CAN WEB3 BRING BACK COMPETITION TO DIGITAL PLATFORMS?

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By Christian Catalini & Scott Duke Kominers

Like the early Internet, blockchain and Web3 applications promise a new wave of decentralization and competition – yet at the same time, it is unclear which of the dynamics that drove concentration in online platforms and services will remain in force under the Web3 paradigm. In this piece, we highlight three fundamental costs that Web3 technology can potentially reduce: the *cost of verification,* the *cost of interoperability and portability*, and the *cost of composability*. We then explore how reducing these costs may influence the design of digital ecosystems, as well as the resulting market structure and competition.

01
INTRODUCTION

The Internet played a major role in decentralizing access to information and services, bringing competition and innovation back to many concentrated industries. At the same time, because of network effects and economies of scale, verticals such as communications, retail, media, and music have seen the emergence of Internet players with substantial market power. Like the early Internet, blockchain and Web3 applications promise a new wave of decentralization and competition – yet at the same time, it is unclear which of the dynamics that drove online concentration in the first place will remain in force under the Web3 paradigm.

In this article, we highlight three fundamental costs that Web3 technology can potentially reduce: the *cost of verification*, the *cost of interoperability and portability*, and the *cost of composability*. We then explore how reducing these costs may influence the design of digital ecosystems, as well as the resulting market structure and competition.

02
THE WEB3 PARADIGM

The key economic feature of blockchain technology is the ability to design digital platforms without assigning control – and market power – to a centralized intermediary.[2] Whether it's for sending value across the globe without relying on a bank or for matching the buy- and sell-sides of a digital exchange, blockchain-based protocols allow parties to coordinate with each other without having to write bilateral contracts or rely on third-party facilitation.

Web3 uses blockchain-based tokens to define new forms of digital ownership, record transfers of ownership, and create incentives for participants to perform actions that contribute to the growth and health of a digital ecosystem. This is fundamentally different from the structure of "Web 2" ecosystems (like on Twitter, Facebook, and Amazon Web Services), where the platform architect predominantly retains control of and ownership over key digital assets (e.g. users' posts, the social graph, and so forth), as well as the rules of participation and exchange, and the monetization models available to application developers.

On a Web 2 platform, creators, aggregators, and participants are not completely free to compete or invent – but instead often have to follow strict guidelines shaped by the platform architect.[3] This can be particularly problematic when the platform architect also competes with some of its market participants directly.[4] And because the platform itself owns key data assets and transaction infrastructure, users may have little recourse or ability to transition to other platforms – even when they are highly dissatisfied.

Web3 platforms, by contrast, are built as open protocols that anyone can interface with through a public blockchain. The underlying data and infrastructure are typically accessible to anyone and can be used, remixed, aggregated, or repurposed with substantially fewer restrictions. The open source community, through code, defines the rules of engagement – and, unlike with traditional APIs, nobody has unilateral control over which features are available to participants.

Openness also means that entities who want to build novel business models on top of Web3 tokens have more transparency and certainty about the rules of engagement, and are less at risk of hold-up by the platform architect. Once a feature is part of a Web3 protocol, everyone has access to it on the same terms, and changes require governance actions by the community of holders. While this process will be substantially slower than the decision-making process of a Web 2 company, it also ensures that a broader set of stakeholders and shareholders are represented.

Take the music industry as an example. Because replicating digital music is frictionless, in the early days of the Internet, artists and labels struggled to stop the uncompensated sharing of their intellectual property. Furthermore, by decoupling music from a physical artifact such as a CD or cassette, digitization made it impossible to own music in a form that was substantially different from the illegal copies – thus devaluing legal music ownership. The lower resulting price for music

2 See C. Catalini & J. S. Gans, "Some simple economics of the blockchain," *Communications of the ACM*, 2020.

3 E.g. the Apple Store Review Guidelines (available online at https://developer.apple.com/app-store/review/guidelines/; accessed January 20, 2022).

