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# Assessing the Asymmetric Relationship between Global Economic Factors and Cryptocurrency: A Comparison between Normal Times and COVID-19 Times using the NARDL Model

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| Article Info | ABSTRACT |
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| | Stock markets, commodity markets, and cryptocurrency markets, have all been negatively affected with the onset of this pandemic covid-19, and the effects are far more intense than that any previous outbreaks. This paper not only aims at understanding the interaction of global economic factors with the digital currency bitcoin, but it also sheds light on the impact Covid-19 had on the relationship between bitcoin and global economic factors. In line with the objective of this study, the researcher determines the asymmetric relationship between global economic factors' price, specifically gold price, crude oil price, stock index S & P price, and bitcoin price during the unprecedented times of Covid-19 using the Non-linear autoregressive distributed lags (NARDL model). Data was analysed for the period March 2014 to March 2021, employing descriptive statistics, unit roots testing, and NARDL model, aided by the statistical package EViews version 11.The findings reveal the presence of a statistically significant and asymmetric relationship between global economic factors and cryptocurrency during the covid-19 times, whilst before the strike of the pandemic, global economic factors were not significant to cryptocurrency as the results are insignificant. Howbeit, the overall model showcases mixed results since the significance of the asymmetric effect for the overall model is due to the significance of the asymmetric effect during covid-19. The relevant authorities as well as central banks are recommended to work closely together to enforce effective economic policies to mitigate the dreadful effects of the covid-19 pandemic without instilling uncertainty among investors thus gearing towards market recovery. |

## 1. Introduction

The tremendous spread of the covid-19, which first burst out in Wuhan China, has fueled a pandemic within the span of a few months, spurring adverse effects not only onto the human life, but also to the world economy. Stock markets, commodity markets, and cryptocurrency markets, have all been negatively affected with the onset of this pandemic covid-19, and the effects are far more intense than that any previous outbreaks (Baker et al, 2020). However, before diving deeper into the area, it is essential to talk about the growth of cryptocurrency and its interdependence with global economic factors to get a glimpse about their interaction and the background of this study in specific.

Technological advancement and changes in consumers' taste have immensely redefined how financial markets will be possibly operating in the upcoming years. Despite the curtailments financial regulations posited to fintech incumbents initially, fintech is perfectly revolutionising and reshaping the financial circle and will be pursuing it in the foreseeable future. From big data analytics to artificial intelligence and robotic process automation, revolution in technology has been massively changing the financial landscape, providing not only several opportunities, but also challenges for consumers, regulators and the institutions providing the service (Allen, 2018). The wake of the 2008 financial crisis, emerged out of financial deregulation in the United States, has indeed orchestrated the advent of a new epoch of financial services, termed "FinTech". Over the past decade, traditional finance has gone through substantial changes and the emerging field of Fintech, on cutting edge of the tech's revolution has extraordinarily captivated the attention of the public, as well as investors (Zavolokina, Dolata, & Schwabe, 2016). FinTech firms are drastically altering the financial services landscape, and are revamping the competitive financial service industry (Kashyap, 2017).

While a huge amount of literature has essentially been devoted to unravel the interconnectedness among financial markets over the past decades, relatively few studies are conducted on the interdependence between global economic factors and the cryptocurrency markets using more advanced methods such as the NARDL method. The interconnectedness amongst global economic factors such as gold, stock markets, crude oil or exchange rates have always been in the limelight and in the epicentre of research of both scholars and practitioners and the following findings provide a brief overview of it. While the traditional financial market is a major topic of interest among academics and practitioners, the new invention of the digital era, the "Bitcoin Cryptocurrency" seems to captivate their interest to a much greater extent. Crafted as a decentralised digital currency in 2008, by Satoshi Nakamoto, Bitcoin is a standout among the leading digital currencies which essentially makes use of the blockchain technology and the Distributed Ledger Technology, rather than relying on national banks, for online payments and to approve transactions (Sahoo, 2017). Nakamoto (2008) defined bitcoin as: "A purely peer-to-peer version of electronic cash (which) would allow online payments to be sent directly from one party to another without the need of going through a financial institution."Ever since it has emerged as enthralling phenomenon in the Financial Markets in 2008, Bitcoin vivaciously portrays itself as the glue which firmly catches the attention and holds the interest of the world's speculators and investors, which ultimately spurred ubiquitous economical unpredictability thereby roiling financial systems on a worldwide basis.

