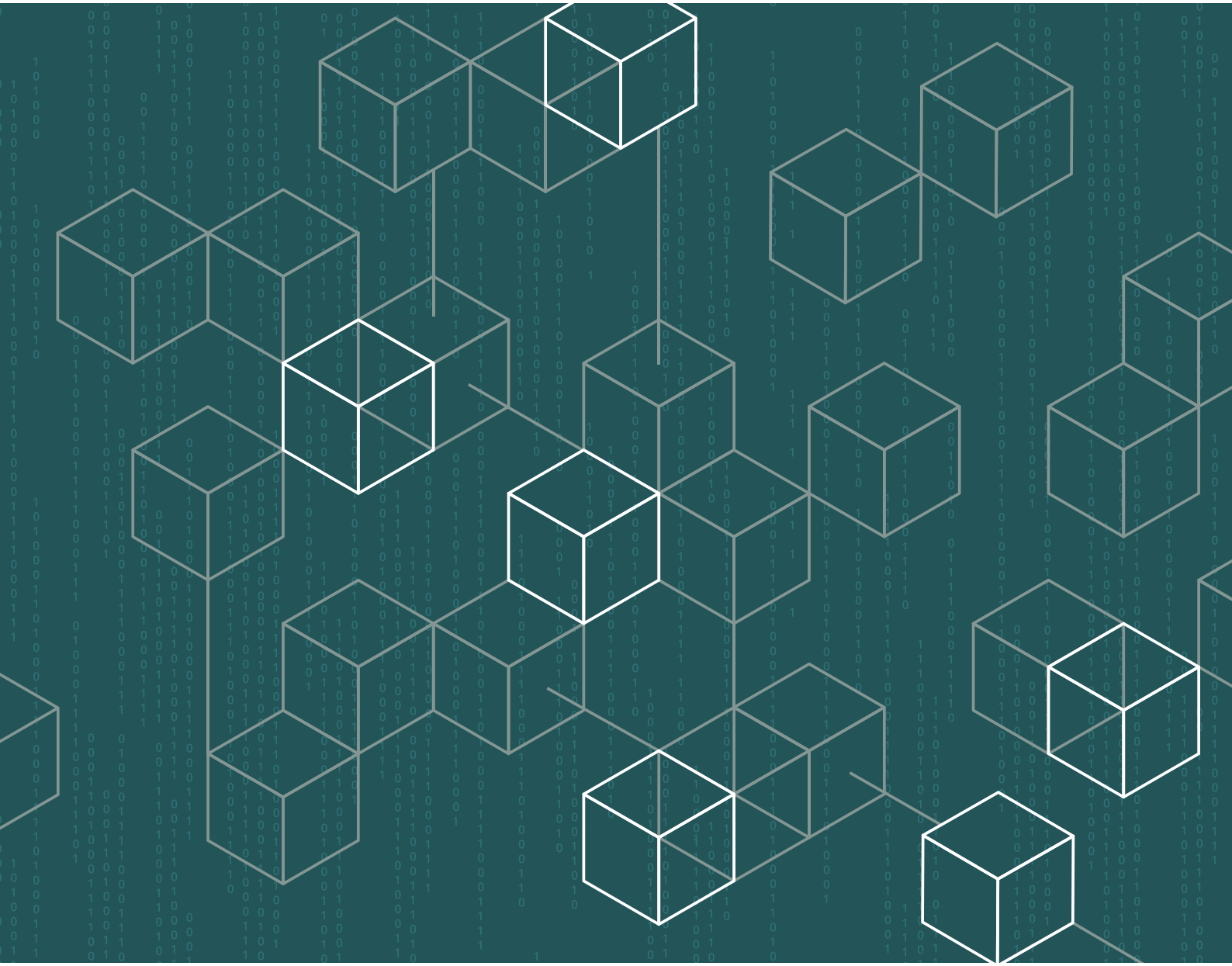
Antitrust and the trust machine



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Foreword

Blockchain is an exciting technology with great but as yet unfulfilled potential. For competition and competition policy, it offers a number of promising opportunities, which agencies will wish to explore. However, from the standpoint of antitrust law the concerns remain the same. This paper explores the platform nature of a blockchain, how pricing on a blockchain works and how the blockchain fits into the supply chain. It considers the risks of anticompetitive behaviour by the blockchain, by users of the blockchain and of anticompetitive behaviour being directed towards the blockchain. It also sets out a range of possible opportunities that arise from the adoption of the technology.

The paper argues that agencies should focus on the development of private permissioned blockchains, and specifically that they explore the design protocols of such blockchains and consider offering guidance and asking to participate as a node on these networks. It suggests that the second area of focus should be the risk that blockchains, particularly start-ups and decentralised permissionless blockchains, are excluded, either through foreclosure or acquisition by dominant incumbents, or as a result of successful lobbying for disproportionate anti-competitive regulations. However, as is the case for many new technologies, the first step for agencies should be exploratory market studies, such as those recently undertaken on big data and algorithms, to understand the nature of the technology and the risks and opportunities that it poses. The OECD's pioneering work on the implications that blockchain technology has for competition law and policy offers a good place to start.

