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Ethereum as a Hedge: The intraday analysis

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Abstract

In this study, we examine on intraday basis Ether - the token or cryptocurrency based on the Ethereum platform. Ether is the second largest crypto-currency, together with Bitcoin they dominate the cryptocurrency universe and account for almost 70% of combined market share. Similar to Bitcoin, Ethereum experienced rapid growth in price from a few cents per Ether after its introduction in 2015 reaching maximum of \$1,432.88 on January 13, 2018. In this paper, we study whether Ethereum crypto-currency is a hedge, diversifier or a safe haven asset. We find that Ethereum crypto-currency is a hedge against the US stock and gold markets. Also, Ethereum tends to behave as a safe haven for gold markets. When currency markets are concerned, we document that Ethereum is a diversifier for the US Dollar.

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1. Introduction

Merely 11 years after the introduction of Bitcoin in 2008, the number of cryptocurrencies reached 2,790¹. The attention attracted by cryptocurrencies can be explained by multiple factors from the novelty and potential of the blockchain technology to the explosive growth of Bitcoin price: since its introduction the price has grown from a few cents per Bitcoin reaching its maximum of \$19,783.06 on December 17, 2017. Currently, it is trading around \$8,186.56 as of October 8, 2019.

The ever-growing popularity of cryptocurrencies, promoted by Bitcoin, stimulated the growth of financial literature that study digital currencies, their application and effect on financial markets. Since Bitcoin is the first cryptocurrency and the recognized market leader, it became a focus of attention of the most research papers. Correspondingly, in recent literature little attention is paid to alternative cryptocurrencies. The second most popular digital currency – the ethereum/ether was introduced in 2015. Ether is a token or cryptocurrency based on the ethereum platform. Together with Bitcoin they dominate the cryptocurrency universe and account for almost 70% of combined market share (Figure 1). Similar to Bitcoin, Ether experienced rapid growth in price from a few cents per Ether after its introduction in 2015 reaching maximum of \$1,432.88 on January 13, 2018².

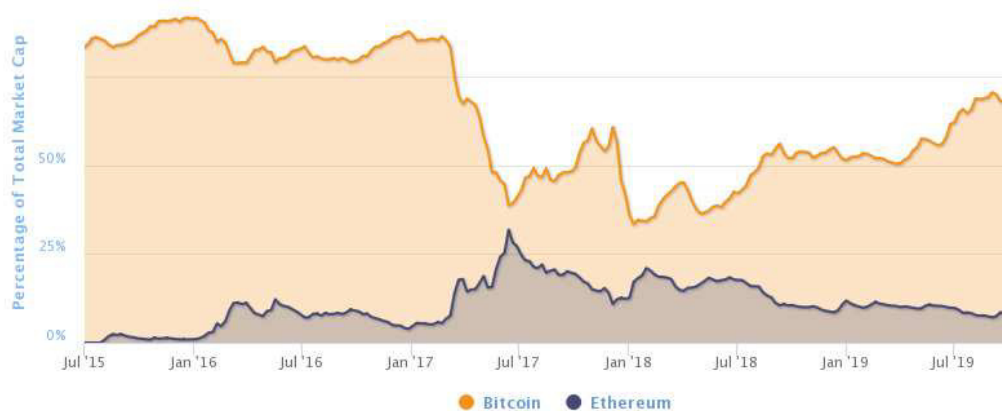


Figure 1. Comparison of Bitcoin and Ethereum market share over Ethereum's lifetime.

Ethereum is very often compared to Bitcoin as they are both based on the blockchain technology. However, there are few fundamental differences that set them apart. First, is their purpose: Bitcoin's main purpose is to store the value in a decentralized manner for secure peer-to-peer transactions. In other words, Bitcoin serves as a medium of exchange, similar to the Dollar (Whelan 2013). On the other hand, being six years younger than Bitcoin, ethereum platform uses newer and more secure technology and protocols and provides new functionality. In addition to storage and transfer of value, ethereum platform introduces smart contracts. Smart contracts allow for a faster and safer automatic contract execution when certain predefined requirements are met. In other words, ethereum provides functionality to develop applications with built in smart contracts that use Ether as a form of payment. Bitcoin does not provide such functionality.

