC countries. There was a strong, Negative correlation between Inflation Rate and Bitcon Prices, which was statistically significant ($r_s(9) = -0.7043$, $p = 0.0088$). Depend on the table above; we can accept that there is a negative relationship between Inflation Rate in GCC countries and the Bitcoin Prices. It is clear that the R-score was high and the P-value was very small especially in the Spearman's Rho Correlation.

6.2.2 The possibility to use the Bitcoin as hedge against inflation:

Depend on the results that mentioned in table (8) we suggested to make inflation hedge. As known the inflation hedge is a process that is considered to provide some protection against the reduced purchasing power of any currency that results from the reducing of its value due to increasing prices. Using a Valuation Approach to Currency Hedging (Hazuka and Huberts, 1994), the researchers formulated the following approach to evaluate the value of the currency future contracts:

$$F[S_t] = S_0 \times E[(1 + I_d)^t / (1 + R_{\text{Bitcoin}})^t] \quad (3)$$

Where,

R_{Bitcoin} : Bitcoin Return

$F[S_t]$: The Exchange rate at time t in base currency per bitcoin.

S_0 : The Spot Price at time Zero

I_d : Domestic Rate of Inflation (each country alone in GCC: I_{KSA} , I_{UAE} , I_{Oman} , I_{Bahrain} , I_{Kuwait})

In the regard of Bitcoin Return it is available and published online[Historical Data (Block-Alive)] and the table (9) below shows sample including the return for two and half years:

TABLE 9
BITCOIN HISTORICAL RETURNS

Month	2016	2017	2018
Jan	-15.10%	-1.95%	-25.16%
Feb	15.94%	21.10%	13.38%
Mar	-5.05%	-13.63%	-36.32%
Apr	8.89%	21.63%	24.83%
May	21.19%	59.19%	N/A
Jun	20.20%	5.01%	N/A
Jul	-5.57%	9.62%	N/A
Aug	-7.65%	64.71%	N/A
Sep	5.80%	-11.31%	N/A
Oct	14.49%	46.88%	N/A
Nov	2.84%	51.22%	N/A
Dec	26.38%	28.98%	N/A

Bitcoin Investment Statistics: Historical Data (BlockAlive), APR 21, 2018 (<https://blockalive.com>)

We suggest Each country in GCC need to make the hedging

portfolio separately which means KSA will make hedging portfolio in isolation from UAE and Oman will make a hedge portfolio in isolation from Kuwait...etc. The value of the hedge portfolio is the value of money that the country can obtain by liquidation of the portfolio when the future contracts expires, and it will be calculated depend on the value of the hedge portfolio (Chance, Brooks, 2008) that equal: $V = h \times S_0 - F(St)$. It is reasonable to assume that the hedge rate (h) is the same as the correlation between the Inflation rate in each country in GCC and the Bitcoin price. And the following model will calculate the value of hedging portfolio to hedge against the Inflation:

$$V = h \times S_0 - F(S_t) \quad (4)$$

Where,

V: The value of the hedging portfolio.

F [St]: The Price of future contracts (same: Exchange rate at time t in base currency per bitcoin)

S₀: The Spot Price at time Zero (current time)

h: Hedging ratio [correlation. Normally in options portfolios will be: (Cu-Cd / Us- Ds)]

As a fact for the single correlation between the inflation rate in each country in GCC and the Bitcoin price for the same period (2009-2017), the above model was suggested by researchers before; can be applied in the future market by using the inflation rate & the bitcoin return and then we can make the valuation for each hedging portfolio. The table below shows the correlation between inflation rate and the bitcoin price in each country in GCC:

TABLE 10
THE CORRELATION BETWEEN INFLATION RATE & BITCOIN PRICE IN EACH COUNTRY IN GCC

Item	UAE	KSA	Oman	Bahrain	Kuwait
R	-0.8602	-0.8934	-0.5671	-0.3589	-0.7712
P-Value	0.008	0.0012	0.01206	0.0351	0.021

