Full length article

The Influence of Gold, Black Gold, and Digital Gold on Stock Market Portfolios

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Article Info	ABSTRACT
	This research paper aims to study the influence of Bitcoin (BTC), Crude Palm Oil (CPO), Crude Oil (WTI), the Dollar Rate (USD), and Gold (XAU), on Stock Market Portfolios (KLSE). Time series data for this investigation was obtained from Yahoo Finance and Investing.com. Furthermore, the Unit Root Test conducted found that the variables are stationary after 1st differencing. Moreover, since there was no Cointegration discovered between the variables, VAR was performed to determine the long-run causality effect, while the Wald Test was conducted to examine the short-run causality effect. The findings revealed that none of the variables contained a long-run relationship, whereas Bitcoin (BTC), Crude Palm Oil (CPO), and Gold (XAU) contained a short-run relationship with the independent variable (KLSE).

1. Introduction

Conventional approaches to investments such as fixed deposits and savings account offer investors low returns but with little to no risk. Although this form of investment is beneficial, the returns may not be as fruitful. As such, investors commonly invest in financial markets. Nevertheless, financial markets are prone to high volatility. This is especially true during times of economic distress or uncertainty. Hence, a portfolio of stocks needs to be done to minimise risk, and maximise returns.

The construction of stock market portfolios is extremely pivotal in terms of risk management and gaining long-term returns. The creation of stock portfolios is done by choosing and allocating various assets that align with an investor's risk tolerance and goals. Various techniques, theories, financial ratios, historical data and strategies can be applied by investors to determine and form their own portfolio. A good portfolio of stocks is balanced out by different industries and asset classes. This way, the impact of a single stock can be reduced and spread out, to prevent the performance of other stocks from collapsing. This is based on the fact that different stocks tend to behave and react differently to economic conditions.

The stock market plays a prominent role in the world of finance. Investors and traders commonly invest in the stock market to build wealth, increase passive income through personal financing and to achieve their financial goals (Eureka, 2023). Nevertheless, investing in stocks is not always a stable form of investment. This is because the stock market is susceptible to inflation. Interest rates and the purchasing power of customers can affect the value of stocks on the market. Similarly, the COVID-19 pandemic caused significant disruptions in global supply chains. This caused the earnings of many companies to reduce, which will in return affect stock prices. Consequently, investors would have to adopt a portfolio of stocks to minimise the risk associated with stock investments. One way to enhance a portfolio of stocks, is to include commodities.

Foremost, Bitcoin (BTC) is a modern commodity that should be included in a portfolio of stocks. Although the cryptocurrency lacks a sense of intrinsic value and is merely considered a speculative asset, including them into stock market portfolios can increase the diversification process. Past researchers (Kim, Kim & Kim, 2020; Selmi et al, 2018) has shown that Bitcoin (BTC) does contain significant influence on stock market portfolios and contains hedging properties. Nevertheless, there is still research (Elie et al, 2020) who have found no form of relationship between Bitcoin (BTC) and a portfolio of stocks. As such, inconclusive result has been identified in past research. Hence, the impact of Bitcoin's (BTC) inclusion on portfolio diversification and risk should be properly evaluated.

Secondly, Crude Palm Oil (CPO) contains special characteristics since it is influenced by factors that differ from traditional assets such as stocks and bonds. Its prices are affected by the supply and demand in the market, substitution and the environment (Zainal, 2013). Furthermore, past research has shown there is a long-run relationship between Crude Palm Oil (CPO) and stock market portfolios (Jamil et al, 2022). Nevertheless, other research has revealed that the commodity only contains low co-movement on a portfolio of stocks (Samadi et al, 2021). As such, inconclusive result has been identified in past research. Consequently, further research should be conducted to determine how the inclusion of Crude Palm Oil (CPO) behaves in a portfolio of stocks and whether it influences its overall volatility.

Additionally, the Dollar Rate (USD) can influence the performance of stocks and its portfolios in various ways. Changes in the dollar rate can affect the prices of commodities in general and on stock markets. Similarly, if the dollar contains a lower correlation with its domestic market, by holding onto international assets in another currency, portfolio risk can be reduced. In fact, investors commonly flock to the dollar rate as a risk-off strategy. Past research (Li & Li, 2022), has shown that the dollar diversified portfolio risk before the pandemic and not during or after it. Nevertheless, there is also research demonstrating a negative correlation between the dollar rate (USD) and the return of stock market portfolios (He et al, 2021). As such, the effect of the dollar rate and its fluctuations on the return of portfolios should be studied.

