



MINING ECONOMICS & WHAT DRIVES THE BITCOIN PRICE: VOLATILITY VS. INFORMATION EFFICIENCY

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Perhaps the greatest complaint about Bitcoin, from both holders and detractors, is the extreme price volatility. It is the currency's most superficially prominent feature, particularly in an investment world trained upon short-term price patterns, and which has even built professional specialties around measuring and interpreting price volatility. They naturally ascribe reasons for the volatility, including the interpretation that its long term purpose – as a hedge against fiat currency debasement – is a failed experiment, since the price is much lower this year amidst rising inflation statistics.

What those observers are missing, however – including operators in the cryptocurrency market place – is that *one cannot evaluate the price of bitcoin without understanding the economics of cryptocurrency mining*. People have not yet adopted the notion that is critical to understanding bitcoin: the price volatility is largely, though not entirely, related to the *economics of mining*, and that is related to the cost of production, which includes the price of the machines and electricity consumption.

One might be inclined to think that this situation is related to the market decline, but that is what was coincidental. Nobody should ever look at bitcoin and think that it reflects a market-based assessment, as if they were common stocks, as in: “Oh, is bitcoin overvalued or undervalued?” That is not the way bitcoin works: it is not a security. What makes bitcoin so powerful and effective as an asset diversifier is that the short-term moves relate to the economics of mining. Virtually no one *not* engaged in the world of cryptocurrency mining understands that phenomenon, because it derives from a completely different set of economics. They wouldn't even be aware that there are basic business and return-on-capital decisions at work – bitcoin is just a ‘thing’, a notion. But those price changes are really a manifestation of the economics.

If the cryptocurrency mining economics were broadly understood, especially the economics as a halving approaches, particularly the fact that the cost of the equipment must be reduced before the halving, then that would be reflected in the price of bitcoin, but ever so gradually, on a daily or an hourly basis. So gradually, that you would hardly notice it. There wouldn't be any volatility. The price volatility comes from the fact that virtually no one who trades it is aware of the whole mining infrastructure. *It's the mining economics that matter for pricing bitcoin.*

As one example of how such relevant information is not broadly or publicly available— such information dissemination being the presumption behind the efficient markets theory—say that on a certain day it's widely announced that the cost of mining bitcoin is going to decline by roughly 50%. The price of bitcoin is going to drop suddenly and sharply. In reality, the information was starting to become available over the course of several weeks prior to the ‘announcement.’

Why? Because if you're a miner, when a new, presumably more efficient model of machine comes out, you'll be offered a few rigs at a very low price, just to give you a chance to test them and see

if you like them. You'll know if there's a price announcement coming. But once the announcement is 'made public,' it's suddenly reflected in the price of the coin. That is the source of almost all the volatility in bitcoin.

That relationship is depicted in the following chart¹, which compares a price index of mining equipment with the price of bitcoin. The price index tracks the price per TH² of the latest generation bitcoin mining ASICs equipment, including Bitmain's Antminer S19, S19j and S19 Pro units and MicroBT's Whatsminer M30s, M30s+ and M30s++ models, among others. As more efficient rigs with far lower operating cost per TH come to market, so too does the price of bitcoin decline.



Source: <https://data.hashrateindex.com>

The only other aspect of volatility you want to be concerned with is the up volatility, which is almost as great, and that's a function of the hash rate. Because when the systemwide hash rate rises, miners' respective shares in the mining pool shrink, which means they are each mining fewer coins. So, each miner's revenue is going down, but their cost remains the same. The only way to stay in equilibrium in that environment is to buy coins, instead.

To explain the alternating buy vs. mine decisions that miners make, there will be some miners, depending on their cost structure, who are the least profitable when the hash rate rises. They compare the expense and work required to mine relative to their reduced profit, and determine that they'd rather take their money and buy a coin instead of buying another machine. Bear in mind—although this sounds odd to people who haven't been much exposed to the world of crypto mining—that many miners consider mining simply a cheaper way of acquiring cryptocurrency. (They can buy a bitcoin and pay 100 cents on the dollar, so to speak, or mine it and, since it is a profit-making business, own it at a lower price.) So, if mining becomes insufficiently profitable compared to simply buying coins, the miners buy coins. They don't start to buy mining equipment again until the rewards for coins and equipment balance. That's how the adjustment mechanism operates.

¹ The ASIC Price Index reflects the current price per TH of the latest generation Bitcoin mining ASICs (under 38 joules/TH) such as Bitmain's Antminer S19, S19j and S19 Pro units and MicroBTC's Whatsminer M30s, M30s+ and M30s++ models, among others. The ASIC Price Index is measured in both US dollars (USD) and bitcoin (BTC).

² Terahash



The introduction of more energy efficient machines lowers the cost of mining bitcoin, and this cost efficiency should be rapidly reflected in the price of the bitcoin commodity, just like what happens when there are radical downward changes to conventional commodity production costs.

However, unlike for conventional commodities (an improved wheat harvester, say), the new equipment does not increase output, since the block reward is constant, as determined by the Bitcoin software protocol. In spite of this, new equipment is so profitable that it encourages miners to purchase new rigs. The increased supply capability from new equipment – and the resultant increase in the system hash rate – is equilibrated by an increase in the difficulty rating in the bitcoin protocol, which ultimately makes bitcoin more expensive to produce. This cost structure phenomenon, plus the growing network effect, is the cause of the extraordinary increase in the price of bitcoin in the last several years.

In the near term, these changing features are what make the bitcoin market inefficient, because the average person has no conception of the mining economics. Therefore, the change seems sudden because the new information becomes broadly disseminated suddenly and is reflected suddenly—it gets called volatility, when it ought to be called inefficiency, because that's what it is.

By contrast, in the stock market, when talking about large capitalization companies, very large numbers of people do business with them, and thousands, maybe hundreds of thousands work for them. So, information about them is, generally speaking, known. Therefore, the incremental information that comes out about them and into the marketplace is usually not profound. Consequently, that information doesn't serve to radically change the price, which is why stock volatility is generally at a certain historically expected level. But in the cryptocurrency market, people are not generally aware of the incremental development of relevant information, even though they could be, because it really is all readily available.

The mining system is revolutionary in that it cannot be gamed. The reason is because the only way you can game a system is if there is asymmetrical information, that is if one side has an information advantage over the other. In the bitcoin system, all the information is disclosed. Therefore, everybody is – or, at least, can be – on the exact same basis. In principle, there should be no surprises that catalyze sudden, large changes in the bitcoin price. In practice, at least to date, too few participants apply all the available information. Once they become willing to make use of the information that is available, no one will have an advantage over anyone else.

That is the beauty of the bitcoin system; you really cannot game it. In the long run, the tremendous price volatility will naturally dissipate, because all these dynamics and transparent informational aspects of the system will eventually be understood by everybody in the system. But until such time, it's going to be volatile. We just have to live with that. That doesn't mean one is not going to make a lot of money in crypto, but that's one of the features you have to put up with.



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