By using the correlation as a hedging ratio and the historical return for the bitcoin currency trading and the inflation rate for each country, the monthly F(St) or monthly currency future contracts for December 2018 to be exercised in January 2019 will be as the following:

TABLE 11
MONTHLY F(ST) OR MONTHLY CURRENCY FUTURE CONTRACTS FOR DECEMBER 2018 TO BE EXERCISED IN JANUARY 2019

Country	$F(S_t) = S_0 \times E[(1+I_t)^t / (1+R_{Bitcoin})^t]$	F(S) _{Dec}
1 KSA	$F(S)_{KSA} = 4,028 \times [(1+0.024)^{12} / (1+0.1066)^{12}]$	4002.0444
2 UAE	$F(S)_{UAE} = 4,028 \times [(1+0.039)^{12} / (1+0.1066)^{12}]$	4006.8972
3 Oman	$F(S)_{Oman} = 4,028 \times [(1+0.011)^{12} / (1+0.1066)^{12}]$	3997.7856
4 Bahrain	$F(S)_{Bahrain} = 4,028 \times [(1+0.07)^{12} / (1+0.1066)^{12}]$	4016.7261
5 Kuwait	$F(S)_{Kuwait} = 4,028 \times [(1+0.01)^{12} / (1+0.1066)^{12}]$	3997.4559

When we want to evaluate the hedging portfolio for each country we will consider the correlation to be the hedging ratio, and we will ignore the minus sign because we should to buy

put option for short position or sell future contract under the amount that calculated in the table (11) which shows F [St] for each country. The value for the hedging portfolio (V) for the (Dec 2018 – Jan 2019) for the countries in GCC will be as the following:

TABLE 12
THE VALUE FOR THE HEDGING PORTFOLIO (V) FOR :(DEC 2018 – JAN 2019)

Country	$V = h \times S_0 - F(S_t)$	$V \times 1000$ (each lot on currencies contract =1000 contract)
1 KSA	$V_{KSA} = 4,028 \times 0.8934 - 4002.0444$	$403.4292 \times 1000 = 403,429.20$
2 UAE	$V_{UAE} = 4,028 \times 0.8602 - 4006.8972$	$542.0116 \times 1000 = 542,011.60$
3 Oman	$V_{Oman} = 4,028 \times 0.5671 - 3997.7856$	$1713.5068 \times 1000 = 1,713,506.80$
4 Bahrain	$V_{Bahrain} = 4,028 \times 0.3589 - 4016.7261$	$2571.0769 \times 1000 = 2,571,076.90$
5 Kuwait	$V_{Kuwait} = 4,028 \times 0.7712 - 3997.4559$	$891.0623 \times 1000 = 891,062.30$

Inflation rate parity (the relationship between the future contract and the spot exchange rate that was calculated above depend on the inflation rate & the return in bitcoin) is an important fundamental relationship between the spot & future exchange rate and the inflation rate in two different currencies. It is the foreign currency market's version of the carry arbitrage future pricing model. A helpful way to understand Inflation rate parity is to consider the position of country which believes that a higher inflation rate can be compensated by converting to a currency that pays high return. And we have to remember in this regard that the future contracts or the option (Put, Call) there are no one is forced to execute the contracts or agreements.

6.3 The 3rd section: Correlation between Bitcoin and the Foreign Trade in GCC countries

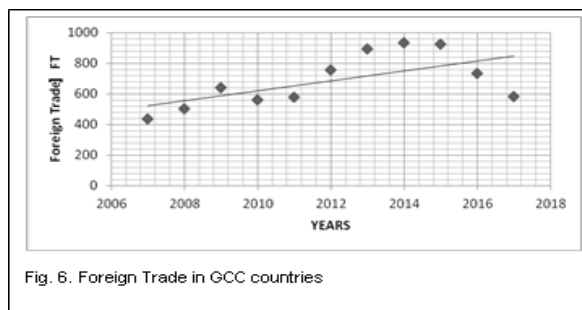
Depend on the data published at the official site: economics trading (GCC countries | Economic Indicators) FT in GCC countries (Gulf Cooperation Council) has been recorded as the following in the end of fiscal year 2017:

TABLE 13
FT IN GCC COUNTRIES CALCULATED BY U.S DOLLARS (BILLIONS)*

Year	FT in UAE	FT in KSA	FT in Oman	FT in Bahrain	FT in Kuwait	FT in GCC Countries
2017	52	24	39	271	198	584
2016	61	24	56	375	218	734
2015	111	22	59	379	354	925
2014	121	22	54	349	387	933
2013	128	17	49	302	399	895
2012	112	15	38	214	376	755
2011	76	21	29	192	261	579
2010	65	17	39	239	202	562
2009	98	15	26	178	322	639
2008	72	13	22	145	249	501
2007	64	10	19	117	225	435

* World Data Atlas: Key Indicators, Economy. (<https://knoema.com/atlas>)

And the figure below shows the Foreign Trade in GCC countries the last ten years:



6.3.1 The result of correlation test between Foreign Trade in GCC & bitcoin prices for the period 2009 until 2017:

The table below (14) shows the result of correlation test between the FT in GCC & bitcoin prices depend on Pearson, Spearman's Rho and Kendall's rank respectively

TABLE 14
THE RESULT OF CORRELATION TEST BETWEEN THE FT IN GCC & BITCOIN PRICES FOR THE PERIOD 2009 UNTIL 2017

Item	Pearson Correlation	Spearman's Rho Correlation	Kendall's rank correlation tau
FT in UAE and Bitcoin Prices	Pearson correlation coefficient is $r = -0.3341$ p-value = 0.3795	Spearman correlation coefficient is $r_s = \rho(\text{rho}) = -0.3333$ p-value = 0.3853	Kendall correlation coefficient is $\tau(\text{tau}) = -0.1667$ p-value = 0.6122

The From table above; A Pearson's rank-order correlation was run to define the relationship between 9 years Foreign Trade and Bitcon Prices in GCC countries. The numbers above ($r_s (9) = -0.3341$, $p = 0.3795$). And from the table above; the Spearman's rank-order correlation was run to determine the relationship between 9 years Foreign Trade and Bitcoin Prices in GCC countries. There was a ($r_s (9) = 0.3333$, $p = -0.3853$). Also a Kendall's rank-order correlation was run to determine the relationship between the same 9 years Foreign Trade and Bitcon Prices in GCC countries. There was a ($r_s (9) = -0.1667$, $p = 0.6122$). Depend on the table above; the researchers cannot accept that there is a relationship between Foreign Trade in GCC countries and the Bitcoin Prices. It is clear that the R-score was very low and the P-value was very high.

7 RESULTS & DISCUSSION

At the end of this study; we found three main results, the first one that there is no relationship or significant correlation between GDP per capita and Bitcon Prices in each of Pearson, Kendall and Spearman's tests in GCC countries. And in the second result they found there is a strong relationship and negative correlation between Inflation Rate and Bitcoin Prices in each of Pearson, Kendall and Spearman's tests also in GCC countries, but in the third result they found that there is no correlation between foreign trade and Bitcoin Prices, in all the tests (Pearson, Kendall and Spearman) combined. Based on the results above we accepted the second hypothesis but they rejected the first and the third one as mentioned in the table below:

TABLE 15
THE HYPOTHESES TEST RESULTS

Date	Price (USD)	Open	High	Low
Jun 17	2,329.0	2,303.6	3,000.0	2,050.2
May 17	2,303.3	1,384.6	2,806.0	1,371.0
Apr 17	1,384.6	1,089.0	1,394.5	1,089.0
Mar 17	1,089.0	1,194.5	1,360.0	890.0
Feb 17	1,195.1	970.0	1,221.9	925.0
Jan 17	970.0	973.4	1,175.0	734.6

*Investing.com (2017) (<https://www.investing.com/currencies/btc-usd-historical-data>)