This report contributes to the work of the OECD Blockchain Policy Centre which provides a global reference point for helping policy makers to address the challenges raised by blockchain and DLT and to seize the opportunities it offers for achieving policy objectives. For more information, visit www.oecd.org/daf/blockchain.

1 Blockchain Technology

Blockchain technology offers an alternative to traditional technologies or business models that build trust amongst different parties. In essence, it offers trust, without the need for a trusted third party. This could be trust in a transaction (that the same amount left one account as arrived in another, that the sender agreed to it, and that the funds used are unique and were not double-spent); trust that a conditional contract will be automatically executed (without dispute); or trust that a product comes from where a user says it came from.

Contrary to some accounts, it does still require third parties, however these third parties are decentralised and so each is non-pivotal, and incentivised by the rules (or protocols) of the blockchain to validate truthfully, so users do not need to trust them. Without the need to trust intermediaries who have invested in building reputations for not being opportunistic (either through word of mouth or rate and review mechanisms), you remove the need to rely on - and hence to pay a premium for - their services. However, the role played by third-parties, and the level of trust placed in them, can vary depending on the type of blockchain. In this respect, it is useful to distinguish between permission-less and permissioned blockchains.

1.1. Permission-less blockchain

In its 'permission-less' conception, anyone with the right equipment can become a validator and so the number of validators can be numerous. Meanwhile the identity of users is pseudonymised so that validators cannot easily identify an individual user, though anybody can observe the actions that have taken place on the blockchain between these pseudonymous parties.

This removes the traditional need to hire a trusted third party (e.g. a notary), or to cover the transaction costs incurred by multiple agents (e.g. acquiring and issuing banks) to verify an action.[1] Instead, the action can be collectively verified by the crowd of validators, who do not know the participants, and who are unable individually to determine the decision to verify. That decision is instead taken on the basis of a degree of consensus across the crowd. This means that to subvert the verification process requires a conspiracy amongst huge numbers of validators. Validators are typically compensated for their work with a mixture of transaction fees and new tokens that are created and used as the platform's currency (the total number of which are determined by the protocols of the blockchain).

1.2. Permissioned blockchain

In an alternative 'permissioned' variant of the technology, restrictions on who can be a validator are applied by a controlling firm or consortia of firms. This leads to a smaller pool of validators, but perhaps individually these are more trusted, at least by the controlling firms. It therefore reintroduces the need for a degree of trust in the third party and so potentially increases costs, relative to a permission-less blockchain.[2] The need for near consensus across the pool of validators may also be relaxed, potentially leading to a single validator verifying the action of two pseudonymised users.

In contrast to its permission-less variation where access to the blockchain's history is open to anybody (public), in a permissioned blockchain this may be restricted to defined users (private) or remain public. However it should be noted that in both public and private variations the detailed contents of the transactions, that is, not the meta-data, might be encrypted to provide greater privacy (leaving validators to undertake so-called 'zero-knowledge proofs').

As an example, the Libra blockchain that has been developed by Facebook is a permissioned but public blockchain (originally with plans to become permission-less in future, though these have now been abandoned). Users will be pseudonymised but transactions will be transparent. The consortia operating Libra at launch included Uber, Lyft, Spotify, Visa, Mastercard, Paypal, Ebay, Vodafone, and Booking.com/Priceline.[3]

2 Key features of blockchains from a competition policy perspective

2.1 Blockchains as Platforms

Blockchains should be seen as platform products that compete to attract both users and validators. The success of any blockchain therefore relies on its ability to attract users, who use the blockchain to validate actions, and to attract validators, who collectively do the work of validating those actions.

In the case of permission-less blockchains the pool of validators is potentially vast, while in contrast, permissioned blockchains will be looking to attract more trustworthy validators. In this sense, they are not open to all; like say Airbnb, but rather, like a luxury hotel-booking platform, they look to attract 'premium' sellers.

As in any other digital platform, a blockchain therefore has to set terms that are attractive to both groups in order to get them on-board. For example, the security, price and speed of verification must be attractive to users, and the rewards for verifying must be attractive to validators. Cross-platform network externalities are likely since more users increase the value of the platform and its tokens, and hence increase the rewards to validators, while more validators increase the security and speed of the verification process, and keep down the verification price for users. As in other digital platforms, this price may be near zero (provided there is sufficient competition between validators).

