Volume 10 | Number 2 | Autumn 2014

Let the Right "One" Win: Policy Lessons from the New Economics of Platforms

BY E. GLEN WEYL & ALEXANDER WHITE

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Many of the leading controversies in competition policy in the last two decades, especially those surrounding the Microsoft case, reflect the challenges posed by platform industries. Unfortunately, too often economists and policymakers have drawn the wrong lessons when thinking about such industries. Central to our analysis is a more realistic view of the process of consumer coordination. Platforms often use "usage revenue later" strategies to ensure that consumers coordinate on their platform. This greatly mitigates the possibility of inefficient lock-in or excessive dominance by a leading platform, but it makes inefficient fragmentation a greater danger. Thus regulation, rather than competition policy, may be more appropriate in addressing potential market failures arising in platform industries.

I. INTRODUCTION

Karl Marx argued that technology shapes economic institutions.[2] Perhaps on a less grand scale than Marx had in mind, the growth of the platform business model over the last two decades in response to the spread of the internet seems a classic case in point. Yet, as Marx also argued, not only economic institutions, but also political and social institutions must adapt to these new technological conditions. Many of the leading controversies in competition policy in the last two decades, especially those surrounding the Microsoft case, have concerned policy-makers' attempts to come to terms with the challenges posed by platform industries. Unfortunately, as we will argue in this article, too often economists and policymakers have drawn the wrong lessons when thinking about platform industries. The crucial ingredient of our analysis that takes us down a different path is the more realistic view recently developed in the economics literature of the way in which platforms' pricing strategies can be adaptive by design.

The crux of the problem is that platform markets typically exhibit externalities between consumers, some of whom fall into different groups or "sides." Video gamers, for instance, benefit from more games being available on their preferred platform. Conversely, game developers benefit from the presence of more gamers. If consumers mis-coordinate, say by expecting an inferior incumbent technology to persist, this may slow technological progress and undermine competition. Yet, we will argue, entrant firms need not sit passively and hope that consumers get their act together. Ambitious platform start-ups can, and often do, offer highly subsidized services until they have built up a sustainable user base; Amazon and Uber are two prominent recent examples. Such strategies largely undermine the traditional focus on consumer coordination in these markets and move the focus to the incentives facing firms. These, in turn, raise a host of very different policy concerns that are orthogonal or, in some cases, contrary to those one would expect when focusing on decentralized consumer coordination.

THE CRUX OF THE PROBLEM IS THAT PLATFORM MARKETS TYPICALLY EXHIBIT EXTERNALITIES BETWEEN CONSUMERS, SOME OF WHOM FALL INTO DIFFERENT GROUPS OR "SIDES."

In particular, we will argue in Section II that the conventional wisdom—that network effects can cause a dominant firm to become inefficiently entrenched—is misleading if firms adopt realistically sophisticated strategies. However, platforms' use of such strategies also undermines the commonly presumed benefit of network effects in stimulating competition for this dominant position. Yet, as we argue in Section III, it is precisely the ability of firms to overcome coordination problems that creates more familiar distortions from industries with economies of scale. Firms chasing the natural profits of a monopoly may overly fragment the market on the one hand, while, if firms are unable to appropriate the value they deliver to consumers, this may inhibit innovation and the adaptation of products to consumer preferences.

In Section IV, we argue that the policy implications of this perspective are quite different from, and in many ways opposite to, those traditionally prescribed. They involve aiding, rather than slowing, the winner-take-all process, thereby ensuring that dominant firms can appropriate reasonable rewards for innovation and limiting the profits that can be achieved through fragmenting the market. Yet this emphasis on letting and even helping the "One" firm that Peter Thiel celebrates in his recent best seller, *Zero to One*, also calls for corresponding regulation to ensure such dominant firms serve the public interest.[3]

We conclude in Section V with a discussion of what we consider some of the most interesting open research questions that could help inform competition policy towards platform industries.

Some of the "contrarian" views we express here have become increasingly prominent in the folk discussion in economics in recent years,[4] which, itself, has likely been stimulated by the success that entrants have had in disrupting dominant firms in internet markets. Nevertheless, we believe that our focus on more adaptive platform strategies, which is inspired by our ongoing formal work[5] discussed below, gives rise to a substantially different logic from any that we have seen argued in the policy literature. Thus we hope that this piece may offer a small contribution to the formation of a systematic and coherent understanding of platform industries.

WE BELIEVE THAT OUR FOCUS ON MORE ADAPTIVE PLATFORM STRATEGIES, WHICH IS INSPIRED BY OUR ONGOING FORMAL WORK DISCUSSED BELOW, GIVES RISE TO A SUBSTANTIALLY DIFFERENT LOGIC FROM ANY THAT WE HAVE SEEN ARGUED IN THE POLICY LITERATURE

We emphasize at the outset that our analysis is based on the current state of the literature on platforms, and our aim is to communicate the lessons of this literature. This literature leaves out many important considerations, some of which we return to in our conclusion. However, to the extent that existing policy intuitions derive from existing literature, rather than these yet unstudied considerations, we believe our analysis is a useful corrective to conclusions that are not actually consistent with the literature.

II. FOUR MISLEADING INTUITIONS

We begin by discussing several intuitions about network industries that we believe to be misleading, in view of both classic results and recent theoretical developments. Before turning to these, we briefly summarize these

developments, which underlie the conclusions we draw below.

Paul David famously argued that the QWERTY keyboard was significantly less efficient than competing designs.[6] Yet, the story goes, due to network effects, generations of typewriter and computer users have found themselves "locked in" to this technology. In a widely cited article, Brian Arthur[7] provides a model of this phenomenon, building on the work of Jeffrey Rohlfs[8] and others, some of whose work we mention below.

A crucial feature of Arthur's model is that the firms controlling the standards are not strategic. While these firms may set some price for their product upfront, this is done in an arbitrary manner that does not anticipate the potential coordination of consumers. While this assumption is reasonable in some contexts, it turns out to be far from innocuous.

The key point is that firms have an incentive not to simply allow consumer coordination (or mis-coordination) to run its course any which way. As the film *The Social Network* dramatizes more vividly than any economics paper could, as a way to promote its later viral spread Facebook's founders exclusively sought out Harvard, and then other Ivy League students, as initial users—offering them an advertising-free service familiar from printed college "facebooks" that showed pictures of classmates.[9] Similarly, Amazon's strategy of maintaining unprofitably low prices in order to build a strong network has become a pop business culture archetype. In China, Alibaba and Tencent have each recently built up the popularity of their taxi-hailing apps by offering subsidies to both drivers and passengers who use them.