Penultimately, Crude Oil (WTI) plays a prominent role in the world's economy. In fact, WTI stands for West Texas Intermediate, and it is one of the benchmarks for oil prices. Furthermore, the inclusion of Crude Oil (WTI) into stock market portfolios can assist in protecting the purchasing power of stocks since the commodity generally contains a positive relationship with inflation (Fareed et al, 2022). Nevertheless, during the COVID-19 pandemic, the stock market portfolios and the commodity contained a negative relationship. As such, inconclusive result has been identified in past research. Hence, the role of Crude Oil (WTI) on stock portfolios risks and returns should be properly studied.Lastly, traditional Gold (XAU) assets have always been considered

a safe haven to invest in, especially during times of economic distress and market volatility. Similarly, Gold (XAU) contains stored and intrinsic value. This makes it an extremely beneficial asset in times of inflation. Researchers (Feng et al, 2022; Le and Chang, 2012) have discovered a significant negative correlation between stock market performances and Gold (XAU). Nevertheless, the commodity lacked liquidity and is often foregone (Dyhrberg, 2015). As such, its effectiveness and role in terms of diversifying a stock market portfolio still faces some criticism in specific market conditions. As such, inconclusive result has been identified in past research. Consequently, the impact of Gold (XAU) on stock market portfolio stability should be properly evaluated. Consequently, taking the above into account, this report will highlight the influence and causality effect of Gold (XAU), Bitcoin (BTC), Palm Oil (CPO), Crude Oil (WTI) and the Dollar Rate (USD) on stock market portfolios.

2. Literature Review

STOCK MARKET PORTFOLIO

The movements of stock market cannot be easily predicted. Despite applying various forecasting techniques such as fundamental and technical analysis, the forecasted market prices cannot be used to predict its movements due to its high volatility (Hong, Bian, & Lee, 2021). Hence, investors would have to create a stock market portfolio to mitigate the volatility of the market. Stock market portfolios are a collection of invested assets held by investors in order to achieve the highest gains for the lowest risk. Furthermore, a portfolio is designed to balance out both risk and return based on an investor's risk tolerance, objectives and their personal timeline for the investment. This way, the impact of a low performing stock would not drastically affect the individual and overall performance of the stock portfolio.

What is more, a portfolio of stocks contains both systematic and unsystematic risk. This can be reduced through diversification. A diversified portfolio consists of different classes of assets to reduce the total risk of the stock portfolio. In other words, total risk will approach market risk and become systematic risk, but only if the total stocks in a portfolio can approach the total stocks present in the market (Alexeev & Tapon, 2012). In the past, a portfolio that consists of 8 to 10 stocks was more than sufficient to reduce portfolio risk (Evans & Archer, 1968). This was supported and further built upon by Diyarbakırlıoğlu and Satman (2013), who illustrated that more than 100 companies would be needed to create the most diversified portfolio. Nevertheless, these claims became redundant by authors Zaimovic, Omanovic & Alimra Arnaut-Berilo's (2021), who stated that the exact number of stocks cannot be picked out in a diversified portfolio, for any investor or in any market. This is because there are too many ranges of literature present, with varying opinions.

The influence of commodities in stock market portfolios has been evaluated extensively by researchers. For example, authors Arfaoui and Rejeb (2016) studied the movement of stock prices using oil, gold, and the dollar. A simultaneous equation system was used to study the data between 1995 and 2015. Both authors discovered that there is an interaction between all these commodities and the performance of stock markets.

2.1. BITCOIN (BTC)
Digital currencies, such as Bitcoin contain no central authority and lack intrinsic value. The main force driving its demand, prices, and value, is the fact that it is limited in supply and is extremely expensive to mine. There are several studies illustrating the relationship between Bitcoin and its role in stock market portfolios.Foremost,

authors Kim, Kim & Kim (2020) conducted a study on the relationship of the prices of cryptocurrencies on the US stock markets. The investigation was conducted in Korea, with the data being utilized from a time period of January 2018 to September 2020. Several models were applied – a Gaussian copula-based GARCH-DCC (GC-DCC), Gaussian copula-based Nonlinear Asymmetric-DCC (GCNA-DCC) and Gaussian Copula Marginal Regression (GCMR) to tabulate the data. The results from the investigation revealed that a portfolio consisting of Bitcoin in the US stock market can significantly improve long-run returns and volatility.

What is more, Selmi et al (2018) investigated whether Bitcoin is best suited as a diversifier in times of high inflation. A quantile-on-quantile regression approach was taken to comprehend the data between September 2011 to August 2017. Moreover, this investigation took place in the United States. The findings of this investigation   revealed that Bitcoin would play a good role in terms of hedging, diversifying and acting as a safe haven. On the other hand, Elie et al (2020) conducted her research using a Wavelet Coherency approach on the idea of using Bitcoin as a safe haven for stocks. The researcher used stock market indices from both the USA and China, for a time period of   July 2010 to February 2018. The findings revealed that there is an uncorrelated link between the returns of stock markets and cryptocurrencies. The researcher stipulated that the high volatility of Bitcoin prices was what caused the time varying result.

