

# Bitcoin Block Size Political Economy

Konrad S. Graf

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*“Bitcoin.com got the chance to sit down with respected Bitcoin thinker Konrad S. Graf and talk about the ongoing Bitcoin block size controversy.”*

**Bitcoin.com (BC):** You mentioned to me that you’ve thought a lot about the block size limit, but haven’t publicly spoken about it much before now. Why is that?

**Konrad S. Graf (KSG):** I’ve been considering this since about autumn 2014 and writing a working draft about it, but just never felt I reached a final product, and my focus alternated with other projects. I am talking about this now mainly because you asked me, but I also think the timing is finally right in my own process to say a few things. I take seriously the principle of seeking first to understand, then to be understood (Covey’s Habit 2). With this issue, there is no shortage of “seeking first to understand” to be done—there is much new here—but at some point in any such process, it is also important to do some “seeking to be understood.”

**BC:** Let’s get straight to it, then: Where do you stand on the block size scalability issue?

**KSG:** Where I stand derives from *how* I look. I recently talked with someone who characterized the debate as between business people looking to keep expanding now and technical people being cautious about the long-term system architecture. I said, “Right, and then there’s me,” meaning there is also at least a completely third way to look at this.

My focus is on economic and legal analysis of social structures and institutions, close to what used to be called “political economy.” Bitcoin is a new blend of service, product, business, culture, and institution. It has multiple technical, business, and economic layers. That makes it interesting but can also lead to confusion. So if that person was right and many others tend to see primarily either a technical system to be fine-tuned or business models to be optimized, I see a market, and that is quite a

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different creature. Economics is not business and it is not engineering; it is a third thing.

If a market itself somehow becomes subject directly to engineering-style or business-style treatment (see crony capitalism, “picking winners,” and similar boondoggles), there are certain implications, none of them good. In the wider world, this looks, for example, like “engineering the economy,” fine-tuning interest rates and exchange rates for “stability” (how’s that working out?), cartelizing industries and killing competition through regulation, and so on.

When engineering methods and mindsets are applied to market factors through government, it is called economic intervention. One problem with such economic engineering, and there are many, is that it treats *people* as among the moving parts in the planner’s model. But those people have other plans of their own. And despite the typical planning narrative, the master plan may well not “really” be better for them.

A major contribution of the economics discipline over the past centuries has been to explain that, and how, market interventions produce waste, shortages, unemployment, dislocations, and lost wealth in society. And those are just the *direct* effects. “The economy” is no machine or product or service. It is not even one giant “business.” It is an ever-evolving order of voluntary interactions among conscious, learning, and adapting beings. Enforced limits distort those dynamic coordination processes, prevent better discoveries from ever happening, and favor less efficient methods over more efficient ones, the known over the not yet known, the status quo over the next innovation.

And then it gets worse. Interventions cannot be “neutral.” They always introduce a win/lose dynamic. This fuels polarization and politicization. Now people feel they must fight to influence the intervention policy in their favor because someone else will surely try to influence it the other way. While market relations are by definition win/win in the sense that no trades take place without mutual consent, any market intervention introduces at least some degree of a win/lose *Hunger Games* style dynamic. Everybody is handed something to fight over in a zero-sum set-up and then feels some need, or even responsibility, to influence *how* the intervention measures are implemented.

**BC: How would you describe what the market is in relation to the block size limit? People talk about the need for a fee market, for example.**

**KSG:** First, “fee market” strikes me a poor usage. Fees are paid; products and services are bought. So this term already obscures the real product. Users submit transactions with a fee as an open bid in hopes of confirmation. Some research indicates that higher is not necessarily better above a certain going level, but bidding below that certain going level tends to result in increased delay probabilities.

So I describe this as a market for transaction-inclusion services. Users bid to have miners include transactions in candidate blocks. Inclusion in more candidate blocks—especially in relation to the total hashrate mining for those candidates—raises odds of quicker confirmation. Users prefer quicker confirmation to slower, other things equal, so the time element of scarcity is key. It is a market for confirmation priority, a time market.

Including each transaction in a candidate block incurs a certain marginal cost to miners. Each transaction has to be received, validated, and either included in a given candidate block by a certain time or not, all at some non-zero cost. The larger a given miner's own candidate becomes, for example, the greater the orphan risk. As such costs and risks rise over the years with rising volume, each miner/pool faces ongoing decisions about operating conditions, connectivity, costs, and risk assessments. These inform each miner's own pros and cons of inclusion at a given time, of deciding to invest in different levels of capacity and connectivity, and so on.

