JAX K-Coefficient: Economics, Mechanisms & Incentives

Vinod Manoharan [*1], Lucas Leger [†1], and Iurii Shyshatsky [‡1]

[1]JaxNet, Kyiv, Ukraine

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[*]vinod@jax.net
[†]lucas@jax.net
[‡]iurii@jax.net

1 Introduction

JAX coins are the native decentralized stablecoins of the Jax.Network blockchain. They are pegged to the cost of hashrate. In this paper, we will discuss how the economics of JAX coins can be influenced by a K-coefficient. For more information about our blockchain, please visit https://www.jax.network.

2 Economics of JAX coins

2.1 Value of a coin in a decentralized network

There's one major difference between the value of a government controlled stablecoin vs a decentralized stable coin. In a government controlled stablecoin, the government puts strict penalties for counterfeiting the currency in order to maintain its value. So, government currency is valuable because the central bank is ready to uphold the value of the currency and work with the other government agencies to control money. In a decentralized network, this policing system is absent and hence people will tend to value a coin at the cost of its production. In currencies like BTC, whose economics are deflationary, the cost of production of a single coin is bound to increase over time and hence the price of each Bitcoin increases regardless of the cost at which it was produced.

However, in Jax.Network transactional shards, the reward of coins is based on the hashrate of the network and hence people would never value the coins at a much higher price than their cost of production.

2.2 Cost of production of JAX coins

By default, JAX coins have a price which is dictated by the market.

$$I.e : p(JAX) = Demand(JAX) \tag{2.1}$$

Since miners are profit motivated, they will print JAX only when

$$p(JAX) > p(H) \tag{2.2}$$

2.3 Opportunity cost of production

In a Proof of Work network, miners are incentivized to secure the network through the issuance of coins. For economic reasons, to decouple the economics from the security of the network, we had to contain coin issuance by using a Proof of Value mechanism.

As Jax.Network is merged-mined by BTC miners, in order for JAX coins to be issued under our protocol, miners have to give up their BTC coinbase block reward + JAXNET (JXN) coinbase block reward. Let's assume for the sake of simplicity that the BTC coinbase block reward is 1 BTC and the JXN coinbase block reward is 1 JXN.

Hence, there is an opportunity cost for miners to print JAX coins.

$$i.e : o(JAX) = \frac{p(BTC) + p(JAXNET)}{D} \tag{2.3}$$

Hence, for miners to print JAX coins,

$$p(JAX) > o(JAX) \ \wedge \ p(JAX) > p(H) \tag{2.4}$$

2.4 Productivity gains caused by Koomey's law

Everything is fine with our decentralized stablecoin JAX as long as there are no improvements in the ASIC industry. When there are improvements in the ASIC industry due to Koomey's law, then the efficiency of JAX coin production improves by around 18% year on year.

This means that the purchasing power of JAX coins reduces by 18% year on year. This could be considered as inflation and whether this is even a problem is separate question.

This may not be a problem because:

1. This reduction in the cost of production of JAX is a result of productive work in the energy, chip manufacturing sectors.

2. The opportunity cost mechanism still ensures that JAX coin production is not preferred, when there's no demand for it, as miners can make more profit through JAXNET production. In this fashion, the JAXNET coins act as a good hedge against inflation.

However, as a backup measure, we have an intrinsic bounded K-coefficient whose value can be set between 0 to 1 by miners, which can control the cost of production of JAX coins in some other base currency.

2.5 Burning JAX coins during an economic slump

During an economic crisis, it might be required for some JAX coins to be burnt. We propose a game later down this paper which can be organized on Layer-2, where the voters choose the value of K and the weightage of the voter is determined by how many JAX coins he has burnt. This creates an incentive for burning of JAX coins for those who would like to participate in governance of the system on Layer-2.

2.6 Algorithmic stablecoins vs JAX

The major problem with most algorithmic stable coins is that they are not bounded and their value drops to zero due to some mess up. However, in JAX this can't happen because the cost of production of JAX coins itself is bounded by the energy that is expended.

The only event that can affect the production cost of JAX coins is a technological breakthrough caused by Koomey's law and it can be countered by setting a K-coefficient whose maximum bound is 1 and minimum bound is 0. We also set some updation bounds between EPOCHs in a range of: -3% to +1% of the past EPOCH's K-coefficient value thus making it difficult for an attacker to manipulate the K-coefficient. Due to these reasons, it's difficult for JAX coins to crash as a stablecoin.

3 K-coefficient

3.1 What is it?

K is a conversion coefficient of miners' work to JAX coins. In Jax.Network, whenever a miner computes a hash in order to find a valid one, the mathematical expectation of JAX coin reward that he gets is equal to K. Hence, K-coefficient setting regulates the cost of production of JAX coin. Adjustment of K-coefficient maybe useful to fix the economics of JAX coins.

