The Hong Kong University of Science and Technology

Department of Information Systems, Business Statistics and Operations Management
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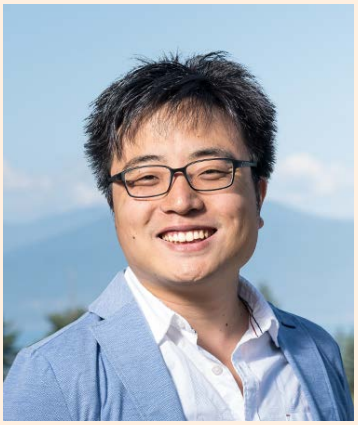

An Economic Analysis of Difficulty Adjustment Algorithms in Proof-of-Work Blockchain Systems

by

Prof. Shunya Noda
Vancouver School of Economics
University of British Columbia

Date : **21 May 2020 (Thursday)**

Time : **10:30 am - 12:00 pm**

Join Zoom Link : **https://hkust.zoom.us/j/97088785794**

Abstract:

The design of the difficulty adjustment algorithm (DAA) of the Bitcoin system is vulnerable as it dismisses miners' strategic responses to policy changes. We develop an economic model of the Proof-of-Work based blockchain system. Our model allows miners to pause operation when the expected reward is below the shutdown point. Hence, the supply of aggregate hash power can be elastic in the cryptocurrency price and the difficulty target of the mining puzzle. We prove that, when the hash supply is elastic, the Bitcoin DAA fails to adjust the block arrival rate to the targeted level. In contrast, the DAA of another blockchain system, Bitcoin Cash, is shown to be stable even when the cryptocurrency price is volatile and the supply of hash power is highly elastic. We also provide empirical evidence and simulation results supporting the model's prediction. Our results indicate that the current Bitcoin system might collapse if a sharp price reduction lowers the reward for mining denominated in fiat money. However, this crisis can be prevented through the upgrading of DAA.

Bio:

Shunya Noda (written as 野田 俊也 in Japanese), is a tenure-track assistant professor of Vancouver School of Economics at University of British Columbia. He works on Economic Theory, with a particular interest in Market/Mechanism Design. He obtained a Ph.D. in Economics from Stanford University. More details can be found in his personal website: https://sites.google.com/site/shunyanoda/

Link to Paper:

https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3410460