Miners, therefore, compete with one another within a service industry. In providing these services, each miner would like to raise his potential fee revenue (especially as the fixed reward declines over the years), but has to balance this against costs over time. A transaction's source, by the way—whether from an end-user, a company, or a payment channel system—should not matter, per se, from a miner's standpoint.

**BC: No government controls the block size limit, though, so can the intervention model really apply here?**

**KSG:** If the limit restricts the maximum quantity of services that the mining industry can supply, this begins to operate as a market intervention. It doesn't matter who is placing that restriction, or why. Intentions and identities do not change the economic effect of a policy. Motives are irrelevant. Market distortion happens due to the policy's nature, regardless of how it got there or who put it there or who left it there. The more the limit comes *to actually limit* regular market volume, the more negative the consequences are likely to become.

Let's take a separate example. Say the average bottom real wage in an economy were around \$7, but the government sets a \$5 minimum wage. What happens? Well, nothing. It doesn't matter. Now, however, this minimum is raised to \$6 and then \$7. Still, not much happens. A few people start to be unemployed who otherwise might have been employed, but this is mostly unnoticed. Now \$8. Effects begin to kick in. Then \$9, then \$10, and more. With each increase, more and more people will be unemployed who *might otherwise have been employed* at a wage between \$7 and the latest minimum. Shrunken, relocated, bankrupted, and unlaunched companies then never provide this non-existent employment.

Similarly, but inverted, the block size limit constitutes an industrywide output ceiling that has remained fixed while data volume has finally risen up to it. This same fixed limit has been in place since September 2010, but it had never before

mattered in practice. The more the limit influences real market volume potential, however, the more economic and social cohesion damage can be expected, so this is far from a costless strategy and the full costs are easy to either underestimate or miss altogether.

Bitcoin has been exciting to some as a free-market money. A central theme in my work has been to characterize bitcoin as a medium of exchange that has emerged from non-state, non-compulsory sectors of society. Some Bitcoin observers with a reasonable economics background may have begun from this general image and then assumed that since intervention is something only a government can do, the block size limit could not be considered such because it emerges from the non-compulsory sector.

Nevertheless, in a market with multiple sources of supply and demand and with prices and quantities supplied, a production ceiling still stands between service suppliers and their customers and still prevents new entrants from joining to break the ceiling. The economic analysis of that policy on this market (the on-chain Bitcoin transaction inclusion market) should be the same as if a government agency had imposed it, even though the “normative” (actually, legal theory) status of the two cases differs.

The two cases are clearly separate under legal theory, but not nearly so much under economic analysis. Government action to impose an output ceiling can only succeed through the threat or actual implementation of officially sanctioned violence against any would-be innocent resisters. In contrast, Bitcoin participation remains wholly voluntary regardless of this or that setting within the code. At the economic analysis level, however, the results of a production ceiling are the same regardless of its source and implementation method.

This case also fails to fit the (mythical) model of a stable free market cartel. Such theoretical arrangements are naturally unstable. Absent legal enforcement, any participant can gain by dropping out and exceeding the ceiling. Any new entrant can start producing without ever joining the cartel. In the current case, however, no particular renegade or newcomer alone can make a hard fork happen so as to break the output ceiling.

So the situation, although certainly novel, remains economically closest to a legally enforced industrywide output ceiling. One implication of this, while fascinating, is not especially encouraging: Not only has Bitcoin demonstrated that some good things that many had considered impossible without government are indeed possible—namely the production of money—it is also threatening to show that some bad things some had considered impossible without government could indeed be possible—namely, successful imposition of a cartel-style industrywide output ceiling.

This begins to make Bitcoin that much more a “mixed-economy coin” in this non-normative, but economic sense, and that much less a free-market coin. The advantages of allowing market coordination and innovation processes to function at their best are partially denied. If Bitcoin’s protocol is analogous to “the law” of this new land, then we are witnessing a particular slow-motion conversion from enabling natural market evolution, to implementing a mixed-economy style environment around the transaction-inclusion market.