As mentioned before, in the literature review that Bitcoin could boost Japan's GDP, (Nomura analysts, 2018) Yoshiyuki Suimon and Kazuki Miyamoto (2018) estimate the wealth effect of bitcoin could boost consumer spending in Japan to as much as 96 billion yen (\$855.4 million). But it is good to mention that by Assuming the Japanese hold about 3.7 million bitcoins and estimating an 866,000 yen (\$7,716) gain in price between the second and fourth quarters of the year, they estimate unrealized gains on Bitcoin held by Japanese people of roughly ¥3.2 trillion (\$28.5 billion), (Source: Crypto Compare, 2018). But we found that there is no relationship between GDP per capita and Bitcoin Price in GCC countries which means the result in this regard was unlike expected. We believe that this digital currency needs legal cover in the GCC countries as what happened in Canada; Maria Santos (2018), With Ottawa already equipped with a new Bitcoin Automated Teller Machine. Basically this is a machine that accepts fiat money and dispenses Bitcoin in exchange. From Canada turns into the country with most Bitcoin ATMs despite government's opinion. David George-Cosh (2014) Canada Says Bitcoin Isn't Legal Tender (the Wall Street Journal). Joseph D. Alba, David H. Papell (2005) found considerable evidence of Purchasing Power Parity that calculated depend on GDP per Capita in the countries which have good commerce, we believe that there results regarding GDP per capita and Bitcoin prices they were against with Joseph D. Alba, David H. Papell's results, in case we consider the bitcoin a kind of currency, and GCC one of the most important countries which used to the E-Commerce. Anna Loseva (2016) found that by increasing the number of Bitcoin in circulation inflation slows down and if the number of Bitcoin in circulation increases by 1% the growth rate of price level in month reduced by 0.241%. This result was compatible with the result of our study result, as mentioned in the 2nd hypothesis, which means when the number of Bitcoin and the price of it go up, the inflation rate will go down. In the same time Burgehelea's study (2008) he found that the use of Bitcoin didn't cause inflation or in other language there is no relationship between Bitcoin and Inflation rate. And this is the most interested result in this regard, because the researchers found that there is a strong relationship between Bitcoin and inflation, which means the Inflation rate and Bitcoin they have no harmonious all the time. In other words, it's hard for them to go the same direction from the Statistics point of view, so the strong relationship that we found in this study completely against the Burgehelea's results. Researchers believe that this digital currency was so young in 2008 when Burgehelea's (2008) was published his results, because the Bitcoin in that

time was very small index price not more than 1 USD as a price for each unit. In the Barro (1995) study he found that there is a causal influence between inflation and economic growth and estimated that the rate of inflation affects negatively the real gross domestic products, we believe that there results regarding GDP per capita and inflation they were consistent with Barro's study, because when they test the GDP & Inflation rate with same dependent variable they found they are opposite. This study came to add new variables to Pavel Ciaian, Miroslava Rajcaniova & d'Artis Kanacs's study (2015) that they found there is positive and significant relationship between the supply and demand of bitcoin and its price, so the researchers can add new variables to this study that they used before; such Foreign Trade, Inflation Rate and the GDP per capita. In addition to the results in the regards of the relationship between Inflation rate and the bitcoin price the researchers try to add benefit from this kind of relationship, and the best way to invest this relationship is to be useful in the future market or in the hybrid market, so they introduced a simple two models depend on (Chance, Brooks, 2008) & (Hazuka and Huberts, 1994) to make hedging against the inflation using the bitcoin currency. And each country in GCC can make a hedging portfolio using its own inflation rate, return of bitcoin currency and the correlation between the inflation rate in this country and the bitcoin price. In the regards of Foreign Trade or International Trade we found that there is no direct correlation with the bitcoin prices. A lot of studies and articles found that the Bitcoin will be a hard number in the Foreign Trade or International Trade (Faisal Khan, 2018. USA Corporat) "I think bitcoin (or its variant) that would have a very important role to play in international trade, once we are past this friend or foe phase with governments, financial institution and regulators that we are going through". We believe that the benefits of Bitcoin for Foreign trade for those trading commodities across borders, Bitcoin gives a host of benefits. The Bitcoin and block-chain technology are poised to disrupt trade finance include: the lack of the exchange rate. If the trader is dealing with many international suppliers in some of countries, then he has to deal with a myriad of exchange rates. If all traders are using Bitcoin, however, he is all dealing in the same currency with the same value, without the constant hassle of monetary exchange. The speed of money movement; Bitcoin transactions are near instantaneous. The transfer itself posts directly, and it takes only about a few minutes for payments to be validated in the block-chain. Secured payments; the money that the traders will receive when they take a Bitcoin payment is also secured. Users need to have the money available upfront fee, so there's no chance of payments bouncing, or credit transactions being deleted. Lower tax and fee; because Bitcoin is a peer-to-peer monetary system, there are no taxes that govern them, and transaction fees are almost absent.