THE KEY POINT IS THAT FIRMS HAVE AN INCENTIVE NOT TO SIMPLY ALLOW CONSUMER COORDINATION (OR MIS-COORDINATION) TO RUN ITS COURSE ANY WHICH WAY.

Any thorough analysis of possible lock-in must therefore take into account firms' capacity to overcome this potential trap using temporary subsidization strategies. To our knowledge, the first work proposing such strategies is by Philip Dybvig & Chester Spatt,[10] which, in the context of public good provision, shows that if consumers all place the same value on network effects, a simple strategy suffices to avoid coordination failures. In particular, given that the size of the effect is known, the authority can, at any given time, charge each consumer who joins the public good program a tax proportional to the size of the network effects currently in place.

This taxation strategy internalizes the network externalities, guaranteeing each consumer a fixed payoff from joining the program. If only a few other consumers join, the quality of the program is low, but so is the price. If many other consumers join, both quality and price are high. Either way, consumers are *insulated* against mis-coordination. Consequently, consumers have no reason to worry that the program will fail to live up to its intended level of popularity. In turn, this means that, by using such strategies, the authority can achieve whatever participation level it desires, without the concern of multiple (i.e., other, unintended) equilibria, in some of which consumers mis-coordinate.

There are limits, however, to how broadly such an approach can be used. Consumers may be heterogeneous—some valuing (in dollar terms) the network effects more than others—and thus there may be no single relevant tax rate for all consumers.

Nonetheless, in some cases, particularly in those of multisided platforms that charge different prices to different groups of consumers (e.g., as a gaming platform does to gamers and developers), these limits do not pose too great an obstacle to solving problems of consumer coordination. This is because simpler strategies can also work. One such kind of strategy, referred to as "divide and conquer," involves charging consumers on one side of the market a sufficiently low price to entice them to join in large numbers and then recouping these losses by charging a high price on the other side. Another technique can be to jumpstart coordination by developing original content and exclusives that draw in users.[12]

In a recent paper,[13] we show that a version of the sort of insulating strategies proposed by Dybvig & Spatt, can, in fact, be deployed by platforms in a very broad set of circumstances, including in the presence of heterogeneous consumers and when competing with other platforms. A key point to understanding why this is true is the following: when consumers value network effects with differing intensities from one another, it is impossible to fully and perfectly protect them all at the same time from fluctuations in their strength, because the appropriate compensation for one would be too little or too much for others. However, it is always possible to protect average marginal consumers. Doing this is enough insulate a firm's total network effects from erosion through mis-coordination.

This approach to studying platform competition, which we call "Insulated Equilibrium" ("IE"), also turns out to be particularly analytically tractable. This is mainly due to the fact that it allows the analyst to set aside questions of consumer coordination and instead focus on firms' incentives. In what follows, we are thus, to an important degree, informed by the analysis we have conducted ourselves using this approach. We try, however, to put things in a broad perspective, drawing as many connections as possible to the rich literature on network industries and multisided platforms.

THIS APPROACH TO STUDYING PLATFORM COMPETITION, WHICH WE CALL "INSULATED EQUILIBRIUM" ("IE"), ALSO TURNS OUT TO BE PARTICULARLY ANALYTICALLY TRACTABLE.

A. Network Effects Cause Inefficient Lock-In

Arthur's and David's primary concerns were with the possibility of a market becoming inefficiently locked-in by network effects to an inferior technology. These concerns played an important role in the Microsoft antitrust case. Microsoft's critics argued that, "because of network effects and the applications barrier to entry, Microsoft did possess significant market power,"[14] and even Microsoft's defenders accepted the premise that network effects could be a source of market power that could exclude rivals but that "the very significant network effects and economies of scale in the platform market are largely absent in the browser market."[15]

The last two decades have seen the rapid decline and replacement of apparently entrenched but likely

inefficient incumbents, such as AltaVista, AOL, Blockbuster, MySpace, and, to a lesser but still significant extent, Microsoft. The aforementioned lock-in argument thus seems shaky and is often perceived as such by academic observers. For example, Jonathan Levin writes, "the combination of low switching costs and low costs to creating new platforms might mitigate traditional concerns about lock-in and dynamic inefficiency."[16] Nevertheless, these views appear to have an enduring influence on policy. For example, in 2013, the European Commission cited, as one of its primary reasons for investigating Google, that, "In high-tech markets, in particular, network effects may lead to entrenched market positions."[17]

Yet the basis of such claims in economic theory is unclear at best. Under IE, while, traditional sources of market power, such as horizontal product differentiation, can create such lock-in, in the models we have studied, network effects can never do this on their own, no matter how strong they are. A more-efficient but otherwise similar entrant may always use an insulating strategy to undercut the incumbent firm.

Moreover, this finding is consistent with the broader message of the literature. Michael Katz & Carl Shapiro[18] sum things up by stating, "The claim that excess inertia [i.e., lock-in] is the theoretical exception rather than the rule now appears in several of the papers on technology adoption and network externalities." Indeed, in some of the models to which these authors refer,[19] the opposite form of market failure can arise, whereby a new technology is adopted too quickly. More recently, a host of papers[20] develop models that appear to further confirm this view.

There are, however, two important preconditions that must be satisfied before one can have confidence in this ability of a new, better technology to overcome what David Evans & Richard Schmalensee refer to as "failure to launch."[21] The owner of an efficient new technology must have both the ability and the incentive to enter the market and replace the incumbent.

REGARDING ABILITY, A CRITICAL QUESTION IS WHETHER, IN THE PARTICULAR INSTANCE IN QUESTION, A POTENTIAL ENTRANT HAS AT ITS DISPOSAL STRATEGIES THAT ARE SOPHISTICATED ENOUGH TO MANAGE CONSUMERS' COORDINATION.

Regarding ability, a critical question is whether, in the particular instance in question, a potential entrant has at its disposal strategies that are sophisticated enough to manage consumers' coordination. In some cases, particularly in multisided industries, relatively passive divide and conquer strategies may be sufficient in order to orchestrate this. In others, more responsive strategies resembling insulation could be necessary. If insulation is needed, the platform must be sufficiently well capitalized in order to finance subsidies to consumers early on that will be recouped only later after reaching critical mass.

