

# The Bitcoin Cash Difficulty Adjustment Mechanism

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(Source: cryptoeconomy)

## Abstract

*In this piece we examine the potential impact of Bitcoin Cash's new rolling 24-hour difficulty adjustment algorithm on the Bitcoin network. We look at the possible implications of price movements of Bitcoin Cash, with respect to hashrate oscillations between the two coins.*

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## Overview

In our last [piece](#) we looked over the history of coins sharing the same hashing algorithm and some of the potential problems related to swings in the hashrate between the two respective coins. In this piece we look more closely at Bitcoin and how it could be affected by changes in the price of Bitcoin Cash.

Bitcoin has a longer difficulty adjustment period than Bitcoin Cash, a two-week adjustment windows, compared to the rolling one-day period Bitcoin Cash now has. Therefore, in the event of price movements changing relative mining incentives between the chains, Bitcoin will be slower to adjust and achieve the 10-minute target time than Bitcoin Cash. This could be a potential problem for the usability or integrity of the Bitcoin network.

## A worked example of a Bitcoin Cash price increase

For the rest of this piece, broadly speaking, we assume miners have the objective of maximizing profits in the short term. Miners may also consider other factors or have other objectives, for example, to see their favorite coin succeed, their hated coin fail, or they may try to maximize the long-term value of their investment in coins and mining hardware, by focusing on maintaining network stability.

The following scenario applies to an increase in the price of Bitcoin Cash, similar logic can be used for other price movements:

1. There is stable equilibrium, where each coin is approximately achieving its 10-minute target time and the hashrate distribution is broadly speaking allocated in proportion to the relative price of each coin.
2. The price of Bitcoin Cash increases.
3. Bitcoin Cash then has higher mining profitability than Bitcoin and a significant amount of hashrate moves over to Bitcoin Cash.
4. Within a day, Bitcoin Cash's difficulty re-targeting mechanism quickly adjusts, such that the Bitcoin Cash block interval is around 10 minutes.
5. Due to the higher difficulty on Bitcoin Cash, some of the hashrate moves back over to Bitcoin. The Bitcoin block interval is longer than 10 minutes, since not all the hashrate moves back over.
6. Within around two weeks, Bitcoin's difficulty re-targeting mechanism adjusts, and Bitcoin's block interval reaches 10 minutes again. More hashpower moves back over to Bitcoin, such that the hashrate distribution is approximately in proportion to the new relative price of the two coins, an equilibrium state.

The below table illustrates the above example with actual numbers.

## Illustration of hashrate oscillation dynamics – Increase in the price of Bitcoin Cash

	Initial state	Immediately after the price increase	After the Bitcoin Cash difficulty adjustment	After the Bitcoin difficulty adjustment
<b>Relative prices</b>				
Bitcoin	1.0 BTC	1.0 BTC	1.0 BTC	1.0 BTC
Bitcoin Cash	0.2 BTC	0.4 BTC	0.4 BTC	0.4 BTC
<b>Relative mining profitability</b>				
Bitcoin	1.00x	1.00x	1.00x	1.17x
Bitcoin Cash	1.00x	2.00x	1.00x	1.17x
<b>Expected hashrate distribution</b>				
Bitcoin	83.3%	0.0%	66.7%	71.4%
Bitcoin Cash	16.7%	100.0%	33.3%	28.6%
<b>Expected block interval</b>				
Bitcoin	10 minutes	n/a	12.5 minutes	10 minutes
Bitcoin Cash	10 minutes	1.7 minutes	10 minutes	10 minutes

*The above model is an over simplification and excludes several other stages of hashrate oscillations. The table assumes hashrate is distributed according the relative price levels of the two coins. Transaction fee dynamics are excluded.*

(Source: BitMEX Research)

## Implications for the Bitcoin network

The above illustrates that the Bitcoin chain could experience block interval swings for longer periods than Bitcoin Cash, due to the longer difficulty adjustment window. However, the data also shows that even a large fluctuation in the price of Bitcoin Cash, from 0.2 BTC to 0.4 BTC, only increases the expected Bitcoin block interval by 25% to 12.5 minutes, after the Bitcoin Cash difficulty adjusts.

These slower blocks may generate some additional transaction congestion on the Bitcoin chain. Although, somewhat ironically, this problem is likely to be of greater concern to Bitcoin Cash supporters than Bitcoin supporters. Many long-term Bitcoin holders may not be concerned by periods of 12.5-minute blocks, as they are looking ahead to the long term, while this issue should be resolved within around two weeks. Although this may be disruptive to users in the medium term, in our view, it is unlikely Bitcoin Cash will maintain such high levels of price volatility for extended periods of time. Therefore, the above problem may not be a serious concern.

However, it is *possible* that price volatility and therefore hashrate oscillations could remain for extended periods of time. If this is the case, although Bitcoin may

deviate from 10-minute intervals for longer periods, the magnitude of the deviation could be larger for Bitcoin Cash. This could therefore impact both coins in a negative way. Should this occur, the eventual Nash equilibrium end game solution could be merged mining, as we discussed in the previous [piece](#). Although due to the current confrontational political climate, reaching such a solution could take a considerable amount of time and reconciliation.

## Bitcoin Cash difficulty adjustment schemes designed to cause disruption

There may be some small elements within the Bitcoin Cash community who wish to disrupt the Bitcoin network. For example, some people may have attempted to combine the timing of a rally in the price of Bitcoin Cash with a sharp downward difficulty adjustment caused by the EDA, to drive miners to Bitcoin Cash and disrupt the Bitcoin network.

If the plan is to cause this kind of disruption, one potential idea could be to increase the difficulty adjustment period, for example to a two-month window from a one day rolling period. This would mean that following a sharp price rally of Bitcoin Cash, the difficulty of Bitcoin Cash would take longer to adjust than Bitcoin. Therefore, Bitcoin Cash could remain more profitable than Bitcoin for longer periods, potentially causing disruption and transaction congestion on the Bitcoin network.

However, a long difficulty adjustment window like this may contradict the Bitcoin Cash philosophy. A shorter difficulty adjustment period, larger blocks and lower block times improve usability, which is a key focus of Bitcoin Cash. In contrast, longer difficulty adjustment periods, smaller blocks and longer block intervals, may improve resilience, which appears to be a key priority for the Bitcoin community. Therefore, Bitcoin Cash is unlikely to adopt such a policy, in our view.

Another issue with this longer two-month difficulty adjustment window is that the level of disruption to Bitcoin Cash, relatively speaking, with respect to periods with fewer blocks, will be even larger than for Bitcoin. Therefore, this approach could be considered a lose-lose type scenario. As we expressed above, ultimately, the win-win scenario could be something like merged mining.

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