Despite Bitcoin's relatively small size in relation to financial markets, the unanticipated hike in its market value has garnered the attention of several scholars, researchers, investors, traders and practitioners. However, without any regulatory body backing the currency, cryptocurrency has been submerged with controversy ever since its prevalence was highlighted and the theory surrounding the dynamics of Bitcoin has ignited some intense discussion. It has been unveiled that bitcoin prices have plummeted more than 80 % in 2018, hovering a little over

USD 3,000 following its USD 20,000 peak in 2017 (Weissman, 2018). On top of that, to fill in the gaps stemming from digital currencies not being issued by central banks, the European Central Bank is planning to launch a digital euro which would constitute an electronic version of central bank money made available to everyone in Europe. The purpose of bringing the digital euro is for shaping and promoting the digitalisation of payments by providing an easy, simple, trusted way of making digital payments, whilst reducing the associated risks in the European economy (European Central Bank, 2020).

As noted above, this paper not only aims at understanding the interaction of global economic factors with the digital currency bitcoin, but it also sheds light on the impact Covid-19 had on the relationship between bitcoin and global economic factors. Bitcoin has been characterised as a safe haven for traditional assets owing to its captivating features such as central bank and monetary policy independence, it serves as a store of value or even its restrained interconnection with traditional assets, however 2020 has presented a rough ride for Bitcoin and developed and emerging markets are shaking with the outburst of the deadly virus, covid-19. This has increasingly challenged  the safe haven features of Bitcoin during instances of turmoil in financial markets, especially the covid-19 bear market.

The world economy is being embroiled by the effects of the covid-19 crisis and ever since the pandemic's outbreak, it has created havocs and massive ramifications for the world economy, collapsing the cryptocurrency and the stock markets equally. To be able to get a glimpse about the impact of covid-19 crisis on both the cryptocurrency market and the traditional markets, it is first essential to look back at some of the important events which has spurred the emergence of the cryptocurrency market.

In the quest of the covid-19 crisis, the effects are far more severe and pertinent than that of the global financial crisis of 2008 and the SARS- COV2. With the outbreak of covid-19 crisis plaguing the world and causing over 90 million confirmed cases and over 2 million deaths (BBC News, 2021), the whole cryptocurrency and traditional stock markets crumbled fuelling serious repercussions for the world economy. At the outset of pandemic, the broader cryptocurrency market began to collapse massively, losing more than half of its value and the prices of the digital currencies began to plummet sharply since most investors were engaged into the immediate selling of their currency. Explicitly, the market value of those cryptocurrencies declined from over 300 billion US dollars around mid-February 2020 to less than 100 billion US dollars by mid-March 2020. And specifically, bitcoin experienced a sharp decline over this period, falling from over USD 10,000 to less than USD 4,000 (Rooney, 2020).

Whilst it is evident that the crypto market collapsed at the outset of the covid-19 pandemic, the large commodity and stock markets were equally not spared from its negative effects. Notably, crude oil and gold are two major illustrations of the large commodity markets, are essentially crucial for the good functioning of the real economy together with the financial markets. Crude oil forms an integral resource for the economy and it is a significant input for several goods and services, however any fluctuations in the price of crude oil can impact on a firm's cash flows and this can in turn jeopardise the smooth running and stability of financial markets.

Further to the above, gold represents a store of value and is constantly being utilised for investment and hedging purposes and these are the features that make it a safe haven in financial markets (Baur & Lucey, 2010). The

ramifications of the global pandemic has been quite appalling for the U.S economy since it has not only faced the massive spread of the covid-19, but it is also facing an oil price slump, with oil prices dropping spectacularly by around 30% in April 2020. There was a drastic fall off in the U.S crude oil prices, plummeting to even historic negative figures, from USD 18 per barrel to -USD 38 per barrel. This spectacular crash in oil price marked the first biggest slump in history as stock piles submerged   the oil storing tanks, shaking oil investors. Furthermore, this crash has been the largest ever since the Gulf war oil spill in 1991 with the Saudi suppliers unexpectedly refusing to give discounts of USD 6 – USD 8 to their western clients (Sharif et al, 2020).

These two shocking incidents (the spread of covid-19 and the crash of crude oil prices) have spurred the collapse of stock markets globally owing to oil price war as well as fears stemming from the news of new confirmed cases and deaths on a daily basis in the United States as well as in many European countries, which is currently the epicentre of covid-19. The blending of these two problems would undoubtedly be the driving force in a long term economic shut down as well as a recession in several economies such as in the U.S, Europe, Asia and Africa. However, the recovery was in progress with demand rising over the past few months, but with the number of new cases soaring, the re-imposition of lockdown restrictions, and some of the world's biggest airlines cutting off workforce have all triggered a drop in the demand for oil. Moreover, Trump testing positive for Covid-19 has added up to the problem, with oil price dropping by 5 %, taking the biggest hit and outstripping other assets (Cooper, 2020).