Regarding the second issue of an entrant's incentive, this point is nicely illustrated by Katz & Shapiro,[22] who show that lock-in tends to occur when technologies are "unsponsored" but not when they are proprietary. Nevertheless, its importance appears to us to be underappreciated in policy discussions. These, therefore, are issues that we believe to be important and will discuss more below, but which are qualitatively different from the hard barrier of lock-in suggested by Arthur and David.

B. Markets Tip Too Often for the Social Good

Another view that is often heard in policy discussions is that platform markets are dangerously susceptible to "tipping" into a state where they are served by only one or a few dominant firms, when it would be more efficient for the market to be less concentrated.

The European Commission has expressed this concern in the context of the Google case.[23] In the United States, in a recent speech, Deputy Assistant Attorney General Renata B. Hesse alluded to the view that "In some markets, particularly platform markets, tipping can occur, resulting in a 'winner take all,' or 'winner take most' outcome,"[24] as a basis for applauding the decision in *United States v. Bazaarvoice*, in which a judge ruled that the online ratings platform had acted illegally in acquiring its competitor, PowerReviews.

Such a position strikes us as particularly strange, because research on the subject appears to point clearly towards the conclusion that, compared to industries without network effects, platform markets are more likely to be inefficiently fragmented. While in traditional industries with fixed costs there is a well-known tradeoff between increasing product variety and eliminating duplicative investments,[25] with (positive) network effects, there is the additional force that consumers benefit from joining the same platform as one another.

SUCH A POSITION STRIKES US AS PARTICULARLY STRANGE, BECAUSE RESEARCH ON THE SUBJECT APPEARS TO POINT CLEARLY TOWARDS THE CONCLUSION THAT, COMPARED TO INDUSTRIES WITHOUT NETWORK EFFECTS, PLATFORM MARKETS ARE MORE LIKELY TO BE INEFFICIENTLY FRAGMENTED.

Theoretical work on this issue, incorporating network effects, by Joseph Farrell & Garth Saloner[26] and more recently, in the context of multisided platforms, by Volker Nocke, Martin Peitz, & Konrad Stahl[27] reflects this view. Indeed the latter authors summarize one of their main results as, "monopoly platform ownership is socially preferable to fragmented ownership if platform effects are strong and possibly even if they are weak."[28] Steven Berry & Joel Waldfogel[29] find empirical support for such claims in the context of media platforms, while Marc Rysman[30] finds a fragmented market for Yellow Page directories gives rise to higher welfare than would a monopoly because network effects in that industry "are not sufficiently strong."

Our work and related work by Robin S. Lee[31] show that such inefficient fragmentation is of particular concern when platforms can use insulating strategies. This is because such strategies tend to soften competition (as we discuss in Subsection II.D below) and thereby allow higher prices that attract even more excessive entry.

C. Solving These Problems Requires Efficient Consumer Coordination

Not everyone in the literature has adopted the pessimistic views outlined in the two previous subsections. However, even those that are more optimistic about equilibrium with network effects typically argue that efficient outcomes depend on disparate consumers' ability to coordinate among themselves. This is formalized explicitly by Attila Ambrus & Rossella Argenziano[32] and is the basis of Daniel Spulber's claim that "consumer

coordination mitigates or eliminates technology lock-in." Farrell & Paul Klemperer summarize the debate by saying that "Optimists expect that adopters can find ways to coordinate on shifting to any better offer that might be available…Pessimists see coordination as more likely to fail, or to succeed only by tracking cues other than adopter surplus such as history."[34]

While efficient consumer coordination could certainly help address some of the issues discussed above, we believe, along with the pessimists, that this is a risky bet. However, we further believe that platforms recognize this risk and "leave nothing to chance" by taking the onus of ensuring coordination into their centralized hands, rather than leaving in to a diffuse process among consumers. To the extent they can achieve this with strategies like insulation, "lucky" consumer coordination is unnecessary in order for efficient outcomes to arise. Careful firm strategies can lead entirely myopic consumers to be endogenously coordinated onto upstart platforms.

D. Prices are More Efficient Because Firms Compete for the Market

While lock-in and excessive tipping are usually viewed as the leading negative features of platform industries, the conventional wisdom from which we dissent here also sees these features as having a corresponding benefit. As Farrell & Klemperer write, "(F)irms are competing for the market, which blunts horizontal differentiation. Thus, strong proprietary network effects can sharpen price competition when expectations are up for grabs and will track surplus."[35] Similarly Mark Armstrong argues network effects will make prices especially competitive because, "When a duopoly platform sets a high price that induces an agent from, say, group 1 to leave, that agent does not disappear but instead joins the rival platform, and this makes it harder to attract group-2 agents."[36]

WHILE LOCK-IN AND EXCESSIVE TIPPING ARE USUALLY VIEWED AS THE LEADING NEGATIVE FEATURES OF PLATFORM INDUSTRIES, THE CONVENTIONAL WISDOM FROM WHICH WE DISSENT HERE ALSO SEES THESE FEATURES AS HAVING A CORRESPONDING BENEFIT.

Such pro-competitive tendencies of network effects do not arise, however, if firms insulate their consumers. Consider a corresponding version of Armstrong's example that is the same as above except that it assumes firms to be using insulating strategies. For concreteness, consider a duopolist videogame platform that raises the price slightly for its console and loses a group 1 gamer. While this loss has hurts—both through lost revenue directly from the gamer and through lower attractiveness to game developers—it does not, indirectly, further weaken the firm's competitive position, even when that gamer switches to the rival platform. This is because both of the platforms internalize network effects via their insulating strategies. The platform that lost the gamer will charge developers a little bit less, and the rival platform that attracted her will charge developers slightly more.

Taking into account all of these changes, on average, game developers will not have an incentive to switch platforms. Consequently, no negative feedback loop will be initiated for the platform that lost the initial consumer. In other words, under IE, the duopolist will directly mourn the loss of network effects via lost

revenue, but will not indirectly fear increased competitive pressure. Thus, given pricing strategies that seem realistically sophisticated, network effects may not increase competitive pressure as much as has been asserted in the literature.