4 Amazon, for example, has replicated and scaled production of some of its third-party sellers' most successful products (see, e.g. K. Canales & D. Reuter, "Amazon systematically used third-party sellers' data to copy products and promote them to shoppers, despite saying otherwise, according to a new report," *Business Insider*, 2021) and influences consumer search through algorithmic recommendations, which often preference Amazon's in-house products (see, e.g. K. H. Lee & L. Musolff, "Entry Into Two-Sided Markets Shaped By Platform-Guided Search," Working Paper, 2021 – although as they note, the consumer welfare implications of this behavior are unclear, and may be positive at least in the short run).

tracks, combined with economies of scale in the process of acquiring licensing rights, tipped the music distribution market in favor of large players such as iTunes.[5] Two decades later, music streaming is highly concentrated, and companies such as Apple have been able to profoundly shape dimensions of the digital music market – ranging from pricing, to format,[6] to visibility of and terms with individual artists.

Web3 brings back, although in a novel form, the concept of ownership for digital artifacts such as songs. Now ownership of a song can be codified in the form of a token, and the token can become the basic economic building block for the funding, creation, and commercialization of music on an open online ecosystem. Early supporters of an artist can buy tokens encoding the artist's songs; this both supports the artist directly *and* helps other participants and aggregators discover the artist by observing the transactions. Tokens can be imbued with add-on features, such as early access to exclusive content or concerts. And the tokens can also be configured to accrue royalties automatically as the artist's music is played through streaming. While some of the same functionality has been implemented before on centralized crowdfunding platforms, in a Web3 ecosystem, these sorts of transactions can take place without relying on a centralized intermediary.

The tokens, in combination with smart contracts and the rules of the protocol, can perform all these operations programmatically. Furthermore, a variety of economic exchanges can be built on top of the tokens in a modular fashion. For example, when a song is remixed or used in a movie, the token associated with the new artifact could automatically share royalties with the piece it is "licensing." And the ecosystem could provide tokens as rewards for different types of measurable contributions, including reviews and referrals to new listeners.

03
THREE KEY COSTS AFFECTED BY WEB3

Like any new technology, the impact of Web3 will be shaped by the dimensions along which it changes the transaction costs of launching and operating businesses. As we highlight, there are three cost categories Web3 will particularly affect.

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The cost of verification: Web3 relies on distributed public ledgers, making the underlying information available to all participants and robust to error or misrepresentation. Web3 thus lowers the cost of verifying that a specific digital asset exists and following that asset's transaction history. Furthermore, Web3 allows anyone to independently verify the current or past state of a digital asset or participant without relying on a third party.

This is what allows for digital ownership to emerge: while a token in and of itself does not guarantee any offline rights, the ability to reach consensus among ecosystem participants about ownership status and related benefits makes it possible to define new types of digital property rights – and again, these rights are established without need for a third party. For example, anyone who holds a Bored Ape Yacht Club token can use that token to unlock access to exclusive discussion groups, events, and merchandise through the Bored Ape Yacht Club's website.[7] Similarly, anyone owning a song token could be allowed to stream it at any point in time on any device. Nobody has to "verify" the token holder's rights – they are embedded in the digital asset itself.

Moreover, the ability to audit digital information cheaply makes it possible to establish better reputation systems, build trust among otherwise disconnected parties, and write self-enforcing contracts. For example, a third-party investor in an artist would not need to worry about the enforcement of a royalty contract because that contract would be embedded into the publicly accessible source code. A low cost of verification can also help establish derivative reputation systems – for example, in order to assess an individual's talent in scouting new artists, one could check how often that individual bought tokens of artists who later turned out to be major successes.[8]

All of this means that Web3 stands to reduce our reliance on

5 See, e.g. the discussion of the rise of iTunes in D. Arditi, "iTunes: Breaking Barriers and Building Walls," *Popular Music and Society*, 2014.