¹ As of October 8, 2019, from <https://www.investing.com/crypto/currencies>

² According to <https://coinmarketcap.com/currencies/ethereum/#tools>

As we mentioned above, the blockchain technology allows cryptocurrencies to exist on their own, without central banks, Treasuries or any other regulatory agency. In other words, investors may consider Bitcoin as an alternative currency in case they lose trust to the mainstream currencies. In addition, cryptocurrencies may serve as an alternative investment asset that can add diversification to an investment portfolio. In both cases, the asset liquidity becomes of utmost importance. Even though Ether and Bitcoin can be fairly easy exchanged for any other currency, Ether usually has comparable or lower transaction cost and provides faster clearance. Bohme et al. (2015) demonstrates that Bitcoin transactions can take up to one hour to finalize. Besides that, the total supply of bitcoin is capped at 21 million, while ethereum does not have such limitation. The built-in cap may negatively impact liquidity of Bitcoin, hypothetically giving Ether an edge on liquidity.

However, ethereum has been under-researched due to the popularity of Bitcoin. We attempt to fill the void in the literature with this study. In this paper, we investigate on intraday basis whether Ether cryptocurrency is a hedge, diversifier or a safe haven asset. To the best of our knowledge, this is the first study to examine this topic. We find that ethereum cryptocurrency is a hedge against the US stock market and against the gold market. In addition, we find that ethereum tends to act as a safe haven for gold markets. When currency markets are concerned, we document that ethereum serves as a diversifier for the US Dollar.

Our paper contributes to the literature on cryptocurrencies in two ways. First, we analyze Ether, the second most popular and promising currency, which is different from Bitcoin significantly enough to justify a separate analysis. Second, to the best of our knowledge, our study is the first to analyze intraday data. Using high-frequency data allows us to capture more detailed and contemporaneous response of Ether to changes in the price of financial assets and commodities. In addition, it allows us to construct more accurate and precise measures to test different characteristics of Ether as an investment asset.

2. Literature Review and Methodology

In our article we investigate if ethereum in its role of investment asset may serve as a hedge, diversifier, or a safe haven for investors. Baur and Lucey (2010) identify three types of assets - hedge, diversifier and safe haven asset. They define those assets as follows - a hedge asset is uncorrelated or negatively correlated with another asset or portfolio of assets, a diversifier asset is positively (but not perfectly correlated) with another asset or portfolio of assets and a safe haven asset is uncorrelated or negatively correlated with another asset or portfolio of assets in times of extreme market correction.

To account for time-varying volatility Baur and Lucey (2010) define and use in their study the following Threshold-GARCH(1,1) model to determine the asset property type:

$$r_{ethereum,t} = a + b_1 r_{sp500,t} + b_2 r_{sp500,t(q)} + c_1 r_{gold,t} + c_2 r_{gold,t(q)} + d_1 r_{usd,t} + d_2 r_{usd,t(q)} + e_t \quad (1)$$

where $r_{ethereum,t}$ represents ethereum's return at time t , $r_{sp500,t}$ is the return on the S&P 500 index, $r_{gold,t}$ is gold's return at time t , $r_{usd,t}$ is the USD/Euro return at time t , $r_{i,t(q)}$ is the q^{th} quantile return

of either the S&P 500 index, gold or the USD. To identify the ethereum properties as a hedge, diversifier or safe haven asset we use their model in this study.

If the regression coefficients b_1 , c_1 or d_1 are zero or statistically significant and negative, that would suggest that ethereum is a hedge for stocks or bonds, respectively. If b_2 , c_2 and d_2 are zero or negative, that would suggest that ethereum is a safe haven for stocks or bonds. If the coefficients are positive and statistically significant then ethereum would be a diversifier.