As with other multi-sided platforms (e.g. ride-hailing services), each blockchain platform may compete with other platforms with the same application, or with non-platform alternative technologies that have the same application**.** These markets may often be intermediate product markets within a supply chain that final consumers might be unaware they are using (as has become the case with Linux-based operating systems). From a competition perspective, what matters is the users' and validators' view of the substitutability between these different technologies. It therefore does not follow that there is a specific market for blockchains, or that a blockchain will comprise its own separate market, since different blockchains can be suitable for different applications, where they may compete with non-blockchain technologies that final users consider meet the same needs.

2.2 Pricing

At the start of a blockchain's development, validators are paid with newly minted tokens and a transaction fee. The protocols of the blockchain may ensure that the newly minted tokens are plentiful in the early days when it is important to attract validators without discouraging users by setting high transaction fees to fund the recruitment of validators. However as the supply of newly minted tokens ends (as in bitcoin), or becomes restricted to a small release each period, the balance of validator income will shift towards transaction fees.

As a platform, the balance of pricing between users and validators is particularly important to a blockchain's success. For example on Bitcoin, users post a transaction price that they are willing to pay to validate their transaction. They can observe transaction prices that other users have posted in order to make sure their posted price is sufficiently attractive to be validated within a timeframe that meets their needs. For example, urgent transactions can be posted with higher fees to ensure they are validated quickly.

In order to raise prices, validators therefore need to either change this price-setting process by changing the protocols of the blockchain, or to (collectively) refuse to validate low priced transactions. When validating capacity is limited, low-margin transactions will not get validated, and after a period will get dropped. This can raise the price. However, artificially limiting capacity will be much more difficult, since it will require co-ordination amongst validators. It is worth noting however that permissioned blockchains might decide to use centralised price setting mechanisms instead of this bidding mechanism.

2.3 Blockchain in the Supply chain

It may also be helpful to think of the role of a blockchain platform within a supply chain. In addition to the users and validators on the platform, there are also inputs that are required for a blockchain to operate, for example developers that sell validating software or hardware to the validators. Validators then use the blockchain platform to sell verification services to users of the blockchain. These users might be final consumers (in the cases of cryptocurrencies), but equally they may be firms that use the blockchain as an input to their product or service which they retail to final consumers (for example, developers of applications that work on the blockchain). In permissioned blockchains, many validators may also be firms that use the blockchain to deliver services in downstream retail markets.

Competitive analysis of the impact of blockchain technology may therefore require us to examine upstream input markets, and downstream retail markets, in addition to the market on which the blockchain platform itself competes, as well as the interlinkages between them.

In considering the implications for competition law, it is therefore useful to distinguish between actions by *users* of the blockchain (e.g. firms competing in downstream markets); actions by *those that control the protocol* of the blockchain; and actions by *those that sell inputs to* the blockchain (e.g. developers of validation hardware/software). Naturally, actions by rivals to the blockchain may also be of interest.

3 Risks of anti-competitive behaviour by the blockchain

The nature of blockchain technology creates a number of risks in regards to anticompetitive behaviour by those that control the blockchain.

Firstly, in cases where blockchain-based business models successfully disrupt non-blockchain models, the cross-platform network effects might be expected to give one blockchain a degree of market power. As is familiar, the argument here is that users or validators struggle to co-ordinate switching to better value platforms that preserves the network effects they obtain from their existing platform.

However, for this to be of any concern for competition law would require that those that control the blockchain can in fact control (raise) its price, or execute a foreclosure strategy, or reach a collusive agreement in order to allow it to raise price. If instead the blockchain is uncontrollable then it is strategically impotent.

3.1 Market power and enforcement against permission-less blockchains

Permission-less blockchains both compete in, and are in effect, governed by markets. They have no formal governing body. Rather they exist as decentralised organisations, their governance controlled in effect by the validators that vote on whether to adopt the protocols that are proposed by developers and which then define the decision-making of the blockchain, rather than alternative protocols that would create a fork in the chain. These validators are therefore responsible for the service that the blockchain offers to the market.

However, these validators are numerous and their identities are pseudonymous. This means that, as a practical matter, it is extremely difficult to change the behaviour of the blockchain, since forcing the adoption of a protocol requires a degree of consensus amongst the validators of the chain. In effect, permission-less blockchains might therefore be seen as a huge employer-owned mutual (e.g. John Lewis), that can propose motions and vote on the firm's detailed decision-making, while being unable to delegate decision-making to a board, nor even to recognise one another.[4]

Now, although we liken this governance framework to a market, the validators would appear unlikely to be considered to be independent contractors (as for example is claimed in the case of ride-sharing platforms), since they follow strict protocols in the gig-work they do for the blockchain. If they are workers or employees they would not face the risk of being accused of colluding with one another, however, this is being tested in the United American Corp. v. Bitmain, Inc. complaint.[5]

In a sense, they might be seen as a gig-working co-operative who collectively determine the blockchain's offer to users (like Partners in a law firm), while individually having to follow the collectively determined protocols (like drivers on a ride-sharing platform). Like an oversized board, they may try to agree on the price that should be set. However, as noted, the prospects of countless pseudonymous validators successfully agreeing either to boycott validation of low-margin blocks, or to adopt new 'price-raising'

protocols, appears far-fetched. Permission-less blockchains may therefore be seen as platforms which might potentially hold latent significant market power, but which are incapable of exercising that power.