In addition to, stock markets, cryptocurrencies, and other commodities declined sharply, with the standard and poor 500 index falling at just 1.7% at intraday lows. On the other side of the coin, the fall-off in the prices of gold was quite minimal with the outburst of the pandemic, however this was accompanied by an inverted trend in February 2020. The global ambivalence pertaining to covid-19 has been inevitably alarming for the price dynamics of both gold and crude oil. Pertaining to the behavioural finance theory, it is found that in such unprecedented times, investment decisions are largely influenced by investors' sentiment. (Ichev R., 2018) advocated that commodity markets are not only susceptible to demand and supply factors, macroeconomic or political factors, but are also to a large extent, vulnerable to other factors. Thus, this new pandemic, covid-19, might foster turmoil in the global financial and commodity markets. Whilst gold price was among the least affected variables at the onset of the covid-19 outbreak, several months later around August 2020, gold price was being spectacularly affected, with spot gold prices falling below USD 2000, crashing about almost 6 percent on 11th August 2020, recording its highest one day loss in the past 7 years, due to traders cashing in on a rally that exacerbated the price level of gold. Owing to this event, several governments and central banks across the globe have injected billions of dollars into the world economy to curb the impact of recession or widespread bankruptcies. This injection of cash into financial markets has boosted the value of various assets, specifically gold and equity markets. Gold, which was commonly the possession of the central bank and the bourgeoisie, is now massively becoming the focal point for several traders for the following reasons. Firstly, the fiscal stimulus and low interest rates gold provides, offer it a competitive edge, making investors flocking to gold in 2020. Moreover, the weakening of the U.S dollar increase the attractiveness of dollar-priced commodities such as gold and this can act as a vital catalyst in rising gold's price (Nagarajan, 2020).

The impact of the covid-19 pandemic has detrimental and catastrophic consequences beyond the tremendous propagation of the virus and attempts to contain it in the United States, provoking the massive crash of US stock markets. One of the most critical and terrible stock market crashes of the recent times was the one sought at the

outburst of the covid-19 in the U.S and just after the announcement of quarantine restrictions pressed by U.S the government. This exhibited serious repercussions on the U.S economy with the Dow Jones (DJ) stock index falling to 23, 851 points, accounting for a decline of 7.79 % in the stock market on 9th March 2020. However, Dow Jones stock index fell to 21, 200 points on 12 March 2020, notching its largest one-day slump in the Dow Jones' history ever since the Market Crash of October 1987, with a – 9.99 % drop. The Standard & Poor 500 stock market index encountered a similar collapse virtually. It has been found that the volatility levels of the US stock markets due to the unprecedented effects of covid-19 are far more pertinent, exceeding those perceived during the Market Crash of October 1987, the 2008 global financial crisis or during the 1929 crash (Grobys, 2020).

The general objective of this study is to determine the asymmetric relationship between global economic factors' price and bitcoin price during the unprecedented times of Covid-19.
The specific objectives of this study are to:

    (i)      Determine the asymmetric relationship between gold price and bitcoin price during Covid-19
    (ii)     Determine the asymmetric relationship between crude oil price and bitcoin price during Covid-19
    (iii)    Determine the asymmetric relationship between stock market price and bitcoin price during Covid-19

**Crude oil** - Crude oil is a liquified form of fossil fuel, extracted from drilling and representing a crucial and strategic economic resource for the economy. Brent and West Texas Intermediate are amongst the predominant benchmark for crude oil price. Moreover, crude oil constitutes a fundamental input for various goods and services and crude oil prices play a huge role in affecting the prices of other commodities for instance, movements in oil prices can impact on a firm's cashflows thus affecting financial market stability or they can prompt inflationary pressures in the country as well.

**Gold** - Representing a major store of value, gold is predominantly utilised for investing and hedging purposes. Gold is often considered to embody a safe haven in financial and energy markets and during inflation growths where the use of gold is intrinsically sought for hedging inflation because of not much significant change is advocates in its supply on a year to year basis. Gold prices have been immensely driven by supply, demand and the behaviour of investors. Moreover, since the price of gold spiral during deteriorating economic conditions, investors utilise it as an effective tool for portfolio diversification.

**Stock market** - It indeed represents a combination of markets and exchanges where public listed firms often undertake activities such as the purchase, sale and issuing of shares on a regular basis. These activities are either carried out through formal way of exchange or through over the counter marketplace, operating under a definite series of regulations. There are several stock exchanges such as the New York Stock Exchange, Nasdaq, Kuala Lumpur Stock Exchange, London Stock Exchange among others. A stock market index is indeed a measure of the stock market enabling investors to make a comparison between past price and current price thus analysing market performance.