3.2 How is it implemented?

The K-coefficient is set by a miner on EPOCH n for the EPOCH $n + 2$. The median of the K-coefficient values on EPOCH n is calculated from a field "vote_K" in the beacon chain header and used as the "current_K" value in the beacon chain header in EPOCH $(n + 2)$.

Miners are free to enter the value of K as they see fit based on their research. However, the value of vote_K should be between 0 and 1, and it should be between previous_K - 3% and previous_K + 1%. As long as 51% of the hashrate is intelligent, the K-coefficient will be set optimally.

3.3 Who controls it?

The K-coefficient is set by miners when they mine blocks and set the "vote_K" field based on what they think is the optimal value of K.

In a nutshell, the value of K should bring the cost of production of 1 JAX to 1 unit of base currency that most miners would like to build their balance sheets in. In the usual case, its USDT.

3.4 51% intelligent hashrate assumption

The K-coefficient is set by miners. It's bounded between 0 and K_1. K_1 is a value of K during the first epoch. It's also bounded by an updation range of: -3% to +1% between epochs.

Setting a wrong value of K might crash JAX coins and hence JAXNET coins, causing a loss for miners, JXN holders. We say "might" because miners are still bound by the

cost of production of JAX coins and we are not entirely sure if we will even need this K-coefficient to create a better currency than USDT as it's mostly a backup measure.

As long as 51% of the miners are intelligent, they would be able to control the median value of K accordingly and set the right value of K as required by the market, otherwise they would be out of business on Jax.Network.

Since miners are profit motivated and are motivated by the transaction fees that they will get on JAX coins and the value of JAXNET coins, there's no logical reason for miners to destroy the network by manipulating K. Even in that case, the updation bounds of K-coefficient setting, makes it much more difficult for someone to inflate JAX than to deflate it.

3.5 Updation bounds

The K-coefficient during an EPOCH can only be updated to a range of: -3% to +1% of the past K-coefficient value in the previous EPOCH. And upon these values, the median is calculated.

This ensures that miners can't quickly update the K-value at will and gives enough time for the 51% intelligent hashrate to contain any malicious updation attacks.

3.6 Incentives to set the right value of K-coefficient

Miners on Jax.Network can either mine many shards for transaction fees or mine a few shards so that they are engaged in the business of printing JAX coins. Miners who are interested in the transaction fees of Jax.Network shards are interested in ensuring that the right value of K-coefficient is set as it majorly determines the economics of JAX coins and hence the transaction velocity on the shards. Also, the crash of JAX coins would crash JAXNET coins and hence all holders of JAXNET coins are extremely interested in the right value of K being set.

4 K-coefficient lottery

4.1 What is the K-coefficient Lottery?

As we allow miners to set the K-coefficient value in the beacon chain, we also propose mining pools to organize a lottery game on Layer-2 using lottery stake tokens.

4.2 What is LOTTOJAX?

Let's call the K-coefficient lottery mechanism stake token as LOTTOJAX.

LOTTOJAX are Layer-2 external coins that could exist at the trader / market maker / mining pool / Exchange Hub level where they check the users who have burnt JAX coins in turn to get LOTTOJAX coins to help them govern the economics of the network

and in return get to participate in the lottery + also receive rewards from the revenues of these businesses such as mining pools, cross-shard exchange hubs, etc.

This K-coefficient lottery could be organized on Layer-2 where LOTTOJAX tokens represent the amount of JAX coins that have been burnt. Burning $10,000$ JAX coins would issue $10,000$ LOTTOJAX coins on Layer-2.

4.3 Proposal for a K-coefficient lottery

One of the major concerns while conducting a K-coefficient lottery on the Layer-2 chain is whether miners are interested in setting the K-coefficient value lesser than 1. This is why the incentives and the organization of the K-coefficient lottery is very important.

There could be multiple ways in which such a Layer-2 lottery could be organized. This Layer-2 chain could be another merge-mined Lottery chain along with our beacon chain. We leave this concept open for future research and development.

Here's one way how the lottery game on Layer-2 could be organized:

The K-coefficient lottery has 4 phases / epochs. An epoch is usually 4096 blocks.

All the epochs run in parallel over 4096 block intervals.

EPOCH 1: Registration of vote. In this stage, a user will send a certain amount of LOTTOJAX coins which indicates the weight of his stake and calculate the

$$vote\_hash = SHA256(salt + K)$$

and submit it on chain. We propose an incentive of 0.25% fee for including this transaction.

EPOCH 2: Casting of vote by signing the vote_hash and submitting it on the LOTTOJAX chain. We propose an incentive of 0.25% fees for the miner to include this transaction. Here too the miner is incentivized as the K-value is still not revealed. In case the vote is not cast, the staked amount of LOTTOJAX coins less the fees that were deducted in Stage 1 are refunded back to the user who registered this vote.