As such, competition agencies would be well-advised not to spend time worrying about decentralised permission-less blockchains. Indeed, this form of blockchain offers a number of reasons for competition advocates to be cheerful (see Pike & Carovano, 2020).[6] However, a caveat to this is that if – and it is a big if – if, somehow, a decentralised permission-less blockchain were to engage in anticompetitive behaviour, then big questions on practical enforcement arise.[7]

Firstly, how would you punish an entity with no assets, no bank account, no office, and such a large and pseudonymous board? Secondly, how would you stop the anticompetitive behaviour that was identified? Who would you instruct to change their behaviour. These would be extremely challenging questions. However, for now at least, they appear to be theoretical and not practical problems.

A more likely concern is that validation of a permission-less blockchain may over time lose its decentralised nature and instead become highly concentrated. In that case, the co-ordination problems on setting prices that we identified might become significantly less challenging. A validator with a high share of validation capacity, for instance, one that employs thousands of validators in order to operate what is known as a 'mining-pool' might then be able to change protocols to raise prices, either unilaterally, or through co-ordination with a small number of other validators. Competition agencies may therefore wish to keep an eye on the degree of concentration of validation capacity on any permission-less blockchains that would hold market power if they were centrally controlled.

In addition, this loss of its highly decentralised nature would mean that a permission-less blockchain with a concentrated list of validators starts to resemble a permissioned blockchain with a small list of validators. Fortunately, however, in such circumstances the blockchain's highly concentrated nature would also make identification and enforcement against the small number of validators easier, as is already the case for the permissioned blockchains to which we now turn.

3.2 Market power and enforcement against permissioned blockchains

Like firms with a traditional corporate structure, permissioned blockchains are operated by a single, well defined, centralised entity (or consortia of entities) that has developed the protocols that govern its actions. These therefore embody the traditional paradox that firms that compete in markets are governed by hierarchical command and control (non-market) mechanisms.[8]

This means these blockchains are perfectly capable of exercising any market power that they have. Indeed we might expect that there would be particularly strong network effects in the increasing number of 'industry' blockchains that are being formed by consortia of upstream and downstream firms that serve a certain market (see for instance those in shipping or diamonds) or that serve a broader set of markets (for example in the case of Libra).

In contrast to permission-less blockchains there should not be the same enforcement challenges in these cases. This is because there is both a centralised governing entity and a list of permissioned validators, and so it is therefore clear where a competition agency would need to direct any enforcement action that it needs to take. Such action might be required in a host of familiar situations, which we consider in the following sections.

3.3 Exploitative abuse of dominance by permissioned blockchains

If an industry blockchain were to set excessive transaction prices, these might potentially be challenged as an exploitative abuse of dominance. Agencies would then face the classic unanswered question of what constitutes an excessive price.

Equally, if excessive prices were identified within a market investigation they might trigger a recommendation or a direct intervention by a competition agency (if the agency has a market investigation regime that provides it with the power to act to resolve the problems it identifies). For example, the application of consumer facing remedies, an ex-ante regulation, or measures to ensure competitive neutrality and hence a level-playing field.[9]

3.4 Exclusion by permissioned blockchains

Alternatively, exclusionary theories of harm might include predatory pricing that forecloses a rival blockchain (or a rival alternative technology). Though here it should be noted that since blockchains are a platform, price-cost tests are not fit for purpose (see OECD, Rethinking Antitrust Tools For Multi-sided Platforms, 2018). Instead, a no-economic-sense test in which the rationality of the pricing structure in the absence of any impact on rival volumes should be used.

Loyalty or exclusivity rebates might also be offered to validators (or users) to raise rivals' costs by denying them scale. Alternatively, tying or bundling of the blockchain with other products or platforms in which the firm is dominant might be used to foreclose rival blockchains or other firms.

Consortia may also adopt measures to prevent users from porting their historic data stored on the blockchain (e.g. on their reputation) to rivals, or measures to prevent the development of interoperability between the blockchain and rivals. For instance, OECD's hearing on the topic was told that portability between blockchains would be highly desirable but seemed unlikely to emerge organically.[10]

Consideration would also need to be given to the possibility that the consortia might exclude *downstream* rivals. For instance if an industry blockchain were to become a standard, or an essential facility for firms operating in that industry, then the consortia that control it might refuse to deal with downstream rivals, or engage in discriminatory pricing that raises their costs and applies a margin squeeze. Each of which might in certain circumstances reduce competition in downstream markets. For instance, Uber and Lyft are consortia members of Libra, and might therefore come to decide upon the price to charge a rival ride-hailing application for adding Libra as a potentially cheaper payment option on the rival app.