6 For example, iTunes drove the unbundling of albums into individual songs (see, e.g. S. Knopper, "iTunes' 10th Anniversary: How Steve Jobs Turned the Industry Upside Down," *Rolling Stone*, 2013).

7 See the discussion in S. Kaczynski & S. D. Kominers, "How NFTs Create Value," *Harvard Business Review*, 2021.

8 See, e.g. the discussion in S. Kominers & J. Esber, "Decentralized Identity: Your Reputation Travels With You," *Future*, 2021.

centralized platforms and intermediaries with established reputations and/or institutional backing.

That said, blockchain technology on its own can only reduce verification costs for information that is already digital. At the interface between the offline and online worlds, new types of intermediaries will have to ensure that the information recorded on a distributed ledger is accurate, and, when needed, that it maps to additional legal rights such as copyright. In the absence of these intermediaries, last mile frictions are likely to severely limit where Web3 platforms can add value, and may skew the evolution of Web3 in favor of sectors of the economy and transactions that do not necessarily need a link with the offline world (e.g. digital media, gaming, and art).

The cost of interoperability and portability: Because Web3 applications are built on top of open protocol standards, they are compatible with each other by design. Unlike APIs which are created, maintained, and controlled by a third party, Web3 protocols allow anyone to read and write to the distributed ledger. The resulting interoperability can be especially beneficial for competition, as users of a nascent application with a small user base can immediately interact with those of an already established player. New entrants can even go further than that and build on top of existing applications in a modular fashion, or create incentives for the installed user base of an incumbent to switch over.[9]

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Portability is guaranteed because at any point in time, ownership is established at the level of the individual token and resides with its owner, rather than with an aggregator or other third party. This is different from Web 2 platforms, where users may create content, contribute to the discovery of the social graph, and drive engagement, yet typically do not own or control the underlying information or value generated.

Because of portability, users of a Web3 application have a substantial degree of control: they can use Web3 assets they already own in new ways without having to ask for permission. Together with interoperability, this facilitates the use of assets across potentially competing applications. For example, someone who has acquired a piece of digital art could use it to decorate a digital space in the metaverse, place it as collateral for a loan in a decentralized finance ("DeFi") application, and trade it on any digital asset marketplace. There is no need for the metaverse application, for example, to integrate directly with the marketplace application; all of these applications can interact with the asset through the underlying blockchain infrastructure, with the owner's permission. While some forms of interoperability will still need additional, shared standards – for example, to ensure that the same type of digital object can be used in two different games in the same way – this represents a significant reduction in the cost of interoperability.

Portability fundamentally changes how network effects operate on Web3 platforms, as the benefits of network effects accrue at the level of the token, not the platform itself. Owning a digital token becomes more valuable when more people want to own or interact with similar tokens. While that represents a fairly traditional type of network effect, because it is attached to the token – not the platform – it can be easily transferred elsewhere. Similarly, as new applications are developed, causing a token to appreciate in value, the owner of the token and not a centralized intermediary stands to benefit directly from the expanded functionality.

From a competition perspective, this means that entry barriers are lower, as entrants with a better value proposition can entice users to port their assets and associated value over.[10] Dynamically, this may mean that Web3 platforms, in the absence of other mechanisms, may face lower investment incentives due to the weaker appropriability regime.

These are not new issues in open-source development, but the presence of a public ledger, tokens, and related monetization strategies make some of these challenges more salient, as imitators can not only borrow code but also fork the history of transactions. In a Web3 world, an imitator can be immediately backwards-compatible with the project it is drawing inspiration from. This keeps incumbents in check, and may force them to focus more on choices that benefit the broader ecosystem rather than extracting rents from the platform they have created.

Interestingly, Web3 and blockchain technology seem to have the broader potential to rebalance the role of network effects in digital platforms. While in Web 2 most of the ben-

9 NFT marketplace LooksRare, for example, recently bootstrapped its initial liquidity by using blockchain transaction records to identify the most active users of the dominant NFT marketplace, OpenSea, and offering all of those users tokens (loosely representing a form of equity in LooksRare's platform) in exchange for listing NFTs on LooksRare (see O. Hernández, "New NFT marketplace LooksRare allows traders to earn rewards," *Cointelegraph*, 2022).