IN OTHER WORDS, UNDER IE, THE DUOPOLIST WILL DIRECTLY MOURN THE LOSS OF NETWORK EFFECTS VIA LOST REVENUE, BUT WILL NOT INDIRECTLY FEAR INCREASED COMPETITIVE PRESSURE.

Conversely, in many settings with realistic user heterogeneity, prices are likely to be distorted upward, relative to socially optimal levels, by more than they would be if users were more homogeneous. While platforms internalize the preferences for network effects of marginal consumers, as long as they are unable to effectively price discriminate they will not account for the preferences of inframarginal consumers.[37] This effect, which we refer to as the "Spence distortion" after one of its discovers (A. Michael Spence), has been analyzed in the context of monopoly platforms[38] but has, to the best of our knowledge, prior to our recent joint work, not previously been studied under competition.

To see its impact, consider the example of a video game platform. It may internalize the benefit of additional games to those users that are just indifferent to buying the gaming system, but cannot profit from the much larger benefits derived from hard-core gamers who plan to buy the system regardless. To the extent that network effects are positive and inframarginal users benefit more than marginal users, as seems likely in most software and transaction platforms at least, platforms prices will systematically be more distorted upwards than they are in an industry where such effects are absent.

Thus, because of the Spence distortion, equilibrium prices may not be much lower in the presence, compared to the absence, of network effects, even though network effects lead socially optimal prices to be significantly lower. Thus the social need to reduce prices will often be higher in platform markets than in standard markets. This might seem to call for greater competition to reduce prices, thereby, apparently, refuting our argument above in Subsection II.B. However, note that the only reason that lower prices are so desirable in the current context is as a means to increase the size of network effects, which is precisely what would be undermined were the market to be fragmented. Therefore, increased competition between incompatible platforms is unlikely to provide the appropriate counter-weight to distorted pricing incentives and, instead, would likely exacerbate the problem further.

III. THE REAL PROBLEMS

Our rebuttal of some conventional views about the distortions to competition created by network effects might appear to put us in the *laissez-faire* camp, represented notably by S. J. Liebowitz & Stephen E. Margolis.[39] However, just because we believe that the standard distortions are greatly exaggerated does not mean we believe no distortions are present. In fact, the market failures we perceive in platform industries appear to be comparably severe to those contemplated under the conventional view, but in many ways different or even opposite in kind.

IN FACT, THE MARKET FAILURES WE PERCEIVE IN PLATFORM INDUSTRIES APPEAR TO BE COMPARABLY SEVERE TO THOSE CONTEMPLATED UNDER THE CONVENTIONAL VIEW, BUT IN MANY WAYS DIFFERENT OR EVEN OPPOSITE IN KIND.

A. Entry is Excessive and Thus Markets are Too Fragmented

As discussed above in Subsection II.B., the literature strongly suggests that platform markets are particularly prone to excess fragmentation. While, in conventional industries such an effect must be driven by supply side economies of scale, in network industries economies of scale arise inherently from the demand. Thus, even in the absence of fixed costs, the situation can effectively be that of a natural monopoly, where the efficient arrangement is for the monopoly to be subsidized to charge prices at marginal cost.

If, however, the platform is unregulated, it will make substantial profits and these may be large enough to attract an entrant, even if, after entry, both firms will be less efficient and potentially charge higher prices and serve fewer consumers than prior to entry. Such entry is unambiguously inefficient. Moreover, unlike in N. Gregory Mankiw & Michael Whinston's[40] model, entry in a network setting may even harm consumers, as it raises marginal costs as well as average costs, though it necessarily brings prices close to marginal cost as well.

When platforms insulate consumers, they internalize network effects and, thus, there is a strong analogy between an industry with economies of scale and a platform industry, especially when users are homogeneous in their valuations for network effects. The possibility of excessive fragmentation in platform markets is thus just an extension of the corresponding logic from an industry with economies of scale.

In many canonical platform models, these effects can be extremely strong. For example, in the simplest version of Armstrong's model of competition in two-sided markets, network effects must be three to four times as strong to induce market consolidation as they must be for such consolidation to be optimal. The set of cases where the market inefficiently fragments is also four times larger (in the space of network effects) than the case where it efficiently fragments.

IN FACT, EVEN IN THE ABSENCE OF INSULATION, FRAGMENTATION IS THE ONLY EQUILIBRIUM WHEN NETWORK EFFECTS ARE LESS THAN TWICE AS STRONG AS IS NECESSARY TO MAKE CONSOLIDATION SOCIAL OPTIMAL.

This suggests that many of the fragmented platforms markets we observe may be inefficiently so. In fact, even in the absence of insulation, fragmentation is the only equilibrium when network effects are less than twice as strong as is necessary to make consolidation social optimal. Furthermore, when an industry is consolidated, the mere threat of entry can sometimes keep prices low.[41] In such circumstances, users may bear most of the costs of fragmentation, because potential value that could have been created through network effects instead goes unrealized.

While these conclusions are based on extremely stylized models—with symmetric firms, users that are homogeneous except for some simple Hotelling horizontal differentiation, etc.—it seems unlikely that they will become less stark with realistic heterogeneity. For example, Spence distortions as discussed in Subsection II.D above might well make the cost to users of fragmentation even higher. It thus seems likely that excess fragmentation is a major distortion in many platform markets.

B. The Gains From More Efficient Technology Cannot be Appropriated Privately

While we have argued that the evidence is cloudy at best that inferior, proprietary technologies have been or could be locked-in because of network effects, there do seem to be some clear cases of superior technologies in the public domain that have been frozen out. A marquee victim of this phenomenon is Esperanto, a language invented in the late 19th century to maximize the ease with which it could be acquired and used from any language. While it is based primarily on Indo-European languages, studies have found it is consistently easier for speakers of almost all languages to acquire than any other language, even ones within the same non-Indo-European families.[42] Despite these advantages over English, a notoriously difficult language even for many Indo-European speakers, English is the modern *lingua franca.* Why?

While Esperanto lacked network effects, the same could surely be said of English in the 19*th* century, when French was far more popular. The obvious answer is that no actor has a concentrated interest in the spread of Esperanto, while British and later American superpowers had a strong interest in spreading the use of English through a variety of forms of cultural and educational outreach. Something similar appears to be happening with Mandarin; the Chinese government has been funding Confucius Institutes around the world to subsidize its adoption.

