**Investigating the Relationship between Cryptocurrency and Energy Prices?**

**The Crypto Energy Problem**

Cryptocurrencies are very popular. Currently there are over 300 million user trading over 2 trillion dollars’ worth of cryptocurrency[[1]](#footnote-1). Far and away the most popular crypto currency is bitcoin, but where do bitcoins come from? Bitcoins are “mined” using a mining program on a computer. When a computer solves specialized complex mathematical problems involved in blockchain technology the user is rewarded with bitcoins. However, by design, there are only a finite number of bitcoins that can ever be mined (21 million). Furthermore, the number of Bitcoins that are rewarded to miners per calculation decreases as the number of Bitcoins that have ever been mined increase. For example, when bitcoin first started, a person using a personal computer at home could theoretically mine 200 bitcoins in just a few days. However, just 5 years later, in 2014 it would take that same person 98 years to mine just 1 bitcoin. As a result, even with the increases in computing power and number of miners worldwide, the number of bitcoins that miners get for the same amount of work has been cut in half repletely, about every four years, since 2009. Today, all of those powerful computers running complex decrypting programs across the globe require an enormous amount of power [[2]](#footnote-2), more than most countries [[3]](#footnote-3). This has only increased over time and caused a seemly enormous outcry [[4]](#footnote-4) of complaints [[5]](#footnote-5) [[6]](#footnote-6). Even major figures in the energy sector such as Elon Musk [[7]](#footnote-7) have said that bitcoin mining is bad for the planet.

**Questions about the Crypto Energy Connection**

However, just because a few people make a public outcry doesn’t necessary mean that they represent the views of the public at large. More importantly, even if the public openly expressed those same views, their actual behavior does a better job of representing what they really think. Does the public really care about the connection between cryptocurrency mining and energy use? Does the use or cost of energy have an impact on cryptocurrency price/use? Is there any relationship between cryptocurrency prices and energy prices at all? We begin our investigation seeking to answer this last question.

**Methodology:**

The datasets analyzed for this project were retrieved from various sources listed below. The datasets needed to be manipulated and formatted prior to completing the analysis. The Bitcoin, Dogecoin and Ethereum datasets were read from csv and the dates and daily closing price of each cryptocurrency was saved in a separate data frame. To ensure that the various data frames could be merged together, all dates were formatted in a YYYY-MM-DD format.  The daily closing price and date of the crude oil and natural gas was retrieved from the commodities datasets.  The coal data was only available by closing price on the first of each month and therefore had fewer number of datapoints to be compared. The data for multiple stock indices were retrieved for closing prices and dates later than or equal to January 1, 2000. A separate data frame was created for each Stock Index.

The data frames were merged with an inner join based on the dates. Each data frame was merged one at a time. Rows with any null data were dropped prior to completing the analysis.  After combining all the datasets (excluding coal), there were approximately 1065 data points available for analysis. For the coal analysis, there were approximately 240 data points available. However, once this data was merged with the Cryptocurrency prices, only 70 data points were common. A csv file was saved with data for Cryptocurrency prices, Stock Market closing prices and the commodity prices.  A separate csv file was saved with the Cryptocurrency and Coal prices.

Each variable was analyzed against Bitcoin, Dogecoin and Ethereum prices.  A scatter plot and linear regression analysis was completed.  A scatter plot with line equation, r-squared and p-value was created for each analysis.

Data Sources:

1. Cryptocurrency Prices
   1. Bitcoin: <https://www.kaggle.com/sudalairajkumar/cryptocurrencypricehistory?select=coin_Bitcoin.csv>
   2. Dogecoin:

<https://www.kaggle.com/sudalairajkumar/cryptocurrencypricehistory?select=coin_Dogecoin.csv>

* 1. Ethereum:

<https://www.kaggle.com/sudalairajkumar/cryptocurrencypricehistory?select=coin_Ethereum.csv>

1. Stock Market Closing Prices
   1. New York Stock Exchange, NASDAQ, Hangseng, Shanghai, Euronext N100, Nikkei N225:

<https://www.kaggle.com/mattiuzc/stock-exchange-data?select=indexInfo.csv>

1. Commodity Prices
   1. Crude Oil:

<https://www.kaggle.com/awadhi123/crude-oil-stock-price>

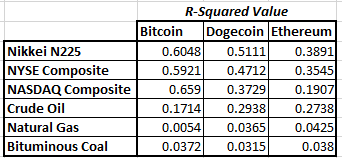
* 1. Natural Gas:

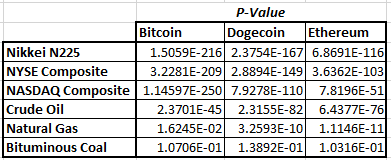
<https://github.com/owid/energy-data>

* 1. Bituminous Coal:

<https://fred.stlouisfed.org/series/PCU212111212111>

**Analysis:**





The notion that individuals are interested in a green planet and would not want to utilize energy to mine cryptocurrency is invalid.  As the scatter plots, linear regression analysis and r-squared values show, there is very little correlation between crude oil, natural gas, bituminous coal - the three commodities utilized to produce electricity required to mine cryptocurrency using computer power - and the prices of the three Cryptocurrencies.

As cryptocurrency is digital, many assume that it does not hold a value similar to a global currency in circulation.  The analysis of the three cryptocurrencies vs the three stock indices shows that is also incorrect.  Based on the r-squared value, there is a high correlation for the three stock indices with the cryptocurrencies except for Ethereum, which has a low correlation with the NASDAQ Composite. It is also interesting to see that the r-squared value for Dogecoin vs NASDAQ is almost twice the r-squared value of Ethereum vs NASDAQ and the r-squared value of Bitcoin vs NASDAQ is three times the r-squared value of Ethereum vs NASDAQ.  As Dogecoin is the penny stock of the cryptocurrency, it is of note that Dogecoin is more highly correlated with the stock market indices than Ethereum, which is a bit more expensive.

Is there any relationship between cryptocurrency prices and energy prices at all? Our analysis would indicate that there currently isn’t.

1. https://www.yahoo.com/now/countries-using-cryptocurrency-most-210011742.html [↑](#footnote-ref-1)
2. <https://www.theguardian.com/technology/2021/feb/27/bitcoin-mining-electricity-use-environmental-impact> [↑](#footnote-ref-2)
3. <https://www.nytimes.com/interactive/2021/09/03/climate/bitcoin-carbon-footprint-electricity.html> [↑](#footnote-ref-3)
4. <https://techcrunch.com/2021/03/21/the-debate-about-cryptocurrency-and-energy-consumption/> [↑](#footnote-ref-4)
5. https://www.coindesk.com/business/2021/03/05/the-frustrating-maddening-all-consuming-bitcoin-energy-debate/ [↑](#footnote-ref-5)
6. https://www.coindesk.com/business/2021/03/05/the-frustrating-maddening-all-consuming-bitcoin-energy-debate/ [↑](#footnote-ref-6)
7. https://fortune.com/2021/05/13/musk-bitcoin-mining-bad-planet-heres-how-bad/ [↑](#footnote-ref-7)