Dyhrberg (2016) compares Bitcoin volatility to the one of gold and the dollar. The author argues that the bitcoin volatility places it somewhere in between Gold and the Dollar. Bouri et al. (2017a) study if Bitcoin can hedge the global uncertainty. The authors find that Bitcoin can indeed serve as a global hedge but only at short investment horizons. Klein et al. (2018) study if Bitcoin can replace Gold as safe haven asset. They find that due to Bitcoin'sk positive correlation with equity returns in market turmoil, Bitcoin cannot replace Gold. Baur et al. (2018) demonstrate that during normal market conditions as well as during market distress Bitcoin is not correlated with equity, nor with debt securities. Bouri et al. (2017b) argue that Bitcoin is a poor hedge and may serve only as a diversifier. In addition, the authors show that Bitcoin may be used as a safe haven asset against Asian equity market, but only for specific investment horizons. Guesmi et al. (2019) demonstrate that adding Bitcoin to an investment portfolio along with oil, gold, and equity securities significantly reduces risk of the portfolio. Chan et al. (2019) investigate if Bitcoin can hedge risk against stock indexes constructed from stocks in the USA, China, Europe, and Japan. The authors demonstrate that Bitcoin hedging ability changes depending on frequency of the analyzed data. They find that Bitcoin is an effective hedge using monthly frequency, however analysis of data with daily and weekly frequency does not support their finding.

Most prior literature focused on studying Bitcoin and its place in the investment portfolio. But few articles can be found on the ethereum, the second most popular cryptocurrency. Among others Katsiampa (2019) analyzes the relationship between Bitcoin and ethereum volatility. The author demonstrates that while both cryptocurrencies respond to the major news in a similar way, Ether can serve as a hedge against Bitcoin. Beneki et al. (2019) find that previously present hedging capabilities of Bitcoin and Ether significantly deteriorate over time.

In this article, we extend the stream of research on cryptocurrencies and their characteristics by analyzing if ethereum may serve as a hedge, diversifier, or a safe haven asset against US stock market, gold market, and US dollars. Since, prior articles demonstrate that Bitcoin properties may change depending on the investment horizon and frequency of analyzed data (see Bouri et al. 2017, and Chan et al. 2019 among others), our study is the first to our knowledge that uses intraday observations with 5-minute frequency. Therefore, we add to the literature studying the changing properties of cryptocurrencies under ultra-short investment horizon, which, in addition, may be of interest for high-frequency traders.

3. Data

In this study, we use five-minute interval data from: <http://firstratedata.com/i/crypto/ETH>. The data cover the period December 12, 2017 to December 31, 2018 between the hours 9:30am to 4:00pm Eastern Time. The trading hours for ether, gold and USD/Euro are longer but we are bound by the S&P 500 limits set in the NYSE.

Summary statistics of ether, S&P 500 index, gold index and USD/Euro exchange rate are presented in Table I. The average value of ethereum in the examined period is 492.50, whereas the average

values of the S&P 500 index, gold and the US Dollar are 2745.29, 1269.59 and 1.18, respectively. The summary statistics show that potentially all return series exhibit ‘fat-tails’ and that potential clustering of volatility and presence of GARCH effects.

Table I. Summary Statistics

This table reports summary statistics (number of observation, mean, median, standard deviation, skewness, kurtosis, minimum, and maximum) of assets prices and rates of returns on intraday basis: closeETH and retETH represent the average 5 minute price and average 5 minute rate of return of Ether respectively; closeSPX and retSPX represent the average 5 minute price and average 5 minute rate of return of S&P500 index respectively; closeXAU and retXAU represent the average 5 minute price and average 5 minute rate of return of Philadelphia Gold and Silver Index; closeUSD and retUSD represent the average 5 minute exchange rate and average 5 minute rate of change of USD/EUR exchange rate.