CRUDE PALM OIL (CPO)

Crude Palm Oil is a vegetable oil that is commonly used in cosmetics, biofuels and foods. Hence, it has a substantial impact on the economy. Nevertheless, its influence in stock market portfolios is easily susceptible by industrial demand, weather conditions, agriculture policies and geopolitical developments. Additionally, several nations such as Malaysia and Indonesia, depend on the performance of this commodity for their economy. As such, any impact on their part can cause disruptions in the supply chain of CPOs at large. There are several studies illustrating the relationship between CPO and its role in stock market portfolios.

Firstly, the authors Meng, Nie, Mo & Jiang (2020) carried out a research investigating the risk of spillover effects associate in the global crude oil market. The data from this investigation was carried out in China from a time period of 2005 to 2017. Additionally, two models were applied in this investigation – an ARMA-GJR-GARCH and copula models. The results from this investigation revealed that there is a larger downside of spillover effect on crude oil prices compared to a downside spillover. As such, the researchers recommended investors to be aware of the asymmetrical risk of the spillover effects in the short and long run.

More so, Jamil, Kogid, Lim & Lily (2022) conducted their investigation in Malaysia regarding the impact of crude oil futures on the index of palm oil. The utilised the time period of January 2010 to June 2020 with the methodology of Autoregressive Distributed Lag (ARDL) bounds test approach and causality test being applied. The findings of this study revealed that a long-run correlation was established between the Asian palm index and crude oil futures. Recommendations was given by the researcher to investors to properly monitor crude oil futures carefully.In addition, authors Samadi, Owjumehr & Halafi (2021) investigated the COVID-19 pandemic's cross-impact on financial markets in Iran. The data was taken from September 2014 to June 2020, with a Wavelet Coherence Analysis and Segmented Regression being applied. Results from the investigation showed that oil prices had a lower co-movement on stock markets. This suggests that the incorporation of palm oil into stock market portfolios is best suited for risk averse investors.

DOLLAR RATE (USD)

The exchange rate of the dollar can play a prominent role in stock market portfolios. In terms of exports and imports, a stronger rate can cause goods to become more expensive for foreign buyers which can negatively affect the country's economy. Furthermore, the stronger the dollar, the lesser the prices of commodities. Additionally, in terms of portfolio diversification, a weaker dollar can strengthen foreign investments and enhance the returns of portfolios. There are several studies illustrating the relationship between the dollar rate and its role in stock market portfolios.First and foremost, authors Li and Li (2022) investigated the linkages between the dollar and stock markets. A GARCH-EVT-Copular approach was applied to the data collected from the time period before January 1, 2020 and after January 2, 2020. This was done to encapsulate the period before and after COVID-19. The results from this investigation revealed that the dollar diversified the risk of stock portfolios before the pandemic. The researchers recommended that the decision to include the dollar in stock market portfolios should be evaluated properly.

More so, authors He, Gokmenoglu, Kirikkaleli & Rizvi (2021) carried out an investigation regarding the foreign exchange rate co-movements and the returns of stock markets. The authors conducted this study in Turkey, with data being obtained from a time period of April 2000 to March 2019. Furthermore, a Wavelet Coherence approach was applied to investigate the casual relationship. It was discovered that there is a negative correlation between the USD/TRY exchange and the Turkish stock market. Nevertheless, the researchers recommended that policymakers should properly comprehend the relationship between both these markets in order to reciprocate appropriate responses.What is more, Demir (2019) studied the impacts of the exchange rate on the Turkish Stock Market index. The author utilized an ARDL Bounds test to evaluate the data from Quarter 1 of 2003 to Quarter 4 of 2017. Based on the results, the author discovered that the dollar has a negative effect on the stock market index. Hence, based on this finding, the author recommended that the country to increase foreign direct investments to raise the performances of the stock market.

CRUDE OIL (WTI)

Crude oil is an important economic resource. It is primarily used in the energy industry. As such, refining companies, oilfield services and production companies are sensitive towards the fluctuations of the prices of crude oil. Similarly, the transportation industry is also heavily influenced by fluctuations in crude oil prices, since airlines and ships require them for fuel. Furthermore, in times of crisis, crude oil prices might perform better than stocks and bonds. There are several studies illustrating the relationship between Crude Oil (WTI) and its role in stock market portfolios.To start off, authors Dai and Zhu (2022) carried out an investigation on the spill-over effects of WTI crude oil and the Chinese stock market. The data from the study was analysed using a DCC-GARCH t-copula model. Their empirical results revealed that WTI is indeed both a cheap and suitable hedging tool during times of major crisis. Moreover, the authors recommended that by including a small amount of WTI crude oil futures into their portfolio of stocks, high hedging effectiveness can be achieved.