EPOCH 3: Revealing the vote. In this stage, the user who cast the vote is now expected to reveal his vote by pushing the K value and the salt as a transaction on-chain. For miners to include this transaction, we propose a 1% fee. In the event of the voter not revealing his vote, his entire stake will be burnt and excluded from the calculation of the pot. Also, if there is less than 70% of the cast votes revealed in total, then all the stakes are refunded and the miners of this epoch who minted LOTTOJAX coins will lose their reward + transaction fees as a penalty for not including the vote revelation transactions.

EPOCH 4. The median of the K values that were voted on is calculated and a lottery is organized in block n during the next epoch and the miners who were part of finalizing blocks $n-3$ to $n+3$ are each rewarded with 0.5% of the total pot and the rest 95% of the pot is credited to the winner who is calculated from the blockhash of block n.

5 Major concerns and arguments

5.1 Effects on decentralization

One could raise a concern that the K-coefficient setting is a centralized affair among 51% of the hash-rate i.e among big miners. However, the K-coefficient is universal within our network and we see no reason for users to be worried about this. Although the setting of the K-coefficient is in the hands of 51% of the hashrate, it doesn't give any special privileges to the big miners and everyone gets to print JAX coins at this exchange rate. Also, the setting of the K-coefficient and the issuance of JAX coins is still completely decentralized and nicely fits under the 51% honest and intelligent hashrate assumption.

5.2 Currency crash due to greed

It's possible that miners could sometimes think about setting a higher K value and print more JAX coins. First, the K-coefficient only comes into play when the profit of the miners is calculated in a different base currency. In an era where the base currency is JAX itself, there is no problem as it's always a better option for miners to print JAX only when there's a demand for it. In other cases, they should simply print JXN. Secondly, if the K-coefficient is set to a higher value, the market will start pricing the JAX coins according to the K-value and hence, what would happen is the following:

Let's say $K = 0.5$.

At $D = 10,000$,

Miners would usually print $5,000$ JAX and sell them for let's say \$1 for a total of \$5,000.

When the miners set $K = 1$.

Now, the p(JAX) in the market would drop to \$0.50.

So, the miner would print $10,000$ JAX coins at \$0.50 and get \$5,000

When using an external base currency, the miners really don't profit anything by manipulating K. Also, the miner who prints JAX after increasing K has a competing miner who will print JXN and exchange it for JAX and in this event, the market exchange rate of JXN:JAX is set to increase. This acts as a strong check for the miner who wants to increase K and print JAX.

So, we argue the following:

1. The greedy miner stands to make nothing from this manipulation.

2. The competing miner who prints JXN against the greedy miner stands to make more money from this action. Hence, applying game theory, no miners will resort to this manipulative move.

3. Manipulating K requires the greedy miners to have more than 51% hashrate for a month just to increase K by 1%. This is extremely difficult to attain.

4. Miners who are mining BTC + JXN + (BTC+JXN+JAX) tx fees and users who are holding JXN understand that a currency crash of JAX would result in a crash of JXN and hence it's in their interest to defend the network against any K-coefficient manipulation and the updation bounds of -3% to +1% of K-coefficient helps the intelligent miners to defend the network from the greedy miner.

Hence, we conclude that this is an extremely unlikely event.

6 Conclusions

In this paper, we have extensively discussed about the K-coefficient and have concluded the following:

- In a bitcoin protocol based network, the value of a coin will be related to its cost of production, if the coin issuance is tied to the hashrate.
- Jax.Network has decoupled economics of the inherent stablecoin "JAX" from the security incentives of the blockchain by using a novel Proof-of-Value mechanism.
- The productivity gains caused by Koomey's law could depreciate JAX coins when calculated in an external stablecoin like USDT for instance. This depreciation due to productivity gains may be detrimental to the economy if sectors other than energy, ASIC manufacturing are unable to post such efficiency gains.
- We propose a K-coefficient, as a backup measure, that could be set by miners in order to control the cost of production of JAX coins which should work under a 51% intelligent hashrate assumption.
- The K-coefficient is bounded between 0 to 1.
- We proposed to set K-coefficient updation bounds between epochs to be between -3% to +1% of the past K-value based on the median vote_K value of the past EPOCH.
- When the base currency of the balance sheet is JAX / USDT, we concluded that JAX coins will not be extensively printed unless the market demands it's production assuming that miners are profit motivated.
- We proposed a K-coefficient lottery mechanism which could be conducted on Layer-2 at the mining pool level.
- We concluded that there is no effect on the decentralization of the network and that weak nodes are not affected by this K-coefficient.
- We concluded that miners won't crash the "JAX" stablecoin as long as 51% of the hashrate is intelligent.

- We additionally propose to have the JAX reward release slower than the JAXNET reward release. For instance 10 beacon blocks for JAXNET coinbase reward release and 100 shard blocks for JAX coinbase reward release.

Should you have any questions about this paper, please contact us through our website: https://www.jax.network