A particularly notable example of linguistic adaption driven by appropriability is Turkey's rapid switch from Arabic script to the Latin alphabet in 1928, which was a key part of Mustafa Kemal Atatürk's strategy to push a modernist political and cultural agenda. If someone could appropriate the benefits of Esperanto usage (e.g. if there was an Esperanto empire), similar institutions spreading it might exist and Esperanto might well become a dominant international language.[43] Absent this, however, even the small costs of acquiring Esperanto are not worth paying given that it has at most 10 million speakers spread nearly evenly across the world.

As these examples suggest, the dynamic subsidization strategies that we argue platforms use to overcome coordination failures apply only in cases where overcoming such failures can generate eventual profits that can justify the initial capital outlay necessary to provide the subsidies. They likely also require sufficient evidence to persuade investors that such a large eventual payoff will be forthcoming if the initial chicken-and-egg problem may be overcome.

THE DYNAMIC SUBSIDIZATION STRATEGIES THAT WE ARGUE PLATFORMS USE TO OVERCOME COORDINATION FAILURES APPLY ONLY IN CASES WHERE OVERCOMING SUCH FAILURES CAN GENERATE EVENTUAL PROFITS THAT CAN JUSTIFY THE INITIAL CAPITAL OUTLAY NECESSARY TO PROVIDE THE SUBSIDIES.

Thus, in our view, the real potential causes of inefficient lock-in are a lack of appropriability on the part of some centralized entity and a lack of symmetric information between this entity and external financiers, unless the entity itself has sufficient capital to subsidize adoption. In the presence of weak appropriability or serious financial constraints, a platform may indeed be forced to rely on users' ability to coordinate. About this, we believe there is reason to be pessimistic, given results in game theory indicating that equilibria in coordination games can easily result in inefficient outcomes unless there is a strong, clear, and publicly

understood sense of the superiority of one technology over the other.44

Private appropriability and capital markets can dramatically reduce the number of individuals in the population who need to receive clear signals about the superiority of a new technology in order for it to be adopted, as these individuals can subsidize others and then appropriate the benefits that follow. The lack of such features is therefore, in our view, a primary—if not the primary—source of lock-in.

C. Provision of Network Effects is Distorted and Competition May Not Help (Much)

As we discussed above, in Subsection II.D, the Spence distortion may cause the provision of network effects (and prices) to be distorted even beyond the usual effect of market power. Moreover, competition is often of little help in addressing this problem because the loss of network effects caused by fragmentation dwarfs the losses arising from the Spence distortion (viz. the absence of price discrimination). Thus, in these cases, fragmentation-inducing competition is no solution.

However, even in the more limited set of cases when fragmentation is socially optimal and thus competition may be beneficial in lowering prices, it is much less clear that it will be effective in overcoming the additional Spence distortion. Recall that the Spence distortion arises from the divergence between the preferences of marginal users, whose value for network effects the platform internalizes, and that of the average users that society would like the platform to serve. When platforms compete, each platform faces two classes of marginal users, the "switchers," who are indifferent between the two platforms (but who certainly will join one), and the "exiters," who are indifferent between joining one platform and staying out of the market (but who clearly prefer one platform if they do participate in the market). A natural way to conceptualize an increase in competition is increasing the number of users willing to switch between the platforms.

WHETHER COMPETITION MITIGATES THE SPENCE DISTORTION WILL THEN DEPEND ON WHETHER SWITCHERS OR EXITERS ARE MORE SIMILAR TO AVERAGE USERS.

Such an increase in competition would clearly incentivize platforms to lower prices and compete more intensively for users. It would also, however, change the sort of marginal users that the firm caters to in providing network effects, leading them to pay more attention to the switchers. Whether competition mitigates the Spence distortion will then depend on whether switchers or exiters are more similar to average users.

One can imagine cases that go in either direction, and we illustrate these formally in our paper. To see why, consider two stylized examples. On the one hand, hard-core gamers, willing to consider buying either an Xbox or a PlayStation, are probably more similar to average gamers than are those who are on the exiting margin between buying one system or nothing. On the other hand, if one thinks back to the 1990s when Apple was a niche operating system used mostly by artists, designers, and publishers, things are different. Such typical Apple users likely placed a high value on features related to the Macintosh interface but a low value on access to a large ecosystem of apps. This attitude may not be that different from that of the artists and designers considering moving from pencil-and-paper methods to computer-aided design who were indifferent between

adopting Apple's system and staying out of the market altogether. On the other hand, it may diverge greatly from the attitudes of users who were indifferent between using Mac or Windows. Thus exiting users may actually be closer to average users in this case than to potential switchers.

This is not to deny, of course, that competition will typically benefit the provision of network effects in such contexts mechanically by bringing down prices. And it may even be that competition typically improves the Spence distortion. However, the forces at work in the Spence distortion are sufficiently richly related to user heterogeneity that our confidence is quite a bit lower that they can be eliminated or even substantially mitigated by competitive pressure. Together with the genuinely harmful effects competition may have in creating fragmentation, this substantially lessens the extent to which a traditional activist competition policy can address the market failures that are most important in platform markets.

IV. DIRECTIONS FOR POLICY

Almost no work we are aware of has seriously confronted the problem of policy design in platform industries. There is therefore very little basis for any positive speculation about the appropriate policy agenda given the perspective on platforms we lay out above. However, we do believe that our analysis gives some general principles and that these, in turn, suggest some potential directions for policy inquiry. We outline these below, in the hope of provoking discussion and inspiring more detailed future research in these directions.

We view over-fragmentation as a leading problem in platform industries. The most basic implication of this view is that public policies should seek to aid eventual efficient winners of platform competition in consolidating their dominant position as quickly as possible, subject only to the constraint of allowing sufficient "market deliberation" to sort out which platform is in fact best. Achieving this goal requires either directly intervening in the structure of the market or trying to influence the relative profitability of firms in transitional, fragmented states while increasing the winner's profitability in consolidated states. We begin by discussing more direct interventions and then turn to subtler incentives in Subsections B and C. Finally, in Subsection D we consider appropriate forms of regulation of dominant platforms.

WE VIEW OVER-FRAGMENTATION AS A LEADING PROBLEM IN PLATFORM INDUSTRIES.

A. Structuring a Winner-Take-All Market

A primary concern that any potential government policies aimed at encouraging market consolidation raise is the danger that they could easily, if unintentionally, "pick winners" in fights for dominance and then defend these "champions" against future, more-efficient entrants who could be portrayed as "fragmenters." The danger of such a pitfall is particularly great given that a firm that establishes a dominant position is also likely to acquire political power that will allow it to capture the regulatory process.