**BC: What about the argument that there actually isn’t a serious cost to adding another transaction, so no reason to exclude low-paying ones?**

**KSG:** There has already long been a discernible relationship between fee/byte and time to confirmation. This is all that is needed. This has been so even during these early years when the fixed block reward has remained overwhelmingly larger than fee revenue. If the cost of transaction inclusion has remained fairly inconsequential, this suggests that producers have not yet met natural cost limitations in a meaningful enough way to make this relationship more important. Node operators and miners haven’t deemed it worth it to refuse to relay or include many lower-revenue transactions, yet. It hasn’t been worth it to invent and deploy more ways to monetize node relay services, yet. Users haven’t felt the urgency to include higher fees/byte than they have been, yet. And so on.

These things could happen anytime, but there is no way to predict when, or even if. It could be next year, or five years or 10, or never. There could be some other solution altogether that is developed when and if it makes enough sense. With an effective output ceiling in place, however, the incentives and opportunities to solve real problems as they actually emerge are reduced, innovation diverted. Market actors instead solve artificially constructed problems created by the production ceiling itself.

Bitcoin was designed with a careful transition program built in—a *long* one. July 2016 brings only the second of many more reward halvings. Over more than a century, new coin revenue is to fade as revenue from transaction inclusion rises. If the system remains successful, mining revenue should more and more become the multiple of three main items: fee/byte, data volume of transactions mined, and the real purchasing power of bitcoin.

At least two, if not all three, of these numbers could be expected to trend upward. That is some powerful math. But the block size limit is starting to limit one of these numbers (data volume) for the first time. Related controversy has probably also been limiting a second one for now (bitcoin purchasing power or “price”). One argument for a narrow block size limit has been that it can (maybe) artificially lift fee/byte. However, any such constructed (possible) lift to fee/byte over the short term could also come at a greater cost to the entire system for other reasons, such as lower service volume and price and distorted innovation paths.

**BC: Another argument in favor of a lower limit is that it reduces costs for nodes because they have less traffic to relay and a smaller block chain to store. What if there are too few nodes without the limit?**

**KSG:** When it appears as though there is a “tragedy of the commons” problem, the first question to ask is who owns what and if something important is unowned and as such unprotected. The parallel question here is how service providers can charge for their services. If they are not charging yet, it may just be that it isn’t worth it, yet, for them to figure out how to do that and then to actually do it.

Look at a node’s situation in economic terms. Many operators are now volunteering. Some run nodes as adjuncts to business operations to improve performance and security for themselves and/or customers. But what if some operators could also figure out ways to charge for express or premium services? What if they could collect small commissions for delivering well-paying transactions faster?

Remember, the transaction-inclusion market for users is about confirmation probability and speed. For miners, each of their current respective candidate blocks could be successfully hashed at any coming second, by which time any transaction that is in is in and any that is out is out. No one can know when that time will arrive and for whom, making time always of the essence on all sides. Any factors that come to influence this in the slightest way can become economically relevant—and therefore possibly subjectable to eventual monetization models.

Miners want to include profitable transactions and users want to send transactions and have them confirm, both in a timely way. That is a harmony of interests between those groups. Nodes intermediate between these bidders and takers (senders and miners). Nodes enable mutually profitable “completed passes” from bidder to taker with each transaction successfully mined. So nodes are sitting on an economic resource—a unique position to connect paying bidders with takers seeking profitable transactions. The “sooner rather than later” preference is also in harmony on both sides.

But nodes are still giving this service away for free. That might continue for various reasons, but if some form of monetization comes to make sense in practice, that could also happen. How about some subscription-based priority relay networks, maybe connected with particular wallets? How about micropayments to nodes using something like 21’s API system? MultiBit wallet software had included a small per-transaction “client fee” to support its own development. Though MultiBit has recently phased this out, it can still be kept in the idea bin for future monetization concepts. These are just a few random possibilities. So while the first answer to a “too few nodes” concern remains the standard advice to step up and run more nodes oneself, a second answer might be to help figure out some additional relay monetization models and see if they are taken up, either now or at some future time when they could become more attractive and useful than now.

**BC: Some have argued that changing the block size limit would be changing Bitcoin in a fundamental way, like changing the 21mn coin cap. The limit is part of Bitcoin and so should stay. How would you respond to that?**

**KSG:** Average block size has not related to the protocol block size limit before recent times. The limit was set in late 2010 about 20 months after launch at a level that was about 1,200 times larger than the average block size of the time. It was noted and defended as a temporary protective measure against certain network attacks. Others were against adding it, arguing it was dangerous to include at the protocol level. It might prove much harder than expected to change later. Special-interest groups with reasons to keep it in place could develop by then. This was all said in 2010.