3.5 Collusive conduct by permissioned blockchains

There would also be a risk of collusive agreements. For instance, as in any joint R&D project there is the risk that the meeting of rivals through the blockchain consortia might facilitate information exchange or discussions that affect price-setting behaviour outside the blockchain (or in downstream markets).

Alternatively, the consortia might collude with other blockchains or non-blockchain based firms to divide markets by geography or by type of application, or to increase transaction prices or slow the speed at which the blockchain operates. In particular, it is notable that common ownership concerns that are causing such concern in the case of institutional investors, may also arise in relation to consortia-based blockchains such as Libra (in which Visa and Mastercard were each founding members as well as potential competitors to the project prior to their exit).[11]

3.6 Conclusion

Are any of these theories new? No. They are entirely standard concerns that competition agencies already investigate in all manner of different market settings involving other types of technology. However, given the nature of these risks, competition agencies should certainly focus their attention on behaviour by permissioned rather than permission-less blockchains. Indeed, to ensure that they can examine permissioned blockchains when necessary there is good reason to look at the possibility of agencies having their own node by which to access such permissioned blockchains (see section 6.4).[12]

4 Risks of anti-competitive behaviour by *users of* the blockchain

We now turn to the risks of anticompetitive behaviour by users of the blockchain. For example, firms using (but not controlling or validating) blockchains may find that blockchains offer helpful ways to facilitate anticompetitive behaviour in the markets in which they compete.

The first reason is that a blockchain offers a cheap and reliable way for firms to commit to a course of action (e.g. to pay a lump sum to a third party) in the event that certain criteria are met. As noted a pool of validators can then validate that the criteria have been met and the action has been completed. Such agreements are referred to as smart (automated) contracts.

These commitment devices can be useful for procompetitive purposes, for instance, to resolve holdup problems (or to verify the absence of free riding which might otherwise require vertical restraints with anti-competitive as well as pro-competitive effects). However, they might also allow firms to soften price competition. For example, they might allow a firm to commit to a price point by making it costly for the firm to move away from that point unless certain criteria are met. This might therefore be helpful for firms wanting to use 'low' price guarantees (which might not be particularly low), most-favoured-nation clauses, or across platform parity agreements to co-ordinate pricing in oligopolistic markets.[13]

Such a commitment device might also help colluding firms to commit to a punishment mechanism for those firms that deviate from a co-ordinated outcome. They might also help to monitor and verify movements in other factors that drive pricing decisions, and which might otherwise disrupt explicit or tacit co-ordination (for example, weather patterns or input prices); or to make side payments. In each case, the blockchain may improve the stability of the co-ordinated outcome, and thus make collusion a more profitable and less risky strategy.

The second reason why blockchain may facilitate anticompetitive behaviour by users is the greater trust in the authenticity of transactions and their price on the blockchain. This provides colluding firms that use the blockchain with better visibility and confidence in the veracity of any deviations from the collusive outcome that occur. Similarly, the availability of trusted transaction price information on the blockchain (rather than listed prices), might improve firms' ability to use algorithms to set prices in a tacitly co-ordinated fashion.

It has also been noted that in the case of permissioned blockchains, an explicit agreement might, with consensus, be irretrievably erased when it ends (and that process might be automated through a smart contract).[14] This might eliminate evidence of past cartels and reduce the relative payoff to claiming leniency.

These theories are again not new. However, the additional possibilities created by blockchains might increase the risk of firms reaching and sticking with explicit and tacit collusion outcomes. To the extent that these risks are also increasing as a result of developments in artificial intelligence and algorithmic price-setting (see OECD, 2017) this may point towards a need to recognise additional 'plus factors' that would allow an inference of tacit collusion. For instance, the existence of price guarantees backed by blockchain.

5 Risks of anti-competitive harm to blockchains

There are also risks of blockchains suffering from anticompetitive behaviour. For instance, oligopolistic input sellers of validating hardware or software might co-ordinate to raise transaction costs on one blockchain (potentially benefiting rival blockchains or technologies). For instance, the firm Bitmain, which is estimated to provide more than 70 percent of tailor-made Bitcoin-mining hardware, has had to defend itself against accusations that it worked with others (perhaps collusively) to foreclose the Bitcoin SV blockchain in favour of the Bitcoin ABC blockchain.[15]

Another possibility is that incumbents in downstream markets or in rival technologies might seek to exclude potentially disruptive new market entrants or early adopters of the technology. This might, for example, involve lobbying for excessive and disproportionate regulation of the technology. The OECD Competition Assessment Toolkit provides a useful framework for thinking through these questions, and for example notes that policymakers should take care to consider the possibility of such rent-seeking when developing regulations of new technologies. In particular, it suggests that they should ensure that consultations with industry involve new and potential entrants, and users, and not only established incumbent firms.[16] As in other areas, regulatory sandpits may prove helpful for developing the necessary and proportionate regulatory requirements for these new technologies and businesses.