The recent debates over the regulation of peer-to-peer ("P2P") "sharing" services, such as Airbnb and

Uber, illustrate the difficult informational problems facing even the best-intentioned regulators. Incumbent city-run regulatory bodies overseeing hotels and taxis have attacked these new platforms' services, accusing them of being "unregulated" and of fragmenting the existing markets. We will return to the issue of regulation in Subsection D below; here, let us first consider the claim that these new platforms should be viewed as inefficient fragmenters.

In the case of Uber, such claims have some truth in the short-run but strike us as very hollow in the longer-term. It seems quite likely that Uber will draw away many passengers from the traditional taxi market, leading to a transitional period during which neither Uber nor traditional taxis have as thick of a market as would be feasible under consolidation. Thus, during this interim period, the availability of easy transport on both of these quite distinct platforms will likely suffer, compared to each one's potential in isolation. However, it appears quite clear that Uber plans to profit primarily after having taken over from traditional taxis as the dominant service. Thus, the current transitional period seems unlikely, in any given city, to be excessively prolonged.

By contrast, matters are more ambiguous in the case of Airbnb. This service has taken a substantial portion of non-business demand for lodging away from the traditional hotel market, which is regulated by city governments. Because hotels have such high fixed costs and deliver their primary value during peak business times, this fragmentation could potentially undermine the standard hotel business model. Moreover, it seems unlikely that business travelers would ever become comfortable trading hotel rooms for Airbnb accommodation. Thus, it's more plausible that Airbnb's presence could prove harmful to welfare.

On the other hand, hotels are able to price discriminate by substantially raising prices at high business travel times, and it is even possible that this ability to price discriminate will be enhanced by Airbnb's removal of low-value customers from the market. It is also possible that a reduction in the hotel market will eventually lead higher-income individuals to rent out their properties and hire short-term managers, leading to greater utilization of space that is, currently, often left unused.

A MAJOR CHALLENGE IN PLATFORM MARKETS, THEREFORE, IS FINDING INSTRUMENTS THAT ALLOW THE GOVERNMENT TO SIMULTANEOUSLY MAINTAIN A LEVEL PLAYING FIELD TO AVOID PICKING WINNERS, AND, AT THE SAME TIME, TO STRUCTURE THE MARKET IN A WAY THAT ACCELERATES THE CONSOLIDATION PROCESS.

In short, there is a lot of learning the market still needs to do about the welfare-maximizing structure in this market. It would be a mistake to take our concerns about fragmentation as justifying interventions to prevent this learning from taking place.[45] A major challenge in platform markets, therefore, is finding instruments that allow the government to simultaneously maintain a level playing field to avoid picking winners, and, at the same time, to structure the market in a way that accelerates the consolidation process.

The most natural class of such policies involves ways in which the government makes choices that impact the natural structure of markets through procurement and licensing. Examples are the design of

packages breadth in spectrum auctions[46] and the determination and pricing of standard-essential patents;[47] both are institutions whose aim is to identify a limited set of (perhaps marginally) superior players and to confer to them an exclusive position but not excessive rents.

Another natural area is government procurement practices, which tend to favor existing incumbent platforms rather than tracking closely the patterns of market shares: how many government workers use Uber for transportation services or Android (rather than Blackberry) as a mobile operating system? Switching procurement practices away from historical inertia towards explicit metrics to track current market leaders would encourage consolidation given the significant weight of the government sector in the market, and it would simultaneously reduce favoritism towards existing incumbents. Policies to impartially favor efficient market structures through procurement are familiar and have proven quite effective. One such example is the ChileCompra program, which has fostered entrepreneurship in Chile through government procurement practices.

B. Tilting Prosecutorial Discretion Towards Consolidation

Our emphasis on consolidation sits somewhat uneasily with the traditional emphasis of competition policy on maximizing the number of firms in the market. This emphasis, however, is driven by the different mechanics of platform markets, as compared to traditional ones, not by some different underlying philosophy. Crucially, platform industries with dominant firms are, in an important sense, highly competitive. Even if, at most points in time, they are consolidated around a single firm, there is a constantly looming threat of displacement by a new dominant firm. This more inter-temporal form of competition calls for a significantly different emphasis in enforcement, compared to a market whose competitive pressure should optimally be maintained through fragmentation.

THIS MORE INTER-TEMPORAL FORM OF COMPETITION CALLS FOR A SIGNIFICANTLY DIFFERENT EMPHASIS IN ENFORCEMENT

What makes such different enforcement patterns possible is that many practices commonly considered anticompetitive have the possibility of either working towards consolidation or towards fragmentation, depending on the market context in which they are deployed. A now-famous example, studied by Robin S. Lee,[48] is the sixth generation of the U.S. video game industry. According to Lee's account, entrant Microsoft used exclusive contracts with game producers to fragment a market that continued to be dominated by Sony's Playstation system, reducing consumer welfare significantly.

Of course, in other cases exclusive dealing and vertical integration could be used by a dominant firm to maintain its dominant position. In many markets, the use of exclusive dealing by an entrant might be viewed as benign, while its use by a dominant incumbent would be thought to call for intervention. If, as we have argued, over-fragmentation is a greater concern than a lack of competition in platform markets, the opposite pattern of discretion may be desirable.

Similarly, in analyzing mergers, the sets of benefits and costs regulators should consider might be quite different from, and even opposite to, the typical criteria of evaluation. While the reduction in product offerings and increased market concentration created by a merger are usually viewed as its primary costs, in platform industries these may be the principal benefits, to both the merger authority and the dominant firm.

SIMILARLY, IN ANALYZING MERGERS, THE SETS OF BENEFITS AND COSTS REGULATORS SHOULD CONSIDER MIGHT BE QUITE DIFFERENT FROM, AND EVEN OPPOSITE TO, THE TYPICAL CRITERIA OF EVALUATION.

However, such mergers may encourage future entry.[49] For example, it is well understood that if a family's daughter has been taken hostage, a prohibition on negotiating with the hostage takers is unwelcome to the family, but that such policies minimize the number of families who, in equilibrium, face this predicament. Analogously, aggressive merger policy that discourages entry for buyout may be desirable.[50] Thus the tendency of a merger to encourage entry, usually viewed as an offsetting benefit, may, in these settings, be a leading source of harm. A recent, worrisome example of this is Facebook's recent acquisition of WhatsApp, which received limited antitrust scrutiny, despite the seemingly high degree of redundancy of the latter.