Variable	N	Mean	Median	Std Dev	Skewness	Kurtosis	Minimum	Maximum
closeETH	20117	492.50	466.90	287.60	0.51	-0.53	79.00	1344.40
closeSPX	20117	2745.29	2736.66	97.75	-0.41	0.85	2348.36	2940.22
closeXAU	20117	1269.59	1266.20	52.84	-0.02	-1.45	1175.26	1364.99
closeUSD	20117	1.18	1.17	0.04	0.38	-1.20	1.12	1.25
retETH	20116	-0.000033	0.000000	0.008266	3.3299	305.7703	-0.174012	0.334579
retSPX	20116	-0.000003	0.000004	0.001119	-0.564911	37.127101	-0.023610	0.015274
retXAU	20116	0.000002	-0.000002	0.000670	0.790579	65.099545	-0.013517	0.011342
retUSD	20116	-0.000001	0.000000	0.000508	-0.093513	69.031951	-0.012207	0.008798

Figure 2 demonstrates the fluctuations of prices of ether, S&P 500 index, gold and USD/Euro over the analyzed period, between the hours of 9:30am to 4:00pm Eastern Time. These graphs suggest the presence of clustering of volatility and potential presence of GARCH effects.

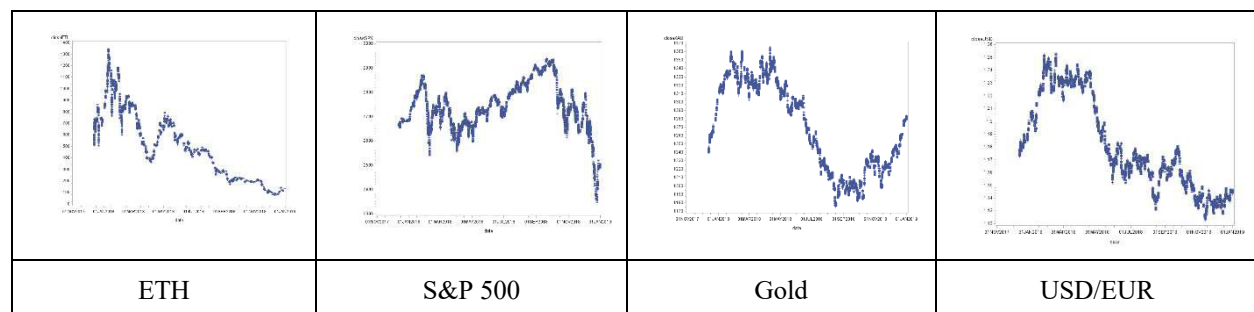


Figure 2. Ether, S&P 500 Index, Gold and USD/Euro 5 Minute Intraday Prices

4. Empirical results

Before we proceed with the hedging potential of ether, we need to establish whether clustering of volatility might be an additional factor that needs to be considered in the analysis to follow. As indicated in the summary statistics and graphs, ‘fat-tails’ are present in the return series for all four assets.

Table II. Tests for ARCH Disturbances Based on OLS Residuals

This table reports p-values for two tests for presence of heteroscedasticity in the analyzed time series: the Q statistics test for changes in variance across time and the Lagrange multiplier (LM) test. Both tests demonstrate the presence of heteroscedasticity in the time series of S&P 500 returns.

Lag order	ETH		SPX		XAU		USD	
	Pr > Q	Pr > LM	Pr > Q	Pr > LM	Pr > Q	Pr > LM	Pr > Q	Pr > LM
1	0.7138	0.7138	<.0001	<.0001	0.8528	0.8529	0.8042	0.8042
2	0.8978	0.8980	<.0001	<.0001	0.9615	0.9615	0.9231	0.9230
3	0.9432	0.9435	<.0001	<.0001	0.9783	0.9783	0.9628	0.9630
4	0.9137	0.9146	<.0001	<.0001	0.9477	0.9475	0.9425	0.9427
5	0.9642	0.9647	<.0001	<.0001	0.9755	0.9754	0.9750	0.9751
6	0.9861	0.9864	<.0001	<.0001	0.9908	0.9907	0.9868	0.9869
7	0.9908	0.9911	<.0001	<.0001	0.9903	0.9901	0.9881	0.9882
8	0.9960	0.9962	<.0001	<.0001	0.9939	0.9937	0.9947	0.9947
9	0.9984	0.9985	<.0001	<.0001	0.9976	0.9975	0.9953	0.9954
10	0.9992	0.9992	<.0001	<.0001	0.9982	0.9981	0.9955	0.9956
11	0.9996	0.9996	<.0001	<.0001	0.9990	0.9990	0.9892	0.9896
12	0.9999	0.9999	<.0001	<.0001	0.9996	0.9996	0.9934	0.9936