In addition, authors Dias et al (2021) conducted their research on the Eastern European stock markets regarding WTI oil shocks. The data was obtained from a time period of September 2019 to January 2021. Furthermore, VAR Grander Causality/ Block Exogeneity Wald Tests model was used to evaluate the data. Based on the results, WTI was found to be causing shocks in the sock markets, especially during the COVID-19 pandemic. As such, the authors advised to remain away from stock market investments, unless their portfolios are safe havens.What

is more, Siddiqui et al (2021), investigated the return on stock markets and the hedging of portfolios inclusive of WTI crude oil. The two models that were utilised in this investigation are an ARMA-BEKKGARCH (1,1) and VARMA-DCC-GARCH (1,1). Furthermore, data was obtained from the US, China, India and Japan for a time period of 2014 to 2018. Based on the findings of the author, WTI crude oil contains a significant unidirectional return towards the spillover on stock market returns. Consequently, investors are advised by the authors to pay closer attention to maintain a minimum amount of WTI in their portfolios, to mitigate the risk.

GOLD (XAU)
Foremost, in the past, Gold was commonly utilised by individuals as the main medium for exchanges. However, due to its liquidity problems, this was abolished. Despite this, Gold is still being used as the economy's standard denomination, due to its intrinsic value. Hence, in times of crisis, gold remains steady as it is not very susceptible to systematic risk. There are several studies illustrating the relationship between Gold and its role in stock market portfolios.

To begin with, authors Kayral, Jeribi & Loukil (2023) conducted an investigation to discover the optimum portfolio hedging strategy during the Covid-19 pandemic and the Russia-Ukraine War. A DVECH-GARCH model was applied . The research was conducted in Türkiye, with data being obtained from a time period of January 2016 to January 2023. The findings revealed that Gold is an effective asset in terms of hedging during times of distress. The researchers then suggested that investors would have to monitor the market and adjust their positions regularly since gold hedging is time varying. Furthermore, Zhang et al (2021) carried out an investigation in China regarding the hedging and diversifying properties of gold on stock market portfolios. The research was conducted from January 2008 to January 2019, and employed a VARR-CCC-GARCH and VAR-DCC-GARCH model. The findings revealed that gold is well suited to diversify risk in a portfolio. The researcher even suggested that more gold should be included into stock market portfolios than stocks itself.

What is more, the authors, Alqaralleh & Canepa (2022), investigated the diversification of a portfolio consisting of precious metals. The research was carried out using a Wavelet-based quantile procedure with a time horizon between January 2008 to January 2019. Moreover, the investigation utilised stock market indexed from Brazil, Russia, India, China and the United States. The results of the research revealed that precious metals such as gold, was an excellent stock portfolio diversifier during the pandemic. Nevertheless, the researchers also recommended platinum, palladium and silver as a means of diversification as well.

3. Data and Methodology

To start this research, our dataset was obtained from Yahoo Finance and Investing.com. The dependent variable is stock market portfolios in Malaysia, whereas the independent variables are, XAU, BTC, CPO, WTI and USD. The time-series data will be used as the foundation for estimate in this study, with the data being analysed using EViews 12.

MULTIPLE LINEAR REGRESSION
The purpose of the multiple linear regression is to illustrate the relationship amongst both dependent and independent variables. Hence, an equation can be created to estimate the value of dependent variable from the independent variable values (XAU, BTC, CPO, WTI and USD). This equation for this research is as follows:

Stock Market Portfolios = β0 XAU + β0 BTC+ β0 CPO + β0 WTI + β0 USD + c

The regression equation is a typical econometric method which represents the integration amongst the dependent variable and independent variables. It is commonly used to project the changes in the dependent variable by varying the independent variables, while simultaneously keeping the controlled variables constant. Moreover, the independent variable is also known as the explanatory and controlled variable, whereas the dependent variable is perceived as the measured and explained variable. In other words, the independent variable remains steady and is not influenced by external factors. On the other hand, the dependent variable is influenced by external factors. This means that, if there is a change in the independent variable, the dependent variable would be affected by it (Göksu & Ergün, 2013).

COINTEGRATION TEST
The Cointegration Test is performed to determine whether there is a long-term relationship in the VECM model. In other words, the test detects whether there are two or more non-stationary components of time series present in the dataset that inhibit them from separating from stability over time.

VECTOR ERROR CORRELATION MODEL (VECNM)
The Vector Error Correlation Model is commonly used to determine whether the cointegration of the variables contains short-run or long-run causality effects. This means that the causality impact amongst Stock Market Portfolios (KLSE) and the independent variables of the study - Gold (XAU), Bitcoin (BTC), Palm Oil (CPO), Crude Oil (WTI), and the Dollar Rate (USD) on stock market portfolios, will be evaluated for both short-run or long-run causality.

4. Results and Discussion

Descriptive Analysis

The descriptive analysis computed by EViews 12 showcases the Mean, Median, and Standard Deviation.