In other cases, the alignment of certain types of conduct with the objectives of reducing excess fragmentation seems clearer, though, obviously, other costs and benefits must be accounted for. Collusion is likely to be particularly pernicious in platform industries as it maintains a stable, fragmented structure that simultaneously keeps prices high and discourages user participation, and it may even encourage further fragmenting entry. While, in other settings, this tendency may benignly maintain product diversity,[51] in platform contexts, it is likely to be an important threat to the performance of markets for consumers. Thus, platform industries seem to call for particularly stringent attention to collusion.

On the other hand, predatory behavior implies a largely opposite set of incentives. It ensures that the profits of both the predator and the predated firms are very low in fragmented states of the market, while back-loading larger profits into consolidated settings. At a superficial level, this is precisely what a policy maker should aim to achieve in a platform industry. This suggests that policymakers should give extra scrutiny to predation claims in platform contexts and be hesitant to enforce them unless other factors suggest they are exceptionally likely to cause harm beyond the standard reduction in the number of firms operating in the market. This reinforces the now-familiar arguments for caution about predation claims in platform industries because of the multi-sided subsidy structure that makes the price-cost test misleading.[52]

C. Subsidizing Participation

Perhaps the clearest policy prescription, the one achieving the most desired goals with the least conflict, is also the one least frequently applied: direct government subsidies for the development and, especially, the use of the services of platforms. While development subsidies may help to some extent with raising capital and are generally useful in

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addressing problems with appropriability, direct subsidies on adoption are likely to achieve more socially desirable ends at once. They can help alleviate market power and often also Spence distortions without risking the fragmentation that competition can cause, and they increase appropriability.

Another benefit of such subsidies is that they may be used to further tilt the competitive landscape towards consolidated states. This might also ease practical concerns about identifying firms that qualify for subsidies. If every start-up in a new platform market or every entrant could quality for subsidies this could easily degenerate into chaos or government favoritism. On the other hand, if only sufficiently clear dominant firms could qualify for such subsidies, and only if they maintain a sufficiently consolidated market, identifying firms to qualify for subsidies should be relatively straightforward. Consequently, the aim of increasing the incentives for consolidation, and reducing the relative profitability of fragmentation, would be directly promoted.

Furthermore, so long as such subsidies are not too large, and so long as they complement, rather than replace, market-pricing mechanisms, they do not excessively undermine the information supplied by the market about which platforms are best to adopt.[53] Another form such subsidies might take is differential enforcement of intellectual property protections aimed at aiding appropriability, though these would not come without important adoption costs.

Of course such subsidies may be open to political capture and thus must be approached with caution, as anywhere. Nonetheless, and especially in view of the numerous problems they address, they should probably be considered more seriously in platform industries than they typically are. We hope future research will seriously consider the optimal design of such subsidy schemes in the dynamic, incomplete information environments in which platforms operate.

D. Regulating Platforms, not Competition or Transactions

> THIS MORE INTER-TEMPORAL FORM OF COMPETITION CALLS FOR A SIGNIFICANTLY DIFFERENT EMPHASIS IN ENFORCEMENT

If the above recommendations strike readers as strikingly pro-monopoly, that's because, in an important sense, they are. Even more than in traditional industries with economies of scale, markets in which incompatible platforms compete are naturally monopolistic. As such, they naturally call for a bouquet of regulation. As with traditional natural monopoly regulation, this bouquet should be designed to make firms internalize the external costs of their actions. However, given the importance of ensuring the appropriability of benefits from acquiring such a monopoly position, it is important that such regulation do this in ways that are minimally costly to firm in question.

Some areas where the interests of platforms and the public may diverge, and where regulation can secure public interests at relatively low cost to platform profits, may be openness and non-discrimination across content.[54] In particular, many platforms, such as YouTube, Instagram, Twitter, and Facebook increasingly play a

dominant role in political organizing and the setting of cultural norms.[55] Given that such organizing and norm-setting are functions with substantial spillovers to social spheres outside of the platform's purview and that they have important public good characteristics, there is, at best, no reason to expect platforms to efficiently manage them. Very likely, firms will have an incentive to use their dominant position to increase their political influence.

Others areas where regulation may reasonably play a significant role include transparency about various aspects of platform design, including, especially, the ways in which private data are used.[56] The value that individuals place on revealing their private data may be greatest among individuals who have the most to hide and thus individuals' unwillingness to join a platform that fails to respect data may itself reveal the information that privacy regulations aim to protect. Platforms may have an incentive to encourage precisely this dynamic, despite the social inefficiencies it creates by forcing individuals to constantly and wastefully monitor their behavior because they know it is being observed. These problems are closely related to the distortions to labor markets from signaling that Spence observed and have been an important source of discussion about the erosion of privacy and propriety norms on platforms like Facebook, LinkedIn, and Instagram.[57]

OTHERS AREAS WHERE REGULATION MAY REASONABLY PLAY A SIGNIFICANT ROLE INCLUDE TRANSPARENCY ABOUT VARIOUS ASPECTS OF PLATFORM DESIGN, INCLUDING, ESPECIALLY, THE WAYS IN WHICH PRIVATE DATA ARE USED.

One area of extensive recent policy discussion about platforms has been the provision of quality-regulation services such as ensuring safety for Uber customers. While there are far more issues involved in such regulatory disputes than we can address here, there are some aspects of these debates that we believe to be particularly mistaken, in light of the analysis presented here. The most important one is that these debates often mix up the appropriate regulation of individual service providers, which, as Rochet & Tirole point out,[58] is a crucial function of platforms, and the regulation of the platforms that themselves regulate their providers. Many local governments and taxi regulatory authorities, for example, have argued that Uber taxis are "unregulated" and illegal, and should be excluded from the market.

This strikes us as confused: Uber, itself, provides an extremely strict regulatory environment (based on user feedback that is often much more up-to-date than the usual taxi evaluation metrics that are applied by local governments). Based on anecdotal evidence as well as our own experience, this leads to a better average level of service in Uber vehicles than in conventional taxis. Nevertheless, regardless of what one thinks of the product itself, the regulation that should be applied to Uber would need to be qualitatively different than that applied to a single cab or a small number of cabs since a customer has no chance to learn their reputations, given the nearly zero chance of repeat interaction. Uber does not compete with other taxi drivers; it competes with the local governments in charge of regulating taxis. These local governments are alternative platforms, competing in the platform market with Uber.