8 CONCLUSION

We tried in this article to find a new relationship between some economic variables not mentioned in previous researches. So, we found a correlation between the Bitcoin Prices and some macroeconomic variables like GDP per capita, foreign trade and inflation rate in GCC countries. We conclude three main results, in the first one there was no relationship or significant correlation between GDP per capita and Bitcoin Prices in each of Pearson, Kendall and Spearman's tests in GCC countries. In the second

result we found that a negative strong relationship between Inflation Rate and Bitcoin Prices in each of Pearson, Kendall and Spearman's tests also in GCC countries, but in the third result we found that there was no correlation between foreign trade and Bitcoin Prices. And we used the negative relationship between the inflation rate & the bitcoin price to introduce a new model that can be used to make hedging strategy against the inflation in GCC countries.

9 REFERENCES

- [1] Adusei, Abuaf, N. and Jorion P. 1990. Purchasing Power Parity in the Long Run. *Journal of Finance*. 45, p157-74.
- [2] Angela ROGOJANU, Liana BADEA. 2014. The issue of competing currencies. Case study – Bitcoin. *Theoretical and Applied Economics* Volume XXI (2014), No. 1(590), pp. 103-114
- [3] Ball, Laurence M., and N. Gregory Mankiw. 1992. "Relative Price changes as Aggregate Supply Shocks," National Bureau of economic Research Working Paper No. 4168, September.
- [4] Best, D.J. and Gipps, P.G. .1974. Algorithm AS 71: The Upper Tail Probabilities of Kendalls Tau Applied Statistics, Vol. 23, No. 1. (1974), pp. 98-100
- [5] Burghilea, C. .2008. "Global financial integration, inflation, and market economies", *Official Journal of the Contemporary Science Association New York*, vol. 3, no. 4, Denbridge Press New York, pp.153-160
- [6] Chance, Brooks. 2008. *An introduction to Derivatives and Risk Management 7th Edition*. Thomson south-western. ISBN: 0-324-64627-5.
- [7] Davison, A.C. and Hinkley, D.V. 1997. *Bootstrap Methods and Their Application*. Cambridge University Press.
- [8] Eurostat-OECD. 2012. *Methodological Manual on Purchasing Power Parities (2012 Edition)*.
- [9] Hill, I.D. .1973. Algorithm AS 66: The Normal Integral Applied Statistics, Vol. 22, No. 3. (1973), pp. 424-427.
- [10] Hongjun Li, Zhongjian Lin, Cheng Hsiao .2015. Testing purchasing power parity hypothesis: a semiparametric varying coefficient approach. *Empirical Economics*. February 2015, Volume 48, Issue 1, pp 427–438
- [11] Isard, Peter. 1995. *Exchange Rate Economics* (Cambridge: Cambridge University Press). Issued in October 1995
- [12] J. D. Alba and D. H. Papell. 2007. "Purchasing Power Parity and Country Characteristics: Evidence from Panel Data Tests," *Journal of Development Economics*, Vol. 83, No. 1, May 2007, pp. 240-251. doi:10.1016/j.jdeveco.2005.09.006
- [13] Ji, Philip Inyeob and Chun, Kwang Myung. 2016. Digital Currency and Inflation Hedge: Evidence from Bitcoin, September 30, 2016. *International Telecommunications Policy Review*, Vol. 23, No. 3, 2016. Available at SSRN: <https://ssrn.com/abstract=2850542>
- [14] Kendall, M.G. 1976. *Rank Correlation Methods*. 4th Ed. Griffin. Charles Griffin, London
- [15] Kimberly Amadeo .2017. *Real GDP Per Capita: How to Calculate, Data Since 1946*. U.S. Economy.
- [16] Laurentiu Guinea Voinea .2013. *The purchasing Power Parity : Evidence From The Great Financial Crisis* . Academic course at economics university of Madrid
- [17] Li, Xin and Wang, Chong.2017. The Technology and Economic Determinants of Cryptocurrency Exchange Rates: The Case of Bitcoin. *Decision Support Systems*, 2017, 95, 49-60. Available at SSRN:

- <https://ssrn.com/abstract=2515233> or
<http://dx.doi.org/10.2139/ssrn.2515233>
- [18] Loseva, Anna. 2016. Bitcoin: A Regression Analysis of Cryptocurrency Influence on the Russian Economy (April 7, 2016). Available at SSRN: <https://ssrn.com/abstract=2765198>.
- [19] Maria Santos. 2018. Bitcoin mining is not easy. 02.01.2018. Ottawa . Canada. www.99bitcoins.com.
- [20] Michael P, Nobay R, Peel D .1997. Transactions costs and nonlinear adjustment in real exchange rates: an empirical investigation. *J Polit Econ* 105:862–879
- [21] Michal Polasik, Anna Piotrowska, Tomasz Piotr Wisniewski, Radoslaw Kotkowski, Geoffrey Lightfoot: Price Fluctuations and the Use of Bitcoin: An Empirical Inquiry, University of Leicester, University Road Leicester LE1 7RH, UK
- [22] Mohsen Bahmani-Oskooee, Tsangyao Chang & Tsungpao Wu. 2014. Revisiting purchasing power parity in African countries: panel stationary test with sharp and smooth breaks. *Journal Applied Financial Economics* Volume 24, 2014 - Issue 22
- [23] Morten Brandvold, Peter Molnár, Kristian Vagstad, Ole Christian & Andreas Valstad. Price discovery on Bitcoin exchanges *Journal of International Financial Markets, Institutions and Money*. Volume 36, May 2015, Pages 18-35
- [24] Pavel Ciaian, Miroslava Rajcaniova & d'Artis Kancs. 2015. The economics of BitCoin price formation. *Applied Economics Journal* Volume 48, 2016 - Issue 19. Pages 1799-1815 | Published online: 13 Nov 2015.
- [25] Robert J. Barro, 2013. "Inflation and Economic Growth," *Annals of Economics and Finance*, Society for AEF, vol. 14(1), pages 121-144, May
- [26] Sandeep Mazumder. 2017. Output gains from accelerating core inflation. *Journal of Macroeconomics*. Volume 51, March 2017, Pages 63–74
- [27] Stephanie Kremer, Alexander Bick ,Dieter Nautz. 2013. Inflation and growth: new evidence from a dynamic panel threshold analysis. *Empirical Economics* April 2013, Volume 44, Issue 2, pp 861–878
- [28] Thomas B. Hazuka and Lex C. Huberts. 1994. *Financial Analysts Journal*. Vol. 50, No. 2 (Mar.- Apr., 1994), pp. 55-59. Published by: CFA: www.jstor.org/stable/4479731. Page Count: 5.
- [29] Tribute Jim Lothian. 2016. Purchasing power parity and the behavior of prices and nominal exchange rates across exchange-rate regimes. *Journal of International Money and Finance*. Volume 69, December 2016, Pages 5–21.