**Bitcoin** - Bitcoin has been defined as a purely peer to peer version of electronic cash enabling online payments to be sent directly from one party to another without the need of going through a financial institution.

## 2. Literature Review

Here, the essence of this study shifts towards contributing to existing literature by exploring the potential drivers of Bitcoin prices and thus analyzing the impact global economic factors notably gold price, oil price and stock markets, has on the cryptocurrency market. Therefore, with respect to this, it is essential to delve into past studies and showcase how our research complements the findings of previous studies.

Insights from scholarly literature have majorly captivated our attention to the relationship entangled between gold price and bitcoin price. Against this backdrop, Yechen Zhu et al (2017) attempted to study how economic factors such Gold Price (GP) among other variables are likely to exert an influence on the cryptocurrency Bitcoin Price. They first extracted monthly data from 2011 to 2016, and used the ARDL (Autoregressive Distributed Lag) bound testing methodolgy to assess the relationship among the variables under study in the long term, and they further constructed a VEC (Vector Error Correction) model to analyse the causal relations displayed between the variables. The empirical results unveiled that while all the other variables in the study displayed a long term negative influence on Bitcoin Price, Gold Price had the least influence on Bitcoin Price. While Bitcoin price tends to showcase a similar behaviour to gold price in the financial market to a certain extent, the study underpins that gold had no influence on Bitcoin price in the long run. The findings of the study further reinforced that gold price has been on the verge of decline since 2013. Moreover, with a cut off of USD 10 billion in bond purchases, the US dollar, in line with the US Stock Market, was significantly rising, forcing the constant weakening international gold prices, thus a fall in bitcoin price was exacerbated by a fall in gold price. According to the findings of Yechen Zhu et al (2017), despite Bitcoin was being advocated as a speculative asset, it was far beyond being treated as a proper credit currency. Therefore, they come to the conclusion that Bitcoin neither showcased signs of stability in the long run nor was it being considered as a safe haven and this might be due to the assymetric effect.

Dyhrberg (2015) conducted a study to determine the financial asset capabilities of Bitcoin for a period of 5 years, from 2010 to 2015, by employing the GARCH (Generalized Autoregressive Conditionally Heteroscedastic) model. The study placed predominant emphasis on investigating whether bitcoin could be treated as a hedge or  a safe haven against price drivers. The findings of the study underpinned that Bitcoin holds several of the hedging characteristics of gold, and can act as a medium of exchange thereby hedging against stocks in the Financial Times Stock Exchange (FTSE) and in USD. The asymmetric GARCH methodology utilised in her study further connotes that bitcoin can be deemed as a useful tool for risk-averse investors to curtail the unfavourable outcomes of potential risks in portfolios and financial markets. Therefore, Bitcoin hugely aid market analysts to hedge market specific risks. Dyhrberg (2015) concludes that Bitcoin can be locate somewhere between a commodity, gold and a currency,the US dollar.

The findings of   Erdas and Calgar (2018), which analysed the asymmetric causal relationship between bitcoin and gold among other variables from 2013 to 2018 via the Hatemi-J (2012) test, document that no mutual causal relationship was established between Bitcoin price and gold price as an investment tool. The observation made unveiled that gold price shocks had no effect on bitcoin investors.   Moreover, since the dynamics of Bitcoin has been an increasingly controversial discussion due to its extreme volatility and investor's caution against it, gold is projected to be among the most commonly sought methods and currency of choice among investors throughout years. While gold embodies a commodity, bitcoin is inferred to be a more elusive tool. Therefore,

an inverse relationship between gold as a secured investment and bitcoin is expected, but no such relationship is observed here. Indeed, based on the empirical results, we can infer that gold and bitcoin has no relationship, but no relationship does not necessarily imply there is no asymmetric relationship.

In another study conducted by Gkillas and Longin (2018) to explore the possible benefits of Bitcoin in extremely volatile market situations, the multivariate extreme value theory was applied. The research strategy of the study was then dissected into four steps. Firstly, being oriented towards equity markets, the correlation of extreme returns explicitly soared in periods of stock market crashes and dropped during market booms. The second step essentially drifts towards integrating each equity market with bitcoin, and the results proclaimed that the correlation of extreme returns experienced a sharp decline during advent of both market booms or crashes, highlighting Bitcoin's pivotal role in asset management as the fusion of bitcoin alongside gold substantially enhances the risk-return ratios of equity positions . Comparable results were derived for Gold, reinforcing its status as a safe haven during financial turbulences. Withal, a low extreme correlation was detected between gold and bitcoin, implying that both assets can complement each other during periods of financial distress and there might be evidences of asymmetric relationship between the variables as well. They further conclude that whilst bitcoin can be acclaimed as the new digital gold, gold still holds its predominance in portfolio risk management.