UBER DOES NOT COMPETE WITH OTHER TAXI DRIVERS; IT COMPETES WITH THE LOCAL GOVERNMENTS IN CHARGE OF REGULATING TAXIS.

As such, it makes little more sense to us to have local governments regulating Uber than it would to have, say, Microsoft regulating Google. Regulation from a higher level (likely national or, in the European case, international) charged with ensuring that the *platform* competition and conduct maximizes social welfare seems more appropriate. Furthermore, such regulation of quality should not be based on the types of concerns that the platform itself already has a strong incentive to incorporate, such as ensuring safe transportation or stays at residences.

Instead, regulation should focus on areas where there is likely to be a systematic divergence between the incentives of the platforms and those of a social planner, such as when product design may be (Spence) distorted to extract greater surplus from inframarginal users. These distortions will tend to be subtler than those typically discussed and often have trade-offs similar to those arising when firms engage in price discrimination.[59] In order to identify particular policy recommendations in these dimensions, it is necessary to specify the market in question and to take into account many of its specific details.

Typically, even in the case of a particular market, these issues are quite complex. For instance, a feature of search engines, that we have not discussed above but which can significantly impact their analysis, is their inability to charge users directly for performing searches. An implication of this is that search engines have a stronger incentive to create conditions in which advertisers have market power in their interactions with users than would be the case if the search engine could charge users directly. Sensible regulation of search engines must, therefore, be mindful of whether attempts to limit the Spence distortion are likely to dampen or amplify this incentive to provide market power. As work by White shows,[60] this interaction depends crucially on the degree to which algorithmic (i.e., ordinary, unpaid) search results compete with paid search advertisement. More broadly speaking, we believe that the concerns raised by the Spence distortion are different from, and sometimes even opposite to, the standard intuitions one might have about quality regulation.

The design of a new regulatory infrastructure for platforms is therefore clearly beyond the scope of our discussion here and involves a host of trade-offs that require much more research. However, we believe that thinking about platforms using the framework of natural monopoly, rather than using only one of standard competition policy, is likely to be a particularly fruitful path going forward. Designing such regulations will doubtless have its limitations and inefficiencies. For a treatment of regulation design in a more traditional context as well as some thoughts on the regulation of networks, see the work of Jean-Jacques Laffont & Jean Tirole,[61] which was recognized by the Nobel Committee a few months ago.

HOWEVER, WE BELIEVE THAT THINKING ABOUT PLATFORMS USING THE FRAMEWORK OF NATURAL MONOPOLY, RATHER THAN USING ONLY ONE OF STANDARD COMPETITION POLICY, IS LIKELY TO BE A PARTICULARLY FRUITFUL PATH GOING FORWARD.

However, we do not see any reason to believe that fragmented competition will offer solutions to the flaws of regulation in a platform context, no matter how severe these turn out to be. The reasons are, first, that the primary distortions from monopoly—low provision of network effects because of excessive pricing—are likely to only be more severe under competition, and, second, that there is little reason to believe the

Spence distortion will systematically be corrected by competition. Nor are most of the concerns about speech or privacy regulation likely to be corrected by competition, except to the extent that they limit platforms' incentives to exploit their political power. Many platforms are thus likely to be cases where the best choices are between regulated and unregulated monopolies rather than between regulation and competition.

V. CONCLUSION

In this article, we have tried to challenge much of the conventional competition policy perspective on platforms. We have argued that, at least as far as existing literature goes, inefficient lock-in is a much less significant threat than is commonly assumed, while inefficient fragmentation is a much larger one. This suggests that regulation, rather than competition, policy may be more important in addressing the problems with the performance of platforms. While these arguments are based on very limited empirical evidence and thus are highly preliminary, most of the existing conventional wisdom is based on similar, but in our view much less theoretically sophisticated and realistic, conjecture. But for this reason our analysis is much more the beginning of a line of inquiry than a final conclusion.

In particular, our analysis relied on one crucial assumption: that platforms are mutually incompatible alternatives. In many cases this seems a reasonable feasibility constraint. It is not clear, for example, how much of the value of a social network like Facebook or a tightly integrated operating system like Apple's could be retained while allowing easy interoperability with other social networks and operating systems. In other platforms, however, competition policy may directly, through conduct remedies, or indirectly, through incentives to overcome fragmentation, affect the incentives of firms to allow interoperation and compatibility. Such possibilities might substantially change our conclusions above, though they might also undermine the risk of inefficient lock-in directly.

In any case, the relationship of insulation to interconnection and resultant policy implications is a rich and exciting area for research. In cases where endogenous compatibility seems important, our conclusions should be taken with a large grain of salt, and attention should be paid to the substantial literature on this subject, which we have not yet satisfactorily internalized into our view.

IN ANY CASE, THE RELATIONSHIP OF INSULATION TO INTERCONNECTION AND RESULTANT POLICY IMPLICATIONS IS A RICH AND EXCITING AREA FOR RESEARCH.

Even within a model of mutually incompatible platforms, many of the richest and most interesting issues posed by platforms remain to be explored. For example, all of our conclusions about inefficient tipping and inefficient fragmentation are based on the simplest possible models with mostly symmetric firms and mostly homogeneous users. We only considered user heterogeneity and platform asymmetry to the extent they impact local distortions in the provision of network effects.

Yet the most interesting questions, in our view, concern precisely the broad structure of asymmetric platforms with substantial user heterogeneity. For example, a "minority" platform may be intensely valued by

its adherents and only sustainable if it substantially fragments the market by attracting marginal users who do not intensely value it, while no one may care much about the precise size of a "majority" platform. In such a case, the sort of dynamics underlying the Spence distortion might lead to precisely the sort of excessive tipping that cannot arise in the simple, symmetric models we focused on. Or, if inframarginal adopters place an exceptionally high value on network effects, insufficient tipping may be particularly severe. As both Dixit[62] and Grewal[63] point out, such issues are not just crucial to competition policy towards high technology industries, but also towards issues as diverse as policies towards ethno-linguistic minorities and international trade standards. ▲

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