10 When the DeFi protocol and codebase of Uniswap was imitated and tweaked by the SushiSwap team, for example, Uniswap lost some liquidity and attention to the new competitor (see, e.g. M. Young, "How SushiSwap Positioned Itself as a Formidable Uniswap Rival," *BeInCrypto*, 2021).

efits of network effects have accrued to the platform architects, and participants only have very costly and hard-to-coordinate ways to express their voices or exit, in Web3 portability and interoperability ensure that the frictions to challenging the teams behind any specific protocol are technically much lower.

The cost of composability: A third fundamental cost affected by Web3 is the cost of composing applications or transactions together across platforms. Because Web3 protocols rely on a combination of tokens and smart contracts, they are inherently modular. A token used in one application can later be ported seamlessly into another without asking for permission from the platform architect. Similarly, smart contracts can be combined with each other to build more complex products and services. While this also introduces new forms of systemic risk – as one piece of code may rely on the proper execution of third-party code, or on the stable functioning of a related ecosystem – it also accelerates experimentation in the space, as developers can reuse what others have created and build incrementally from what is already available on a particular network.

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As a result, we should expect new types of contractual arrangements to emerge that take advantage of composition across platforms – such as, for example, allowing a token representing ownership of a song to accrue royalties irrespective of the way the song is distributed (e.g. streaming, inclusion in a movie soundtrack, or sampling in a remix). Similarly, composability will make it easier for different revenue models to co-exist – such as ad-based and subscription models for the same content.

Composability also dramatically simplifies building aggregators and marketplace platforms, as anyone can access the underlying blockchain and offer a particular "view" on the associated content. While search costs may still end up driving some concentration, the drop in the cost of composability should still lead consumers to have a wider variety of channels for accessing content. For example, on a Web 2 social media platform, the only way for consumers to experience content is through the choices of the platform architect. In Web3, instead, consumers should be able to choose the way they experience content by selecting across platforms that present that content in different formats. And if no available platform presents the preferred content frame, a consumer can in principle design such a frame themself by reading from the blockchain directly.

04
WHAT THIS MEANS FOR MARKET STRUCTURE

By lowering the three costs just described, Web3 has the potential to significantly improve digital platform competition. Lowering the costs of verification and composability makes it easier to stand up new platforms or classes of transactions; moreover, interoperability means that users of these new services can immediately interact with the assets and user bases of established platforms. Enhanced portability, meanwhile, makes it easier for participants to exit an app and move their business, transaction histories, and other data elsewhere. Because Web3 applications and aggregators always face the dual threats of new platform entry and user exit,[11] they should have less latitude to take extractive actions even once they establish themselves in the space; this is sometimes summarized by a change from "don't be evil" to "can't be evil."[12]

Going back to our music example, in theory, because Web3 protocols reduce the role of intermediaries such as streaming platforms and labels, artists and the communities that support them should be able to retain more of the value they create. Distribution is also different: while in the previous paradigm the platform controls not only access to content but also what is surfaced by algorithms or editors, Web3 digital content can be distributed across multiple types of interfaces at the same time. Anyone can build an aggregator because the "licensing contract" is embedded into the protocol and effectively permissionless – unless the artists create restrictions to the contrary, anyone willing to pay the right level of royalties has immediate access to the song.

Similarly, once a consumer owns a digital asset in a Web3 ecosystem, they are freely able to interact with it and consume it through different service providers. This is different from the way consumers experience digital goods today, under which when a consumer buys a song or an e-book,

11 See, e.g. D. Finlay, "What Moxie Missed on Web3 Wallets," *Medium*, 2022.

12 See M. Ali, "Can't be evil," *Medium*, 2017.

they're really just licensing access through a specific provider, rather than taking ownership of a copy. Whereas license-based ownership in Web 2 prevents consumers from switching platforms – because if they did, they would lose access – Web3 promises a more platform-agnostic consumption experience in the future.