To contribute to the discussion on Bitcoin's key determinants, we bring forth the work of Vassiliadis et al. (2017) which emphasises on utilising cross correlation analysis for the period 2013 to 2015, thereby delineating the relationship between the price of bitcoin and a set of other economic related factors such as crude oil price, among other variables. The obtained results unveiled a strong correlation between bitcoin and the other variables deployed in the study. There has been a strong relationship between lagged bitcoin price and crude oil price, with it remaining above 80 % of its peak value for lags up to around 3 years.

Another strand of literature by Huynh et al. (2020) empirically examines the usefulness of cryptocurrencies in the realm of financial modelling and risk management by analyzing the information spillovers between an asset which is crude oil and cryptocurrencies such as Bitcoin. Moving forward, they probe onto the causal relationship between movements in crude oil price and the cryptocurrencies' value covering the period April 2013 to April 2019. Furthermore, an entropy method is applied to capture the flow of spillovers within the information framework. The obtained results reveal that shocks to the US crude oil index as well as the European crude oil index have a strong correlation with the fluctuation in most of the cryptocurrencies.

Van Wijk (2013) sheds lights on the importance of macroeconomic and global financial developments on Bitcoin price. The financial developments were indeed captured by oil price, stock market indices among other variables which served as important financial indicators of the world economies. Those leading indicators which actually give an insight about financial performance and economic growth, determine bitcoin's value. Using the Error Correction Model (ECM), the author seeks to investigate the impact those financial indicators carved on bitcoin price. The obtained results revealed that most of the variables including oil price, Dow Jones stock index held a significant influence on Bitcoin's price in the long run. The results further professed that whilst the Dow-Jones stock index had a positive effect on Bitcoin's value in the long run, the other variable namely oil price was negatively correlated with the bitcoin's price. It has been further noted that the value of the Dow Jones Index posits a significant impact on    Bitcoin's price in the short run.

The relationship between bitcoin and stock markets has essentially carved a pivotal importance in the realm of the financial world since it consequentially adds up to the existing body of the traditional financial and fintech knowledge alike and since then, several researches have been deeply ingrained into investigating the relationship among the two. Speculations led to the reinforcement of the claim that bitcoin can be perceived as an important tool in boosting stock market's predictability.

Bartos'(2015) work is embedded on outlining the impact of public announcements on bitcoin's price and whether this price mirrors the efficient market hypothesis (EMH) of Fama. The Error Correction Model (ECM) was employed to test data on a daily basis for a period of 17 months, spanning from March 2013 to August 2014. In this study to assess the effect of all the variables under study on bitcoin's price, the researcher first conducts the regression analysis with all the independent variables such as the stock market indices Dow Jones and S&P 500, Google stocks, Facebook stocks, bitcoin mined among several other variables. The empirical analysis confirmed that bitcoin's price react to public announcements and it indeed mirrors the efficient market hypothesis. The study also advocated a higher bitcoin's price during instances of positive events, while the opposite was sought in times of negative events or even when no events occurred. It was also revealed that events played a fundamental role in bitcoin's prices and in conjunction with the Efficient market hypothesis, bitcoin prices essentially reflect all known information and since this information is largely accessible by all speculators in the market, nobody would engage into using this particular information to outperform the market.

Besides, Dirican and Canoz (2017) attempt to determine whether Bitcoin exerts a likely influence on investors' decisions. The ARDL bound test was principally applied in their study to determine the existence of a co-integretion relationship between bitcoin prices and the selected stock market indices. The presence of a cointegationary relationship was observed between the prices of Bitcoin and the key Chinese and U.S stock indices, implying that bitcoin prices might affect investors within those leading stock markets in term of their investment decision processes in the long run. Howbeit, Bitcoin did not showcase any relationship with the other stock indices in the study such as the BIST100, FTSE100 and NIKKEI225 stock indices. Notably the author of this study seeks to conduct further research to investigate the correlation among corresponding Istanbul Stock Exchange sub-indices.

The ongoing Covid-19 crisis and corresponding financial chaos has sparked an intense debate on the impacts of covid-19 on financial markets, fueling a plethora of research papers conducted in this realm. This study essentially builds upon the current level of knowledge in the existing literature on the implications of   global economic factors on the cryptocurrency market during the covid-19 pandemic.

