

Transaction fees change the culture of bitcoin, study says

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Bitcoin transaction fees—financial rewards for adding certain records to

a blockchain ahead of others—keep the cryptocurrency functioning, but may threaten its long-term viability and contribute to its energy waste, according to a first-of-its-kind study from Cornell researchers.

As [bitcoin](#) has grown over the past 10 years, users must wait longer for their transactions to be added to the blockchain—a constantly updated list of records distributed among a network of computers. This lag spurred the emergence of fees, which users pay to move to the head of the line.

"Bitcoin now works essentially how markets work, because if you want something to happen faster, you have to pay for it," said Maureen O'Hara, the Robert W. Purcell Professor of Finance and professor of economics in the Samuel Curtis Johnson Graduate School of Management and senior author of "From Mining to Markets: The Evolution of Bitcoin Transaction Fees," which published in October in the *Journal of Financial Economics*.

"Transaction fees are not part of the original system—they just evolved," O'Hara said. "A system that's designed by a computer scientist for [security problems](#) may not be well-designed to trade in the markets, so the development of fees is actually a good thing. But it also created all kinds of problems."

While the fees help some deals get processed faster, the cost could make most transactions impractical, O'Hara said. For example, to use [bitcoin](#) to buy a \$4 latte at Starbucks, you might have to either wait several hours for the purchase to go through or pay \$5 to speed it up.

"One of the biggest challenges for bitcoin has been that the fees are too high for it to be used as a simple [transaction](#) account, and it takes too long," O'Hara said. "The number of bitcoin transactions that can be added in any given time is orders of magnitude smaller than, say, Visa

cards."

The paper was co-authored by David Easley, the Scarborough Professor of Social Science in the College of Arts and Sciences, and Soumya Basu, a doctoral student in computer science.

Bitcoin was designed in 2008 by a pseudonymous programmer, Satoshi Nakamoto, as a decentralized digital currency that relies on peer-to-peer interactions, rather than a bank or financial institution. It was intended to be corruption-proof, since all transactions are verifiable by anyone on the network.

Users known as miners solve complicated math problems to add records to a block; the first [miner](#) to solve the problem is paid in bitcoin to complete the [transaction](#). In bitcoin's early years, miners competed to add transactions and they were added quickly.

Today, more than 17 million bitcoins are in circulation, with 100,000 companies accepting payments in [bitcoin](#). But for security reasons the size of each block is limited, and as the cryptocurrency has grown, the volume of transactions outstripped miners' ability to add them quickly. Transaction fees emerged as a way to speed the process.

O'Hara compared the fees to a parade in which one onlooker stands to get a better view—causing all the other onlookers to stand, too.

"If everyone is standing up, you're not seeing any better than you were when you were sitting down," she said. "And if everybody's paying a [transaction](#) fee now, then you may end up in the same situation that you were in before—the fees got high and you have to wait anyway."

Another problem with the [transaction](#) backlog is the amount of energy it requires. Blockchains are notorious consumers of power—running

[bitcoin](#) for a single year uses the same amount of energy as all of Switzerland. The mathematical problems miners solve to add transactions to the block use enormous amounts of computing power, and when multiple miners are competing to solve the same problem, power is wasted.

"Only one [miner](#) gets paid, but all the others use massive amounts of electricity," O'Hara said. "And with more fees, mining becomes more profitable, which then induces more miners to enter, which then uses more electricity."

In the study, the researchers developed a new economic model to explore the reasons behind the rise of [transaction fees](#) and their impact on [bitcoin](#)'s ecosystem. They then tested their model's results with data describing all [bitcoin](#) transactions and validations between 2009 and April 2017.

More information: David Easley et al. From mining to markets: The evolution of bitcoin transaction fees, *Journal of Financial Economics* (2019). [DOI: 10.1016/j.jfineco.2019.03.004](https://doi.org/10.1016/j.jfineco.2019.03.004)

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