The expectation was that the limit could just be raised or removed later when and if needed. Of course it could be raised later, went this thinking, *if and when* the system somehow managed to succeed and grow that far. It is easy to forget that at the time long-term Bitcoin success seemed outlandish to most people, including many with relevant expertise. So “just raising it later” put the possible drawbacks into the long run. Well, “the long-run” has now arrived, as it has a sometimes unpleasant habit of doing.

The most conservative position is adjusting the limit to keep it well above the current average block size. A dynamic limit tracking somewhere well above current average volume could maintain this relationship indefinitely without any later code changes. A dynamic limit could still protect (to the extent it really is usefully protective; a technical topic) without intervening in the transaction-inclusion market. The limit could return to being just another obscure setting among others.

**BC: What do you think of the idea that the new coin reward is a subsidy propping up people transacting today at artificially low cost?**

**KSG:** Part of the idea with this seems to be to accuse transaction senders of shameless freeloading when they use Bitcoin today to transact. Since these current parasitic users are all sponging off the “subsidy” anyway, this thinking seems to go, they already deserve to have the prices they pay for transacting increased through a restriction of available service supply across the industry.

I see this as—at best—a confusing misuse of the term subsidy. The coin reward and transaction revenue are an integrally “bundled good” for miners. A subsidy, however, is usually understood to be a separate amount that a bureaucracy injects, financed from some ill-gotten outside revenue source, to promote some product or behavior the bureaucracy prefers. In Bitcoin, however, the fixed block reward and transaction revenue were designed from the start as a single inseparable prize for miners. No exterior “subsidy” is added. Instead, this singular bundled good’s composition shifts over time with reward halvings and transaction market

evolution. This was not only an integral part of Bitcoin's original time-phased design, but also part of what defines what "Bitcoin" *is*.

**BC: What do you think about off-chain scalability solutions like the Lightning Network and sidechains? Are they viable alternatives to raising the block size limit?**

**KSG:** What I have discussed so far implies nothing *directly* yet for which traffic might best be conducted on-chain versus off-chain, but it does already put the question into a different light. Who is to judge this? The Politburo-style discussion about whether morning coffees ought to be bought on or off chain is just the kind of ridiculous result that always comes from politicization of market factors.

Such issues can only be settled well through market competition under changing real-world conditions. Entrepreneurs offer services. Different people come to use these services, often in unanticipated ways. Production costs, pricing, and relative pros and cons evolve for each option over time and also relative to each other option. In this way, what works best on chain will tend to happen there; what works best via centralized account-based services will gravitate toward them (as it already does to some extent); what works best on sidechains will tend to happen on them; and what works best in payment channels will tend to happen in them. But these are all *results* revealed over time through rivalry among functioning services as each competes against every other.

This is just where intervention measures can do serious damage. They *prevent* the best solutions and balances of solutions from ever being discovered. They distort the industry's development in wasteful directions. Some companies and user types benefit to some degree while others lose to a greater degree. The problem is, losses are often better hidden than gains. People can be fooled into thinking there has been a net gain for the "industry" or the "economy" when it has been a net loss instead. Smaller gains are visible while larger losses are invisible.

When I read the initial sidechains white paper, I immediately published a reply ([25 October 2014](#)) raising the issue of whether those coins would actually trade at par with on-chain bitcoin, especially in open circulation as opposed to narrower applications. I still think that is an open question to keep in mind. Payment channels are promising on this count to the extent they just sub-increment control of specified on-chain bitcoin among parties in an added value way. Building a *network* of payment channels, though, could easily add enough complexity that traders might also not treat those units as what are called "perfect substitutes," in the monetary-theory sense, for on-chain bitcoin. That just has to be seen in practice. And even *with* real user uptake, latent systemic risks can still build.

This topic reminds me of a classic line in the film, *The Social Network*, "If you had invented Facebook, you would have invented Facebook." The version here is, "if it was the same as on-chain bitcoin, it would *be* on-chain bitcoin." As soon as it is *not*



on-chain bitcoin, mental accounting costs, the possibility of additional delays, liquidity risks, narrowed flexibility of uses, systemic risks, security differences, and so on set up the possibility of those units being discounted relative to on-chain bitcoin (not trading at par). Just because software defines a *technical* peg, this does not also guarantee an *economic* par in the eyes of traders. It might happen or it might not; only real use can show that. Particular users have to come to see the benefits as *more than* outweighing the risks of use, plus they have to overcome decision and research costs, including whether to even bother to consider the matter at all.