Our contention has been raised to the fact that during this apparently inexorable flux in economic times, Bitcoin showcases a high correlation with gold and stock prices. While governments of major territories were struggling to revive their economies, whilst constantly containing the propagation of the virus, hard commodities such as gold, have captivated the attention of several academic practitioners as popular investments owing to its storing value. On similar veins, over the past few months, Bitcoin equally surfaced as an alternative store of value to gold and its price took a bullish run, rebounding from the initial crash at the onset of the covid-19 outbreak. It has also been found that gold price and bitcoin price have become intrinsically correlated over the past few months, with both displaying similar behavior and serving similar purpose as store of value.

Cheema et al (2020) tested the efficiency of safe haven assets, specifically precious stones such as gold and cryptocurrency such as bitcoin during the unforeseen periods of the 2008 global financial crisis and the covid-19 pandemic by estimating a GJR-GARCH regression analysis. Owing to a growing investors' preference in large stock markets, the ten biggest economies such as India, China, Canada, France, the United States, the United Kingdom, Brazil, Japan and Germany have been specifically chosen. The findings of this study demonstrated gold as a weak safe haven across all the ten stock markets during the financial crisis, whilst it no longer served as a safe haven during the covid-19 crisis due to its price moving in correlation with stock markets price and also due to investors no longer trusting gold as a stable asset. Moreover, bitcoin epitomises a highly speculative investment during the covid-19 crisis.

Another study by Lahmiri & Bekiros (2020) uses the generalized autoregressive conditional heteroskedasticity model to analyse the effects of the corona virus on the volatility independency of global markets. It has been found that the aftermath of the covid-19 crisis has immensely affected the randomness in the volatilities of both the standard & poor 500 market and precious metals such as gold and silver. In addition to, the findings displayed the advent of three volatility clusters ( precious metals, energy and bitcoin) whilst the standard & poor 500 epitomised a unique cluster. The findings of the study also evince the outburst of covid-19 has fuelled a lesser interconnectedness between the volatility in precious metals and the volatility of the bitcoin market.

Section 2 is indeed engrossed in scrutinizing a wide array of extant literature over the past years to showcase the relationship between macroeconomic factors and bitcoin price, typically pivoting on how these factors can significantly affect bitcoin's price especially during the covid-19 period. Notable scholars, academicians, researchers as well as financial economists and analysts have drawn significant interest on this subject matter since covid-19 is a new phenomenon and they wish to get better insights. From the literature analyzed, the researcher confirms that majority of studies report a relationship between the macroeconomic indicators' price and bitcoin price during the covid-19 period, whilst others showcased no relationship. The purpose of this study is to fill in the gaps by embracing various research methods which will be thoroughly discussed in the subsequent chapter.

## 3. Data and Methodology

The heart of this study lies within the positivism ontology and the deductive approach whereby the motive is utilising existing data for testing a theory and hypotheses. In addition to, objective-wise, this research work delves into an explanatory study where it hinges on establishing the causal relationship between the dependent and the independent variables (Saunders, 2012). Furthermore, this research work is quantitative in nature since collecting and analysing data will be carried out numerically and statistically and the researcher delves into examining the causal relationship between the variables in the study as well.

The study will be embedded on the use of secondary data as data for each of the variables under study will be collected by the researcher itself. Since the study implies the prices of indicators and cryptocurrency, the researcher will be collecting data from online sources – most specifically from Yahoo Finance for the dependent variable – bitcoin price as well as the independent variables – oil price, gold price and stock market price on a monthly basis from the time period 2014 to 2020. Data is collected from this source since it represents a feasible option for the researcher and not only is it time and cost-effective, but easily extracts historical data which could

not have been possibly collected from primary methods. Data for each variable under study is collected on a monthly basis for the 6 year-period from Yahoo Finance and the same is keyed in excel. Afterwards, the dataset extracted is cross checked with data from sources such as Goldhub-World Gold Council, S&P global or from oil price USA's website thus ascertaining the authenticity of the collected data. The usage of secondary data undeniably constitutes a vital organ in the heart of organizational researches. Publicly available data is subject to inspection and scrutiny and indeed sets the premise of the research (Walliman, 2011).

Lastly, the data analysis methods will be majorly descriptive statistics, unit root tests as well as the non-linear autoregressive distributed lags (NARDL).

Applying descriptive statistics in this study inherently enables the researcher in assessing its dependent and independent variables in a systematic approach.

The researcher will further embark on using a non-linear ARDL model (NARDL) as advanced by Shin & Nimmo (2011), which represents an assymetric extension of the ARDL model to capture the essence of long term as well as short term assymetries in the variables under study. To implement the NARDL modelling approach, we proceed with the following steps. The first step will be to embrace the ARDL method which applies irrespectively of whether the variables are I(0) or I(1), it is still crucial to carry out unit root tests so that I(2) variables are not present. Therefore, to effectively carry out the unit root test, the commonly acknowledged Augmented Dickey Fuller (ADF), Philip Perron (PP) and *Kwiatkowski–Phillips–Schmidt–Shin* (*KPSS*) unit root tests are applied to establish the variables' order of integration.