Table 1: Descriptive Analysis

Variable	N	Minimum	Maximum	Mean	Std.Dev
KLSE	2148	1219.72	1895.18	1634.205	124.7044
USD	2148	3.1463	4.495	4.05152	0.310632
WTI	2148	-37.63	123.7	59.07568	18.69847
XAU	2148	1045.4	2049	1438.087	267.4596
CPO	2148	1759	8163	3083.265	1159.123
BTC	2148	178.103	19497.4	4350.213	4103.482

Foremost, considering the mean values of the variables, KLSE is valued at 1634.21, BTC is valued at 4350.21, CPO is valued at 3083.27, USD is valued at 4.05, WTI is valued at 59.08 and XAU is valued at 1438.09. As such, it is shown that BTC has the highest mean value, while USD has the lowest. Secondly, for the median values, KLSE is valued at 1637.09, BTC is valued at 3603.52, CPO is valued at 2653.00, USD is valued at 4.14,

WTI is valued at 55.53 and XAU is valued at 1310.60. Consequently, BTC has the highest median value, while USD has the lowest. Additionally, the maximum (max) and minimum (min) values of the variables are as follows – KLSE's max is 1895.18, while min is 1219.72, BTC's max is 19497.4, while min is 178.10, CPO's max is 8163.00, while min is 1759.00, USD's max is 4.50, while min is 3.15, WTI's max is 123.70, while min is -37.63 and XAU's max is 2049.00, while min is 1045.40. Moreover, the standard deviation of the variables can be shown as follows – KLSE is valued at 124.70, BTC is valued at 4103.48, CPO is valued at 1159.12, USD is valued at 0.31, WTI is valued at 18.70 and XAU is valued at 268.46. Hence, it is portrayed that BTC contains the highest volatility, while USD contains the lowest volatility.

Correlation Analysis

Table 2: Correlation Analysis

	KLSE	USD	WTI	XAU	CPO	BTC
KLSE	1					
USD	-0.36318	1				
WTI	-0.2908	-0.07691	1			
XAU	-0.68779	0.371269	0.353007	1		
CPO	0.47905	0.303125	0.239367	0.784597	1	
BTC	-0.69796	0.342573	0.387109	0.617636	0.481595	1

The figure above shows that the correlation between each variable remains between
-1<x<1. KLSE has negative correlations with all of the variables, while BTC, CPO, and XAU have positive correlations with all the variables. CPO has a relatively strong positive correlation with XAU. Nevertheless, USD and WTI have a weak negative correlation, while the balance correlate positively.

Regression Analysis

Table 3: Regression Analysis

Variable	Dependent Variable: KLSE Index			
	Coefficient	Std. Error	t-Statistic	Prob.
C	2090.31	25.87491	80.78519	0.0000
CPO	0.017023	0.002354	7.2304	0.0000
BTC	-0.013204	0.000551	-23.9484	0.0000
USD	-26.19263	6.18366	-4.23578	0.0000
WTI	0.135864	0.103679	1.310426	0.1902
XAU	-0.245504	0.011698	-20.986	0.0000

R-squared	0.60738
Adjusted R-squared	0.606464
S.E. of regression	78.23015
Number of Observation	2148
Log-likelihood	-12409.42
F-statistic	662.7326
Prob(F-statistic)	0.0000

Here, the dependent variable is represented by KLSE (Kuala Lumpur Stock Exchange), while the independent variables are symbolized by BTC (Bitcoin), CPO (Crude Palm Oil), USD (Dollar Rate), WTI (Crude Oil) and XAU (Gold). Moreover, FIGURE also portrays the outcomes computed by EViews 12. The following regression equation can be constructed as:

KLSE = -0.013 BTC + 0.018 CPO – 26.193 USD + 0.1359 WTI – 0.246 XAU

Additionally, the R^2 of Figure 8 is established as 60.74%. Hence, this means that 60.74% of independent variables (BTC, CPO, USD, WTI, and XAU) are affected by the dependent variable (KLSE). The balance 39.26% is not included in this study. What's more, the Prob (F-statistic) is showcased as 0.000, which is less than 5%. As such, this implies that the variables in the dataset are significant and can be used to interpret its associations. Furthermore, the Coefficient values of the dataset can reveal whether the independent variables contain a positive or negative relationship as well as an insignificant or significant correlation with the dependent variable. Figure 8 portrays that BTC, USD, and XAU contain a negative relationship with KLSE, while CPO and WTI contain a positive relationship. Nevertheless, WTI contains an insignificant relationship with KLSE, due to the fact that its P-value is greater than 5%, while the other independent variables remain below 5%.

Diagnostic tests

the JB test conducted shows that the P-value is smaller than 5% at 0.000. Hence, H0 is rejected, and H1 is accepted. This leads to the conclusion that normality distribution is avoided since the dataset is bigger than the sample size. The Breusch-Pagan-Godfrey (BPG) test is used to determine whether the dataset is heteroskedasticity or homoskedasticity. the BPG test conducted shows that Prob Chi-Square value is 0.000, which is smaller than 5%. As such, H0 is rejected and H1 is accepted. This leads to the conclusion that stock market portfolios are heteroskedasticity. As such, GLM needs to be conducted. The Prob Chi-Square value is now 0.067, which is more than 5%. Hence, H0 is accepted and H1 is rejected. This leads to the conclusion that the residual is free of serial correlation.