Alternatively, rivals might use anti-steering clauses of the type that have been found anticompetitive in the US in healthcare cases (see Charlotte Mecklenburg Hospital Authority), and by other jurisdictions in credit card markets. These can allow dominant credit card firms to prevent merchants steering consumers towards the use of payment methods with lower transaction cost (of which blockchain will be one) by reflecting that cost in the retail price that consumers pay. While the use of such agreements by American Express was controversially supported by the US Supreme Court, the more recent decision in hospitals suggests these clauses are still generally problematic where the platform has market power (regardless of the specific market definition adopted).[17]

6 Opportunities from blockchain technology

Like many new technologies before it, blockchain creates an opportunity to reduce prices, improve quality, and disrupt the market power of incumbent firms. It is a general purpose technology that has multiple uses and hence the potential to impact a wide range of markets. While the most popular applications of blockchain have thus far been in the financial sector, the technology may substantially affect numerous other sectors, including legal services, notaries, data storage, energy and transport. Indeed, it is already being used to improve global supply chains, and pilots are underway on its ability to authenticate the ownership of intellectual property rights, land rights, identity data, health records, online votes, pollution certificates, search query data, stock, pensions, insurance schemes and many other assets.

6.1 Reducing transaction costs

Underlying this broad range of potential uses is the way in which a blockchain platform can create an efficient 'marketplace' of validators that cost a fraction of the price that trusted intermediaries are currently able to charge for their services. It is true that the issue of the energy required to power permission-less blockchains still needs to be solved (one existing blockchain currently absorbs the average daily power usage of Austria).[18] However, if a solution is possible, then the magnitude of the reductions in transaction costs will challenge both existing payment systems and existing intermediaries, creating opportunities for new entrants to thrive.

In addition, this reduction in transaction costs in downstream markets may facilitate the adoption of new business models. For example, by allowing smaller firms and specialists to set themselves up as viable businesses to whom larger firms outsource work or functions, rather than keeping it in-house.

6.2 Clashing with the tech titans

One possibility that has been predicted by some is that blockchain will disrupt and replace the leading digital platforms. The two most interesting articulations of this theory are driven in the first case by the tokenisation process that many blockchains adopt, and secondly by the potential that blockchains offer for practical steps that improve users' control of their data. We explore each of these below.

6.2.1 Tokenisation

The first version of this theory is that the offering of free tokens offers a costless way for new entrants to reimburse users for the value of the network effects they bring to the platform.[19]

Indeed ideally, blockchains might seek to design protocols that target additional token-drops at influential users as they grow, for instance to target the points on the 'S-curve' of network adoption where a platform can take off or run out of steam. However, to do so early adopters would need to be willing to take a long-

term view and water down the value of their own tokens in exchange for the uncertain prospect of the blockchain's growth.

This is an interesting addition to the entry strategies of a new entrant facing a dominant platform. In a sense this recognises that the tokens are investment securities that are being awarded with a view to the future value of the blockchain. However, it is also possible that a token simply offers a user a share of the added value that they are bringing to the network, and hence is not a speculative investment instrument any more than a discount for referring your friends and family would be. Nevertheless, given the move towards regulating ICOs as securities along the lines of stocks, bonds and derivatives, we might in any case expect that the issuing of tokens by start-up blockchain platforms will quickly cease to be the simple process that it has been.

6.2.2 Creating a decentralised alternative to digital platforms

A second theory is that decentralised blockchains may offer an alternative to centralised digital platforms. It is certainly possible, for example, that the trust generated by a blockchain might mean that alternative trust building mechanisms such as rate-and-review systems may become obsolete. For example, where validation by a blockchain provides confidence in the authenticity of a product, or automates the pay-out of an insurance claim in certain circumstances, the need for a crowd-sourced review of the reliability of a seller might not be necessary.

However, blockchain technology does not itself offer the matching or searching algorithms that drive many of the important cross-platform network effects that power these platforms.

For example, the matching function in general search is the algorithm that matches your search query with a webpage, the matching function in hotel-booking is the algorithm that matches your search query to a hotel, and the matching function in social network or telephone network is the look-up that connects you to your friends/family. Without these matching functions, the user reviews offered by platforms are of little value. Therefore to really challenge the digital platforms will therefore require that applications offering this functionality are built on the blockchain.