The researcher have employed E-views in this research work to run the tests mentioned above. (Richard Startz, 2015) reported that E-views represents a perfect package to effectively manage data, carry out econometrics and statistical analyses, generate forecasts, model simulations or high-quality graphs rapidly. Moreover, E-views is much easy to use and is a worldwide statistical package immensely embraced by a notable scholar, academicians, researchers, economists, financial and policy analysts on a global scale for the purpose of executing several tasks from analyzing financial data to carrying out research (Richard Startz, 2015). In essence, the fundamentals of e-views are more prevalent in this study since it is designed to analyse time series data.

## 4. Results and Discussion

Here, the essence conducting several tests to test the hypotheses of the study and to unfold the asymmetric relationship between the dependent variable and the independent variables. The researcher breaks the data set into three different samples – namely the full sample which seeks to analyze the overall data on a monthly basis i.e., from Oct 2014 to Mar 2021, sub-sample 1 which analyses the data before the covid-19 pandemic i.e., from Oct 2014 to Oct 2019 and sub-sample 2 which analyses the data set during the covid-19 pandemic i.e., from Nov 2019 to Mar 2021.

All throughout this chapter, descriptive statistics testing, unit root testing and NARDL testing have been clearly orchestrated using the statistical package EViews version 11. The unit root tests namely the ADF and the PP tests were used to determine whether the dataset is stationary or not and whether there is the presence of unit roots in the model or not. However, since there was the presence of I(2) for the variable BTC, there was a need for

the researcher to use a third testing to determine the order of integration. Therefore the KPSS test has been employed to ascertain the order of integration.

In line with the above, this study dwells in unravelling the presence of an asymmetric relationship between gold price, crude oil price, stock index price and bitcoin price during the covid-19 period. Therefore, a comparison of three particular time frames is made (during the overall model, before covid-19 crises and during covid-19 crises) to better have a glimpse about whether global economic factors affect cryptocurrency. The findings derived from the Non-linear autoregressive distributed lags (NARDL model) are tabulated in Table 1 in next page.

During the overall sampling period which is from March 2014 to March 2021, the negative effects of gold price had a negative and a significant asymmetric relationship towards bitcoin price in the long run and the positive effects of gold price had a positive, but no significant asymmetric relationship towards bitcoin price in the long run. a negative and statistically significant asymmetric relationship has been reported between the positive effects of crude oil price and bitcoin price in the long run. On the other hand, the negative effects of crude oil price, during the overall model, showcased a positive and statistically significant asymmetric relationship with bitcoin price in the long run. Last but not least, there has been evidence of a positive and significant asymmetric relationship between the positive effects of stock index price and bitcoin price in the long run and the negative effects of stock index price has a negative but an insignificant asymmetric relationship towards bitcoin price in the long run.

Table 1: summary of NARDL findings

| Summary of NARDL Findings | | | | | |
|---|---|---|---|---|---|
| Full Sample (overall model) | | Sub-sample 1(before covid-19) | | Sub-sample 2 (during covid-19) | |
| Oct 2014 – Mar 2021 | | Oct 2014 – Oct 2019 | | Nov 2019 – Mar 2021 | |
| Variable | Tau-statistic | Variable | Tau-statistic | Variable | Tau-statistic |
| COP_POS | -137.92*** | COP_POS | -2.47 | COP_POS | -37.41** |
| COP_NEG | 120.50* | COP_NEG | -30.71 | COP_POS (-1) | -69.78*** |
| GP_POS | 8.13 | GP_POS | 1.73 | COP_NEG | -1083.17*** |
| GP_POS (-1) | -12.48* | GP_NEG | 2.50 | COP_NEG (-1) | -688.95*** |
| GP_NEG | -13.75*** | SIP_POS | 2.48 | GP_POS | 20.14*** |
| SIP_POS | 4.87* | SIP_NEG | 4.63 | GP_POS (-1) | 17.22*** |
| SIP_NEG | -0.25 | | | GP_NEG | -83.50*** |
| SIP_NEG (-1) | -6.89* | | | GP_NEG (-1) | -94.90*** |
| | | | | SIP_POS | -8.89*** |
| | | | | SIP_POS (-1) | -5.57*** |
| | | | | SIP_NEG | 64.82*** |
| | | | | SIP_NEG (-1) | 41.26*** |

*Indicates significant at 10%*

*** Indicates significant at 5%**

**** Indicates significant at 1%***

The second model, which is before the outbreak of the covid-19 pandemic reveals that both the positive and negative effects of gold price had a positive, but no significant asymmetric relationship towards bitcoin price in the long run, there is a negative but no significant asymmetric relationship between crude oil price and bitcoin price in the long run and that both the positive and negative effects of stock index price have a positive but an insignificant asymmetric relationship towards bitcoin price in the long run.

