BUIP069: Academic paper - Mining, Taxation and Public Goods in Bitcoin

Proposer: Nicola Dimitri (BU member)

Project Title: Academic paper - Mining, Taxation and Public Goods in Bitcoin

Bitcoin address: 1N9ukmAq6EhhVigrAHiMMzSHdEwDAcLskP

Project Motivation

Mining is a fundamental activity for the functioning of bitcoin communities. The increasing costs of such activity recently posed a number of questions. One such issue is that fees paid by users for registration of their transactions exhibited a steep increase, over some time periods, most likely the outcome of several elements such as the size of registration blocks, the average amount of a transaction, the increase in the dollar/bitcoin exchange rate.

Transaction fees are offered for two main reasons: (i) to increase the likelihood that a transaction will be confirmed as soon as possible (ii) as a tax, paid by users to the miners for the latter to maintain and sustain the bitcoin network and system functioning. Under the second interpretation, fees could be thought of as a contribution to miners for their delivery of a *public good* (blockchain confirmation)

However, unlike governmental taxes transaction fees are not mandatory but voluntary. Yet, should they be too low it is unlikely that a transaction will be confirmed soon, or confirmed at all, since due to a limited block size successful miners clearly tend to include in the next block those transactions proposing higher fees.

Because daily transactions fees collected by miners reached a meaningful level with time, though currently (9 July 2018) they are below their peak, it would be interesting to investigate the following question.

What if bitcoin miners would deduct a share of their transaction fees (or more in general revenues) to improve the exchange system and its functioning? As above, considering the system functioning as a public good also for the miners, what if miners themselves contributed to enhance its efficiency?

Though miners are already investing on some of these initiatives at individual level, what seems to be missing is a jointly sponsored fund, where resources could be spent in activities of common, mutual, interest for all miners. Examples of such activities could be communication and training campaigns, to diffuse knowledge of the system functioning and its advantages, for both individual users and businnesses. Funds could also be used to sustain interaction activities with monetary authorities, financial intermediaries and related subjects.

Every miner would benefit from such initiatives.

The above question raises few issues. For example, on the one hand, it is clear that if such

contribution would be left completely voluntary there may be room for *free riding*, opportunistic, behavior by individual miners. That is, some may prefer the other miners to invest more than they themselves do, to enjoy the benefits of the system improvements at no or low costs. However, in this case the final outcome could be that nobody, or only few miners, would accept to deduct such share from their revenues to the benefit of the whole community. On the other hand, if such contribution is made mandatory by the majority of miners then this could potentially discourage some of them to continue their activity unless the system (*public good)* improvements, and expected increase in future revenues, would more than compensate one's contribution.

The starting view of this project is that a decision to introduce such contribution should resolve a trade-off, between paying to improve the system vs increasing expected future revenues. If the latter would prevail on the former then miners may be willing to contribute.

Project Objectives

The objectives of this project are the following:

- Conceptualise how a miner's contribution to a commonly managed fund, given by the share of his own revenue, could enter into his decision making, and what sort of role it could play. In a simple static model (Dimitri, Ledger 2017) I argued that revenues would affect only how much to invest in computational resources and not whether to invest. This result may need to be rivisited under the assumption that a deduction of revenues now could increase revenues later.
- The reference model would still be strategic, game theoretic, plausibly as in Dimitri 2017, however now some of the main parameters would probably have to change and time will have to enter explicitly into the framework.
- Indeed, for example, a preliminary sketch of some quantities of the model could be

  as follows. I would envisage that a miner's revenues , rather than being constant (as in Dimitri 2017) should now be seen as a function $R(ns)$ of the share $0<s<1$, of deducted revenues per miner, and the number of contributing miners n. In fact, if $sR(ns)$ is the deducted sum for the contribution, then $r(s)=(1-s)R(ns)$ would be the miner's net (of deduction) revenues. The shape of $R(ns)$ would reflect how revenues are expected to change as a result of the deducted sums invested in the system improvement. Assuming $R(ns)$ to be twice differentiable, the share maximising the miner's revenue s^* could be found by considering the first derivative

$$r'(s)=-R(ns)+(1-s)R'(ns)n$$

If s* is found by means of first order conditions, that is $r'(s^*)=0$ then

$$R'(ns^*)/ R(ns^*)= 1/((1-s^*)n)$$

or also

$s^*=e(R(ns^*))/(1+e(R(ns^*)))$

where $e(R(ns))=nsR'(ns)/R(ns)$ is the elasticity of the function $R(ns)$ that is the % variation of $R(ns)$when ns changes by *1%*.

If r is the miner's revenue with no deduction, and $r(s^*)$ the optimum miner's revenue with deduction, then if $r(s^*)>r$ it would be profitable for the miners to introduce the deduction to improve the system functioning.

Expected Impact

Th outcome of the project will be a research paper, with both academic and policy content. We expect the findings to help shedding light, for the BU community, on the conditions making a fees deduction, to improve the system, desirable for the miners. If miners would decide to do so, they would act in a so called "*coopetitive"* way (Brandeburger-Nalebuff, 1995), a combination of *cooperation* and *competition*. This is because while, on the one hand, they would *cooperate* to improve the system while on the other hand they would *compete* to mine successfully. Indeed, a better working system and a wider network of users will be in every miner's interest. Investing to do so would be a *cooperative* act by miners. However, once this is done and the revenues opportunities increased, for every miner, then they would keep *competing* with each other to solve the cryptopuzzle and confirm transactions.

Project Duration (Expected) If Approved 6 months, starting 2 weeks after approval

Budget 10.000 € (ten thousands euro) The budget is computed based on the following considerations. The paper is expected to take about 200 working hours, spread over 6 months, at an hourly fee of 50 euro. In case of acceptance, funds could be paid in three instalments

i) 3000€ two weeks after approval

ii) 3000€ three months after the first instalment (i)

and the remaining

iii) 4000€ six months after the first instalment

Payment (ii) will be made conditional on approval by BU on satisfactory progress of the project. BU may ask for further progress before paying. Payment (iii) could be anticipated, if the final version would be ready and approved earlier than six months after the first instalment. It could also be delayed if BU would ask for more work before approval, or if the author would ask for more time.