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Yet as in Web 2, aggregators and platforms that own the interface with the consumer may still retain substantial market power. For example, users can technically hold cryptocurrency such as Bitcoin or Ether in a self-custodial wallet, and thus avoid the need to rely on any intermediary when transacting – yet for convenience and security reasons, most cryptocurrency users today choose to hold and manage their crypto tokens through centralized intermediaries such as custodial wallets or exchanges. As a result, we have seen the emergence of new types of intermediaries with substantial influence over Web3 ecosystems.

Whether these new intermediaries have less market power than the ones they are replacing is an open question. In the business of digital asset custody, economies of scale in security, brand, and ease of use may well give a small number of players an advantage. And indeed, the mere presence of an open protocol does not guarantee a competitive outcome. While email, for example, is built on top of open protocols like SMTP and IMAP, the vast majority of consumers rely on a small number of email systems like on Gmail because of their functionality and ease of use.

Convenience and well-designed user interfaces can easily drive concentration in digital platforms. Moreover, these same dimensions can provide enough utility to consumers for them to accept compromises on other dimensions such as privacy.[13] Web3 is no different. Because of its intuitive interface and overall brand awareness, OpenSea has quickly become the largest non-fungible token ("NFT") marketplace – and this has allowed the platform to add proprietary extensions to NFT auctions and transactions. While the NFT market is fundamentally open, in the absence of more open solutions at the last mile between consumers and the blockchain, aggregators can still try to maintain a privileged position and have some degree of power to shape interactions and transactions.[14]

At the same time, Web3 applications have the potential to be different in the long run. OpenSea already faces multiple competitors that have used blockchain records of NFT transactions to identify top OpenSea customers and recruit them to trade on their platforms instead.[15] And there are active efforts underway to build trustless applications that reduce the reliance on platform aggregators such as OpenSea entirely.[16] Rather than relying on proprietary APIs to read and write on a blockchain and visualize outcomes to a user, trustless applications connect an end user directly to the blockchain, modularizing the different layers between the ledger and what a user may experience on their device.

A challenge for the development of trustless applications is that consumers may not care about decentralization enough, and so questions about what market structure will arise inevitably become questions about what levels of decentralization vs. openness the market will demand across different industry verticals.

05
CODA

By reducing the costs of verification, interoperability and portability, and composability, Web3 is poised to help address many of the challenges that regulators, policymakers, and academics have surfaced with respect to competition and consumer welfare in Web 2. Over time, Web3 may even enable some of these more open digital ecosystems to compete head-to-head with entrenched digital incumbents.

But the outcome is far from predetermined. While Web3 applications that emerge on the margins around transactions that Web 2 cannot support are likely to reflect more competitive digital ecosystems, the outlook for application categories that already exist in Web 2 is less clear-cut. Web 2 incumbents will still be able to leverage their installed user

13 See, e.g. S. Athey, C. Catalini, & C. Tucker, "The Digital Privacy Paradox: Small Money, Small Costs, Small Talk," NBER Working Paper No. 23488, 2017.

14 See, e.g. the discussion in B. Thompson, "OpenSea, Web3, and Aggregation Theory," *Stratechery*, 2022

15 Again, consider for example the case of LooksRare, discussed in footnote 9.

16 See, e.g. V. Buterin, "The word 'server' imo is not very useful in the blockchain context," *Reddit*, 2022.

bases, data, and technical abilities to deliver a far superior user experience – which means that whenever convenience and usability matters, Web3 applications will start at a massive disadvantage.

While the history of technology is filled with examples of established companies entirely missing a new wave towards a model that is different from the one they thrived on (e.g. from a more centralized one to a more decentralized one or vice versa), for Web3 to reach its potential, we will need regulation and infrastructure that supports greater interoperability overall – and especially portability of digital assets, data, and services into Web3 applications and frames.

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