The findings from the third model that is during the outburst of the covid-19 pandemic (from Nov 2019 to Mar 2021), picture a positive and statistically significant asymmetric relationship between the positive effects of gold price and bitcoin price both in the long run and the short run. Likewise, the positive and negative effects of crude oil price, in both the long run and short run, depicted a negative and statistically significant asymmetric effect with bitcoin price. On the other hand, the negative effects of stock index price have a positively asymmetric significance with bitcoin price both in the long run and in the short run, during the covid-19 period. It has also been unveiled that the positive effects of stock index price both in the long run and in the short run present a negative and statistically significant asymmetric relationship with bitcoin price during the stated period.

## 5. Conclusion

The cascading effects of the covid-19 pandemic triggered asymmetric effects between traditional commodity markets and virtual cryptocurrency markets, spurring an unprecedented shut down of the economy and economic turbulence globally. Thus, the relevant authorities as well as central banks should work closely together to enforce effective economic policies to mitigate the dreadful effects of the covid-19 pandemic without instilling uncertainty. Likewise, governments should intervene to reduce fear and panic in investors, whilst boosting their confidence for market recovery. Moreover, another implication would be the strengthening of international cooperation among regulators on a global scale, and implementing a long term risk governance system thus curbing international financial risk contagion.

It is also noted that there is a positive and statistically significant asymmetric relationship between the positive effects of gold price and bitcoin price both in the long run and the short run. Likewise, the positive and negative effects of crude oil price, in both the long run and short run, depicted a negative and statistically significant asymmetric effect with bitcoin price. On the other hand, the negative effects of stock index price have a positively asymmetric significance with bitcoin price both in the long run and in the short run, during the covid-19 period. It has also been unveiled that the positive effects of stock index price both in the long run and in the short run present a negative and statistically significant asymmetric relationship with bitcoin price during the stated period.

There are some limitations which have been encountered while conducting this study. This study has placed predominant importance on bitcoin only, deemed as the biggest and most popular cryptocurrency, while ignoring other cryptocurrencies. Furthermore, the objective picture of reality is distorted, with the sources the researcher has used throughout this study has massively mirror his subjective interpretations about the situation and once the covid-19 pandemic settles down, the results might largely differ. Similarly, since covid-19 is a relatively new phenomenon and research is still being conducted on it, there is limited studies conducted in this realm using advanced methodology and in future, with a longer time frame used, the findings might largely contradict the findings of this study.

The cardinal point of conducting this research was to grasp an insight about the prevalence of an asymmetric relationship between global economic factors and cryptocurrency both during normal times and during the covid-19 period. In line with the limitations encountered in this study, the researcher recommends future academics and scholars to replicate this same study using the same variables, but with a larger sample size since covid-19 is a new phenomenon and in this way, there will be higher accuracy in the findings established. Moreover, future researchers are requested to replicate this study once the covid-19 situation settles down and there is a huge possibility that the findings will largely differ from that of the current study. Furthermore, using a larger sample size by elongating the time frame and incorporating high frequency data, will increase the accuracy as well as the reliability of the data and will assist researchers in governing the risk of getting a false negative return. Alternatively, notable scholars could replicate this study using other advanced methodologies instead of employing NARDL to determine whether the findings actually differ from this actual research work.

Additionally, future researchers are recommended to delve into a wide array of relevant journals in this realm to get ample empirical evidences to support their findings. Besides, this study analysed global economic factors affecting only bitcoin price, future research works can be extrapolated to include other cryptocurrencies such as Litecoin, Ethereum,  Ripple ect. In addition to the above, scholars conducting their research in this specific area are advised to incorporate other global economic factors, rather than just gold, crude oil and stock index. This could undeniably improve the accuracy of future findings. Last but not least, since this study analysed only the factors affecting bitcoin price, future researchers are recommended to investigate about the mechanism of these global economic factors on the price dynamics of bitcoin.

To conclude, the NARDL findings reveal that global economic factors significantly affected the cryptocurrency bitcoin during the covid-19 times, whilst before the strike of the pandemic, global economic factors were not significant to cryptocurrency. Howbeit, the overall model showcased mixed results since the significance of the asymmetric effect for the overall model is due to the significance of the asymmetric effect during covid-19.

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