One should recall again here that basically every expert was convinced Bitcoin would *fail*—until it didn't. But what is the flipside lesson from that? The flipside for something like the Lightning Network right now is that even if almost every expert thinks it will succeed, it might still fail—unless it doesn't.

A vital point for considering off-chain layers is that people must also continue to be able to use on-chain bitcoin directly. The “be your own bank” motto has been one source of Bitcoin's attractiveness, and with good reason. On-chain bitcoin is the closest equivalent in the Bitcoin sphere to the classical image of a silver or gold coin in one's pocket. This is the unit that has no *additional* risk from layered derivative systems, imperfect substitutes, credit expansion, inflation, “redemption,” waiting times, or counterparties.

An easy and ever-present opt-out path into on-chain bitcoin use is the top thing that can help keep off-chain options honest over time. It is that opt-out path that is most missing from conventional monetary systems. It is missing, of course, because it was removed!

**BC: There has been a battle between arguments for more on-chain traffic versus more off-chain traffic, but it sounds like you are suggesting another way to look at that?**

**KSG:** Yes, this is critical because many have argued that Bitcoin will need to evolve into a layered ecosystem with different services built on the main chain as the base protocol. I share the expectation that it most likely will to some degree, and in limited ways already has. But there is one big difference. Often in the background to this argument is an assumption that *therefore* the block size limit needs to be kept small to restrict on-chain traffic growth. But that is a completely different and additional claim. On the other hand, many seem to imagine that very high on-chain traffic (“Visa levels”) could eventually follow (for better or worse) without a block size limit. Not necessarily.

In a limit's absence, I would expect the actual block size to continue reflecting economic realities for the system and its many participants and contributors through a “decentralized” process capable of reflecting real (as opposed to modeled) pricing, costs, relay speeds, enhancements, and the full pros and cons of all “really

existing” competing transacting and storage options. None of this can be usefully “decided” in advance. These are all properties that should emerge from the relevant complex processes themselves. If the *real and natural* supply pressures of growth never come to be exerted on producers, the innovations to address them will likewise be far less likely to ever take place. Instead, industry evolution will be redirected on the basis of *imagined and modeled* supply pressures. Bitcoin will become perfect at coping with the balance of conditions in projected models and under arbitrary limits, but imperfect at coping with reality.

The best context in which any industry can develop is under authentic open competition among services as they come on line. Otherwise, we end up with people playing economic planner, “picking winners” (possibly including themselves), and so on. Just having that sort of thing present *at all*, though, has its own systemic costs that are easy to underestimate. Incentives are set up for a battle to control and shape this economic planning in one way rather than another.

When authentic economic signals operate, entrepreneurs provide better and cheaper services to end-users over time in a dynamic, adaptive process. Economic production tends to provide *greater* quantities and qualities of service, more *quickly*, and for *lower* prices, all in a way that accounts for real evolving production constraints “on the ground” from the standpoint of each participant.

The contrasting pattern is providing *lower* quantities and qualities of service, more *slowly*, and for *higher* prices over time. That pattern is ordinarily only seen in highly politicized and long-distorted pseudo industries, such as “education” or “healthcare,” or indirectly state-run companies or agencies. But we are now seeing this pattern creep into on-chain Bitcoin service provision allegedly to prevent some projected catastrophes supposedly sure to follow if “the market is left to its own devices.” We need to act now to “save the industry from itself.” We have to prevent “cutthroat pricing” that will “drive out the small producer.” That is the ancient interventionist refrain, repeated so many times it is hard not to start singing along. What I call “the argument from repetition,” just saying the same thing over and over regardless of truth value, sadly remains one of the most powerful persuasive strategies.

It is also important to realize in this that off-chain solutions also compete *against* on-chain transactions, that is, against miners—though there are also synergies. Some transactions conducted off chain might have been conducted on-chain instead. That is a substitution competition. Conversely, if opening and closing payment channels produces new demand for on-chain transactions that *would not have otherwise* happened on-chain, then that is a synergistic effect for miners. Meanwhile, rising use of both on- and off-chain options can lift bitcoin purchasing power, a positive for miners either way. Against this unpredictable mix of synergy and competition, a policy that limits miners’ ability to compete against off-chain options is distortive. If one industry segment is hobbled and this benefits another industry segment, this creates economic waste on balance and end users lose.