If matching or searching applications that work on a blockchain are built by firms, this will risk simply reproducing the same bottleneck of access to the user that the existing platforms enjoy. Therefore, as Pike & Capobianco (2019) have explained, to successfully challenge the platforms, a permission-less blockchain will need to develop within its protocols an application with that functionality.[20] If this were possible, it would remove the bottleneck, or at least the market power over that bottleneck (for the reasons described in section 3.1).[21]

Such an application might be less nimble than corporate operated platforms, due to the potentially difficult process of changing the protocols on a permission-less blockchain. However, the efficiency advantage that it derives from being able to operate without a rate-of-return target that is comparable to a firm might nevertheless enable it to thrive and access the same valuable network effects that private platforms enjoy (see for example Wikipedia as discussed by Mason, 2015).[22] Pike & Carovano (2020) expand upon why decentralised permission-less blockchains might offer the prospect of radical pro-competitive and inclusive efficiencies, and hence might contribute to a pro-competitive industrial policy.

6.2.3 User control of their data

Another potential threat to the market power of digital platforms is that blockchain might facilitate the sale of data, and thereby break the zero-price floor that has protected many digital platforms from being undercut by new entry. For example, blockchains like that of the Tide Foundation allow users to store their data and to limit access to it to those that pay for it. This allows the data to be organised and sold directly to advertising agencies that want to target their advertising, or to firms that want to train a pricing algorithm,

or to firms that want to implement a pricing algorithm (the functioning of which requires personalised identifiers in order to produce a personalised price).

Moreover, consumers might use blockchains to jointly sell their data via data unions that manage and monetise the collective data that consumers create.[23] To facilitate the growth of such unions, they might be constituted as civil society organisations rather than as commercial intermediaries, and membership might be by opt-out consent. This joint selling via blockchain might then allow consumers to extract the value of the large externalities that are created when data is combined. This value presently accrues as advertising revenue for those platforms that receive the data in exchange for 'free' products. However, by bypassing these platforms, users might obtain that income for themselves. Perhaps providing a component of a broader universal basic income.

Users may of course sell their data without a blockchain (see for instance the Solid initiative).[24] A blockchain might however help in a number of ways. First, it might give both parties confidence in the uniqueness or exclusivity of the access to the data that is sold (or in the number of licences to that data). It might also require any other firm that wants the data (or a piece of it) to buy permission access from the holder of the data account in exchange for a micropayment.[25] Similarly, it might allow consumers to offer compensation should they later sell additional access to the data (thereby raising the initial price). If limits can be placed on the re-use of the accessed data (e.g. it is non-duplicable and self-erases after a specified period), it might even prevent a recipient of the data from running further analysis on the data without again compensating the user (again potentially using micropayments to keep the transactions economically worthwhile).

6.3 Innovative remedies

Commercial products such as those discussed above might come to market themselves. However, where market studies identify that competition is not working well in digital markets, competition agencies may consider proactively facilitating or sponsoring the development of such products in the same way that the development of Open API standards in banking has been driven by competition agencies like the CMA.

Similar innovative remedies might include removing regulatory barriers to the use of blockchains to set-up trusted automated (robo-) switching services. This might for example include the switching of electricity accounts when the price is no longer the best available on the market (e.g. Flipper). These are already available without blockchain technology, but as with a price comparison website require a user to trust that the service is effective in its monitoring of market prices, and that it automatically switches on the basis of prices and not commissions. It might also work for services that switch social networks, search engines, browsers, or music streaming website when a sufficient number of friends and family make conditional decisions to make the same switch, or when a different provider with the same functionality offers a larger payment.

6.4 Ways of working

A final opportunity from blockchain is the potential for competition agencies to innovate in their own ways of working. For instance, the development of industry blockchains may offer an opportunity to competition agencies to improve the effectiveness and efficiency of their investigations. Agencies with access to the blockchain might, as in the case of R3's platform, receive real-time information on the market at zero marginal cost to participants, allowing them to monitor markets, adherence to commitments, collect data for ongoing cases, and screen for suspicious patterns.

7 Conclusion

In conclusion, blockchain is an exciting technology with great potential. For competition and competition policy, it offers a number of promising opportunities, which agencies will wish to explore. However, from the standpoint of antitrust law the concerns remain the same as in traditional markets. Agencies will therefore need to continue to apply their theories of harm, and to focus on understanding rivalry, substitutability and control of competing products.

We suggest that agencies should focus on the development of permissioned blockchains, and specifically that they explore the design protocols of such blockchains and consider offering guidance and asking to participate as a node on the network. The second area of focus should be the risk that blockchains are excluded, either through foreclosure or acquisition by dominant incumbents, or as a result of successful lobbying for disproportionate anti-competitive regulations.[26] However, as is the case for many new technologies, the first step for agencies should be exploratory market studies, such as those undertaken on big data, to understand the nature of the technology and the risks and opportunities that it poses. The OECD's pioneering work on this topic offers a good place to start.

Endnotes

[1] See the issues paper for the first groundbreaking *OECD Hearing on Blockchain and Competition Policy* (2018) https://one.oecd.org/document/DAF/COMP/WD(2018)47/en/pdf; the summary of discussion and the Executive Summary https://one.oecd.org/document/DAF/COMP/M(2018)1/ANN8/FINAL/en/pdf.