Table 4: Diagnostic tests

Heteroscedasticity	
X2	43.97634
Prob > X2	0.0000
Serial correlation	
F-stat	2.7035
Prob > F	0.0655

Normality Distribution	
Jarque- Bera	0.0000
Prob>JB	0.791228

Note: *** significant at 1%; ** significant at 5%, * significant at 10%

Unit root test

To determine if a dataset contains stationary or unit root, the Augmented Dickey-Fuller (ADF)

Table 5: Unit Root Test

	Unit Root test (Augmented Dickey – fuller test)						
Variable	Equation	KLSE	BTC	CPO	USD	WTI	XAU
	Intercept	0.1895	0.6089	0.7878	0.8795	0.092	0.6312
Level	Trend and Intercept	0.7034	0.5245	0.455	0.7364	0.2182	0.5098
	None	0.7108	0.7688	0.5565	0.8604	0.5258	0.9208
	Intercept	0.0001	0.0001	0.0001	0.0001	0	0.0011
1st Differencing	Trend and Intercept	0.0001	0	0	0	0	0
	None	0.0001	0	0	0.0001	0.0001	0.0001

Table 5 showcases the results of the ADF unit root tests. 1st differencing is conducted on the dataset to determine that all the variables are altered froa m non-stationary to a stationary position. Hence, p-value must be less than 5%. Similarly, if the dataset is above 5%, 2nd differencing can be conducted.   As such, the p-values of all the variables in Figure 18 at Level for Intercept, Trend, and Intercept and None are above 5%. This means that the datasheet is not stationary and contains unit root. Consequently, 1st differencing is conducted to ensure the variables change to stationary. After 1st differencing, the p-values of all the variables at Level for Intercept, Trend, and Intercept and None changed to below 5%. Hence, H0 is rejected, and H1 is accepted. This leads to the conclusion that the data is stationary and has no unit root after 1st differencing.

Cointegration

Table 6: Cointegration

Trace Test Statistics (mtrace)				
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.012016	72.64786	95.75366	0.6301
At most 1	0.010812	47.64841	69.81889	0.7359
At most 2	0.005231	25.16666	47.85613	0.9142
At most 3	0.00454	14.32019	29.79707	0.8222
At most 4	0.002107	4.909755	15.49471	0.8183
At most 5	0.000265	0.548817	3.841465	0.4588
Maximal Eigenvalue Statistics (mmax)				
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.012016	24.99945	40.07757	0.7675
At most 1	0.010812	22.48175	33.87687	0.5704
At most 2	0.005231	10.84648	27.58434	0.9692
At most 3	0.00454	9.410431	21.13162	0.798
At most 4	0.002107	4.360938	14.2646	0.8194
At most 5	0.000265	0.548817	3.841465	0.4588

Based on Table 6, at None, Trace Statistics is valued at 0.6301, which is more than 5%. As such, H1 is rejected and H0 is accepted. This means that the dependent variable (KLSE) and the independent variables (BTC, CPO, USD, WTI, and XAU) are not cointegrated. Similarly, the Maximum Eigenvalue Statistics, at None, shows a value of 0.7675, which is more than 5%. Hence, H1 is rejected and H0 is accepted. Consequently, the dependent variable (KLSE) and the independent variables (BTC, CPO, USD, WTI, and XAU) are not cointegrated. Considering the above, there is no cointegration present between the variables since both test's p-values at None are more than 5%.   As such, without the presence of cointegration, VECNM cannot be conducted. Instead, VAR has to be carried out.

Vector Error Correction Model

Long-Run Relationship

Table 7 : VECM long - run representations: GDP as a dependent variable

	Coefficient	Std. Error	t/Statistics	Probability value
KLSE	1.005371	0.021757	46.20984	0.0000

Based on Table 7, C(1) the coefficient is 1.0054. This means it is positive. Furthermore, its P-value is 0, which is less than 5%. Hence, it is significant. As such, there is no long-run causality present amongst the independent variables to stock market portfolios, since the coefficient is positive and significant (P-Value > 5%).

Short Run Analysis

Wald Test (WT) is conducted to determine whether the dataset contains a short-run causality effect. The decision rule for WT is as follows:

(i)   There is a presence of short-run causality from the independent variables to the dependent variable (p-value < 5%).

(ii) There is no presence of short-run causality from the independent variables to the dependent variable (p-value > 5%).