There are claims, which I have not assessed, that the Lightning Network might be able to deliver millions of transactions at almost no fee per transaction. That sounds rather unlikely at first glance, but if it were the case and people started using it in that way, it would produce on-chain traffic to open and close channels, but at the same time, on-chain Bitcoin transacting would soon look rather slow and expensive in comparison, especially with total supply restricted. That means the services miners provide for their revenue would look rather slow and expensive in comparison. Yet these same services are to produce the mining revenue that is to gradually displace, and some day replace altogether the fixed block reward.

So amid talk of protecting miners, there has in fact also been a push in favor of both: 1) limiting miners' ability to compete for revenue against off-chain services and 2) developing competing alternatives that are supposedly far faster and cheaper than miners' own services. With that, one can already begin to envision a future round of modeler-planner-interventionist calls to "do something" about on-chain volume, but this time the other way. Before long, we might start hearing that "We need to get more transactions on-chain! Support the miners!" I would not even be surprised, given the many similar ad hoc unprincipled swings visible in regulatory history.

Likewise, we hear that there will be "too few" distinct miners and an "underproduction of security" for the network based on various models. Sometimes the goal seems to be to protect smaller miners, but then the next minute, it is suddenly to "protect" the largest miners of all (currently in China) because they happen to have slower internet connections! If one were interested in "decentralization," it might not be wise to protect the existing market *leaders* in one of the only areas they currently have a competitive disadvantage.

**BC: If the block size issue becomes irreconcilable, is it realistic to assume that another cryptocurrency will be able to break Bitcoin's network effect and create a mass exodus?**

**KSG:** I do not think much dire is likely to happen if the limit stays in place for awhile. Probably the worst short-term result is the increase in politicization and the uncertainty that this injects into the market. Some traffic that might have happened on-chain will simply never be seen. That said, after spending several years wading into and out of every kind of FUD pond while researching Bitcoin, this is the first issue that has left me with some lingering concern. It's not an all-or-nothing concern, but a "this is worse rather than better" type concern. The risk is of Bitcoin being turned partly into a mixed-economy coin *from within now*, motivated by fear of it possibly, maybe, being turned into a mixed-economy coin *from without later*. These fears are based on modeling of an alleged "underproduction of security," which looks just like an entire genre of doomsaying based on too-simple analyses. Trying to prevent some projected scenarios with a measure that has its own definite current negative effects easily turns into a Faustian bargain.

When it comes to complex systems such as an economy or climate or even stock markets, predictive modeling is notoriously unreliable. Indices and monkeys can often beat stock predictors. The “present trends” in the typical doom narrative almost never “continue.” And doomsayers are not well known for looking back to objectively examine the entire scope of their past failed predictions. Millenarians waking up to a still-existing world just brush it off, reschedule their exact world-end date, and move on. This is the valuable function of sites that track, for example, the ever-growing list of Bitcoin obituaries. Another such site might track warnings of impending 51% attacks that were never conducted by now defunct mining pools.

The Bitcoin phenomenon does have aspects of product and of service, yet important aspects of it also constitute markets. The product and service aspects ought to be fine-tuned, optimized, and managed from engineering and business standpoints. But the specifically market aspects, which show up as prices and industrywide quantities supplied, ought to be left to users and service providers to work out over time through authentic competitive innovation processes driven by reality more than by inevitably partial and always suspect projective modeling of complex systems. It has been easy to see that bitcoin trading is a market—it is a textbook example of one—but transaction-inclusion is a separate emerging services market, one that has, at this still quite early stage, remained subtler to perceive and consider as such.

**BC: Thank you very much. Anything else in conclusion?**

**KSG:** Too much emphasis in this debate has been diverted onto people and groups, although this is also all too common in other fields. There are arguments from authority, arguments from credentials, and arguments from so and so said this or that. I listened to an interview related to the block size limit awhile back and guessed that about 90% must have been about personalities and credentials. So I went back and examined the time stamps, and it was worse. Only 4.6% of the recording concerned substantive evidence and logic on the topic.

So it is important to continue making an effort to return to ideas and the content of arguments; not *who* is making them. Keep leaving behind the *who* and returning to the *what*. That is also a discipline to practice, a discipline essential to civilization.