2 Though as noted in section 6.1 there are currently other costs associated with permission-less blockchains.

3 Visa, Mastercard, Ebay, Mercado Pago, Booking and Paypal all dropped out of the project in late 2019. Vodafone left in early 2020. Members of the consortia now include SOEs such as Temasek of Singapore.

4 Indeed the DAO and other decentralised autonomous organisations are an attempt to create an organisation enterprise governed by blockchain code and hence with no managers. These could potentially invest in and operate businesses including non-blockchain businesses.

5 See Konstantinos Stylianou: https://jolt.law.harvard.edu/digest/what-can-the-first-blockchain-antitrust-case-teach-us-about-the-crypto-economy and Constantine Cannon briefing: https://constantinecannon.com/2019/05/29/the-first-blockchain-antitrust-case-or-is-it/. However, whether they are employees or independent contractors, the point remains that trying to change the price will be extremely challenging.

6 Pike & Carovano, *Reasons to Be Cheerful: The Benevolent Market Power of Decentralised Blockchains*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3680600. Forthcoming, within Algorithmic Antitrust, Springer, 2020

7 Schrepel, Thibault, *Is Blockchain the Death of Antitrust Law?* The Blockchain Antitrust Paradox (June 11, 2018). Georgetown Law Technology Review 281 (2019).

8 As noted by Noah Philips (https://www.ftc.gov/public-statements/2019/05/competing-companies-how-ma-drives-competition-consumer-welfare) there can also be a market for corporate control, that is, competition for-the-firm.

9 See OECD work on Competitive Neutrality http://www.oecd.org/daf/competition/competitive-neutrality.htm.

10 This might suggest that there is value in agencies advocating for the development of standards for data portability and interoperability between blockchains.

11 For instance, Visa and Mastercard were each members of Libra while being potential competitors to it. The type of common ownership concerns that might arise in such cases could potentially be dealt with either through merger control, or through the proposals made by Elhauge, E. (2016) *Horizontal Shareholding*, 129, Harvard Law Review. 1267-1292 (2016), and Posner, EA., Scott Morton, F. & Weyl, GA, (2017) *A Proposal to Limit the Anticompetitive Power of Institutional Investors*. Antitrust Law J. 81: 669–728. Notably, Visa and Mastercard choosing to exit the Libra project reflects a decision to voluntarily adopt the proposal from Posner, Scott Morton, & Weyl to maintain competition by discouraging investors from betting on multiple firms in a single oligopolistic market.

12 Notably this is already the case for blockchains such as R3 as discussed at the OECD Hearing on Blockchain Technology and Competition Policy.

13 See OECD, 2015, http://www.oecd.org/daf/competition/competition-cross-platform-parity.htm.

14 Schrepel, Thibault, *Collusion by Blockchain and Smart Contracts* (January, 2019). Harvard Journal of Law and Technology.

15 See Konstantinos Stylianou, *What can the first Blockchain antitrust case teach us about the crypto economy?* https://jolt.law.harvard.edu/digest/what-can-the-first-blockchain-antitrust-case-teach-us-about-the-crypto-economy

16 See the OECD's 2019 Recommendation on Competition Assessment and its associated toolkit: http://www.oecd.org/daf/competition/assessment-toolkit.htm.

17 For instance, as set out in OECD (2018, Rethinking Antitrust Tools for Multi-Sided Platforms) it remains unclear how the transaction or non-transaction nature of a platform such as a blockchain would be of relevance to market definition, which is in itself a concept of limited value in the case of digital platforms.

18 https://www.theverge.com/2019/7/4/20682109/bitcoin-energy-consumption-annual-calculation-cambridge-index-cbeci-country-comparison

19 Catalini, Christian and Tucker, Catherine E., (2018), *Antitrust and Costless Verification: An Optimistic and a Pessimistic View of the Implications of Blockchain Technology*. MIT Sloan Research Paper No. 5523-18.

20 Pike, C. & Capobianco, A. *Antitrust and the Trust Machine* (2019) Competition Law & Policy Debate, October 2019, volume 5, issue 3, pp48-57, https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3487750

21 Provided that the decentralised blockchain remains decentralised and does not become concentrated over time.

22 See Mason, P. (2015) *PostCapitalism*, Allen Lane.

23 See Posner, E. A., & Weyl, E. G. (2018). *Radical markets: Uprooting capitalism and democracy for a just society*.

24 See Annex L, pp6-12, of the CMA interim report on the digital advertising market study, https://assets.publishing.service.gov.uk/media/5df9efa2ed915d093f742872/Appendix_L_Potential_approaches_to_improving_personal_data_mobility_FINAL.pdf.

25 Alternatively, the user might share the data willingly, for instance if the data was their healthcare record, and they were happy to share this with their own doctor and any doctor who might treat them.

26 This is not to rule out that there may be proportionate regulations with anti-competitive effects.

www.oecd.org/competition