The statistics of the Wald Test can be derived from the below equation:

KLSE = C(1)*KLSE(-1) + C(2)*KLSE(-2) + C(3)*BTC(-1) + C(4)*BTC(-2) + C(5)*CPO(-1) + C(6)*CPO(-2) + C(7)*USD(-1) + C(8)*USD(-2) + C(9)*WTI(-1) + C(10)*WTI(-2) + C(11)*XAU(-1) + C(12)*XAU(-2) + C(13)

Table 8: VECM short-run representations: GDP as a dependent variable- Wald test

Variable	T- statistics	Value	Probability
BTC	Chi-square	2.094530	0.12345
CPO	Chi-square	0.031716	0.9688
USD	Chi-square	0.641245	0.5214
WTI	Chi-square	4.015997	0.0182
XAU	Chi-square	0.018	0.8858

Based on Figure 23, the p-values of the T-statistics for Bitcoin (BTC), Crude Palm Oil (CPO), USD, and Gold (XAU) are 0,1234, 0.9688,0.5214 and 0.8858 respectively. This shows that these variables do not contain a short-run causality with the dependent variable, stock market portfolios since its p-values are higher than 5%. On the other hand, Crude Oil (WTI) p-values of T-statistics are 0.0182. Hence, this variables has a short-run causality effect since their p-values is less than 5%.

5. Conclusion

It is of utmost importance to comprehend the extent of influences commodities have on the portfolio of stock markets. This is because, investors can then utilize these commodities to diversify their portfolios and conduct proper risk management. Furthermore, commodities can also behave as leading indicators in the stock market. Consequently, this research paper carries out an investigation based on daily returns of commodities ranging from 2003 to 2023. Moreover, Unit Root Test, VAR, and Wald Test will be conducted to test the relationship present between the dependent variable (KLSE) and the independent variables (BTC, CPO, USD, WTI and XAU). Foremost, the Augmented Dickey-Fuller (ADF) Unit Root Test revealed that at Level, neither of the variables met the requirement of a unit root test, since its values were greater than 5%. Hence, 1st differencing was applied to the variables. After performing 1st differencing, all variables in the dataset fulfilled the requirement of the unit root test, since its values were smaller than 5%.   Secondly, through Lag Selection demonstrated in Figure 20,

Lag 2 was deemed to be the most appropriate lag. Moreover, since the dataset contained no cointegration, VAR had to be conducted instead. The VAR model demonstrated that there is no long-run causality effect present among the variables and Stock Market Portfolios (KLSE). Additionally, results from the Wald Test revealed that only Bitcoin (BTC), Crude Palm Oil (CPO) and Gold (XAU) contained short-run causality with Stock Market Portfolios (KLSE), while the dollar rate (USD) and Crude Oil (WTI) did not.

REFERENCES

Alexeev, V., & Tapon, F. (2014). How Many Stocks are Enough for Diversifying Canadian Institutional Portfolios? Discussion Paper Series N, 1-12.

Alqaralleh, H., & Canepab, A. (March, 2022). The role of precious metals in portfolio diversification during the Covid19 pandemic: A wavelet-based quantile approach. Resources Policy, 75.

Arfaoui, M., & Rejeb, A. B. (October, 2017). Oil, gold, US dollar and stock market interdependencies: a global analytical insight. European Journal of Management and Business Economics, 26(3), 2444-8494.

Batten, J. A., Kinateder, H., Szilagyi, P. G., & Wagner, N. F. (January, 2021). Hedging Stocks with Oil. Energy Economies, 93.

Bouri, E., Shahzad, S. J., Roubaud, D., Kristoufe, L., & Lucey, B. (2020). Bitcoin, gold, and commodities as safe havens for stocks: New insight through wavelet analysis. The Quarterly Review of Economics and Finance, 77, 156-164.

Breusch, T.S.&Pagan, A.R.(1980). The Lagrange Multiplier Test and Its Applications to Model Specification in Econometrics. Review of Economic Studies 47(1). p. 239-253.

Bursa. (2023). CRUDE PALM OIL FUTURES (FCPO) FREQUENTLY ASKED QUESTIONS (FAQ). Retrieved from Bursa Malaysia: https://www.bursamalaysia.com/sites/5d809dcf39fba22790cad230/assets/5e0aefb539fba27b8a3efba2/FCPO_Physical_Delivery_FAQ_Dec2019.pdf

Dai, Z., & Zhu, H. (2022). Time-varying spillover effects and investment strategies between WTI crude oil, natural gas and Chinese stock markets related to belt and road initiative. Energy Economics, 108.

Demir, C. (1 February, 2019). Macroeconomic Determinants of Stock Market Fluctuations: The Case of BIST-100. Economies, 7(1).

Dias, R., Santos, H., Heliodoro, P., Vasco, C., & Alexandre, P. (2021). WTI OIL SHOCKS IN EASTERN EUROPEAN STOCK MARKETS: A VAR APPROACH. The 5th Conference on Economics and Management, 71-84.

Dyhrberg, A. H. (October, 2015). Bitcoin, gold and the dollar – A GARCH volatility analysis. Finance Research Letters, 1-8.

Diyarbakırlıoğlu, E., & Satman, M. H. (2013). The Maximum Diversification Index. Journal of Asset Management, 14, 400-409.

Elie Bouri, S. J. (March, 2020). Bitcoin, gold, and commodities as safe havens for stocks: New insight through wavelet analysis. Elsevier, 156-164.