In Table II we summarize results for the Q statistics test for changes in variance across time and the Lagrange multiplier (LM) tests for 12 lags. The reported results indicate presence of ARCH effects only in the S&P 500 index return series, but not in the returns of ether, gold and USD.

To test ether’s hedging ability, we follow the methodology developed in Baur and Lucey (2010) and estimate equation (1). Model 1 represents the fully specified equation (1). To account for the presence of heteroscedasticity in the S&P 500 return time series, we estimate two additional specification of the equation (1): Model 2 and Model 3. In Model 2, we exclude the S&P 500 index from the equation (1) and estimate Model 3 that focuses solely on the S&P 500 index. From a multitude of GARCH model specifications, we adopt the simplest, GARCH(p,q) model with normally distributed residuals. The estimation results are summarized in Table III.

Table III. Estimation of equation (1)

This table reports equation (1) estimation results: Model 1 is fully specified equation (1), Model 2 is estimated without S&P 500 index to account for its heteroscedasticity; Model 3 focuses solely on the S&P 500 index and includes it as the only regressor.

Variable	Model 1		Model 2		Model 3	
	Coef	P-value	Coef	P-value	Coef	P-value
Intercept	0.0001	0.0982	-0.00001	0.8612	0.0004	<.0001
retSPXSHOCK	1.0847	0.0000			1.5734	<.0001
retSPXSHOCK_NO	-0.1170	0.0846			-0.1392	<.0001
retXAUSHOCK	-0.6637	0.0001	-0.5702	0.0007		
retXAUSHOCK_NO	-0.2158	0.1081	-0.4424	0.0009		
retUSDSHOCK	0.5653	0.0107	0.9395	0.0000		
retUSDSHOCK_NO	0.3977	0.0243	0.3529	0.0456		
ARCH0					0.00002	<.0001
ARCH1					0.9256	<.0001
GARCH1					0.5173	<.0001

In all model specifications that include S&P 500 index (Model 1 and Model 3), the regression coefficients on retSPXSHOCK_NO are negative and statistically significant suggesting that ethereum may act as hedge against S&P 500 index. However, ethereum does not appear to be a safe haven during stress in the stock market, as evidenced by the positive and statistically significant estimated coefficients on the shock variable retSPXSHOCK.

In all model specifications that include Gold index as an explanatory variable (Model 1 and Model 2), the regression coefficients on retXAUSHOCK_NO are negative and statistically significant suggesting that ethereum tend to be a hedge against gold. In addition, ethereum appears to be a safe haven during stress in gold markets, as evidenced by the negative and statistically significant coefficients on the shock variable retXAUSHOCK.

In all model specifications that include USD/Euro pair (Model 1 and Model 2), the regression coefficients on the US Dollar variable retUSDSHOCK_NO are positive and statistically significant suggesting that ethereum may behave as a diversifier for the US Dollar. However, ethereum does not appear to be a safe haven during stress in the currency market, as evidenced by the positive and statistically significant coefficient on the shock variable retUSDSHOCK.

5. Conclusion

Most prior literature on crypto-currencies focuses on the analysis of Bitcoin and its characteristics. In this paper, we attempt to fill the gap and analyze Ether, the second largest crypto-currency based

on the Ethereum platform. In particular, we study on intraday basis whether Ether is a hedge, diversifier or a safe haven asset. We find that ethereum crypto-currency can serve as an intraday hedge against the US stock market and against the gold. Also, ethereum may serve as an intraday safe haven against gold markets. When currency markets are concerned, we document that ethereum tend to act as a diversifier on intraday basis for the US Dollar.

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