Eureka. (12 May, 2023). What Is the Importance of Regular Stock Portfolio Management? Retrieved from LinkedIn: https://www.linkedin.com/pulse/what-importance-regular-stock-portfolio-management-eurekasec/

Evans, J. L., & Archer, S. H. (1968). Diversification and the Reduction of Dispersion: An Empirical Analysis. The Journal of Finance, 23, 761-767.

Fareed, Z., Abbas, S., Madureira, L., & Wang, Z. (2022). Green stocks, crypto asset, crude oil and COVID19 pandemic: Application of rolling window multiple correlation. Resources Policy, 29.

Fisher, R. A. (1948). Conclusions fiduciaires. Ann. Inst. H. Poincaré 10. p. 191–213.

Göksu, A., & Ergün, U. (2013). Applied Econometrics with Eviews Applications. International Burch University.

He, X., Gokmenoglu, K. K., Kirikkaleli, D., & Rizvi, S. K. (April, 2023). Co-movement of foreign exchange rate returns and stock market returns in an emerging market: Evidence from the wavelet coherence approach. International Journal of Finance & Economics, 28(2), 1994-2005.

Jamil, I., Kogid, M., Lim, T. S., & Lily, J. (2022). The Impact of Soybean Futures and Crude Oil Futures on Palm Oil Indexes: Evidence from Bounds Test of Level Relationship and Causality Analysis. Economies, 10(10), 237.

Jarque, C. M. & Bera, A. K. (1981). Efficient Tests for Normality, Homoscedasticity and Serial Independence of Regression Residuals: Monte Carlo Evidence. Economics Letters 7 (4).p. 313–318.

Jeewantha, J. (28 November, 2021). ASSUMPTIONS OF CLASSICAL LINEAR REGRESSION MODEL (CLRM). SSRN, 7.

Jong Min Kim, S. T. (23 October, 2020). On the Relationship of Cryptocurrency Price with US Stock and Gold Price Using Copula Models. Mathematics, 8(11), 1859.

Kayral, I. E., Jeribi, A., & Loukil, S. (2 April, 2023). Are Bitcoin and Gold a Safe Haven during COVID-19 and the 2022 Russia–Ukraine War? Journal Risk Financial Management, 16(4), 222.

Li, J., & Li, G. (2022). Modeling the Linkages between Bitcoin, Gold, Dollar, Crude Oil, and Stock Markets: A GARCH-EVT-Copula Approach. Discrete Dynamics in Nature and Society, 10.

Meng, J., Nie, H., Mo, B., & Jiang, Y. (1 July, 2020). Risk spillover effects from global crude oil market to China's commodity sectors. Energy, 202.

Mensi, W., Shafiullah, M., Vo, X. V., & Kang, S. H. (2021). Volatility spillovers between strategic commodity futures and stock markets and portfolio implications: Evidence from developed and emerging economies. Resources Policy, 71.

NASDAQ. (2023). West Texas Intermediate. Retrieved from NASDAQ: https://www.nasdaq.com/glossary/w/west-texas-intermediate

Samadi, A. H., Owjimehr, S., & Halafi, Z. N. (2021). The cross-impact between financial markets, Covid-19 pandemic, and economic sanctions: The case of Iran. Journal of Policy Modeling, 43(1), 34-55.

Schwab. (2023). What are gold futures? Retrieved from Charles Schwab: https://www.schwab.com/futures/gold#:~:text=What%20are%20gold%20futures%3F,on%20a%20future%20delivery%20date

Selmi, R., Mensi, W., Hammoudeh, S., & Bouoiyour, J. (August, 2018). Is Bitcoin a hedge, a safe haven or a diversifier for oil price movements? A comparison with gold. Energy Economics, 74, 787-801.

Shahzad, S. J., Roubaud, D., Krištoufek, L., & Lucey, B. (2020). Bitcoin, gold, and commodities as safe havens for stocks: New insight through wavelet analysis. The Quarterly Review of Economics and Finance, 77(C), 156-164.

Siddiqui, S. R. (2021). Stock Return Dynamics and Portfolio Hedging: A Case of Leading Oil Consuming Economies. SCMS Journal of Indian Management, 18(2), 91-105.

Xingxing He, K. K. (2021). Co-movement of foreign exchange rate returns and stock market returns in an emerging market: Evidence from the wavelet coherence approach. International Journal of Finance & Economics, 28(2), 1994-2005.

Zaimovic, A., Omanovic, A., & Arnaut-Berilo, A. (15 November, 2021). How Many Stocks Are Sufficient for Equity Portfolio Diversification? A Review of the Literature. Journal Risk Financial Management, 14(11), 551.

Zainal, B. B. (13 June, 2013). A Study on the Factors Affecting Crude Palm Oil (CPO) Price in Malaysia. SSRN, 10.

Zhang, Y., Wang, M., Xiong, X., & Zou, G. (2021). Volatility spillovers between stock, bond, oil, and gold with portfolio implications: Evidence from China. Finance Research Letters, 40.