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Regulating Platforms as Utilities? A Business Model Perspective

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Abstract

Current discussions about how to regulate platforms revolve around the extent to which existing frameworks can and should be applied to modern-day platform firms and business models. We outline and explain the economic and strategic features of platforms, and compare and contrast them to utility industries often considered structurally similar. We will then outline the manner in which these industries have been regulated and the rules for regulatory intervention and assess how these approaches and others currently being discussed are likely to affect competition and innovation on modern-day platforms.

1. Introduction

Platforms have enjoyed a rapid rise in economic importance in recent years. While platform business models have existed for a long time (even physical markets with independent stalls would classify as platforms), platform business models have made inroads in many markets, like transportation (Uber) or accommodation (AirBnB), and have created entirely new markets like social networks (Facebook). At the heart of platform business models is that platforms enable interaction between two or more groups of agents, typically on different sides of the platform (e.g. advertisers and readers, sellers and buyers, gamers and games, apps and users) to create valuable connections and/or transactions (Rochet and Tirole, 2003; Armstrong, 2006).

Therefore, a platform ecosystem creates more value for a user the more users of her own group or a different group she can interact with on the platform, so-called direct and indirect network effects (Wright, 2004; Levin, 2011). Indeed, the network effects resulting from connections between market participants make up for a significant part of the value of a platform and have an self-reinforcing effect (more users create more network value which in turn attracts more users). Hence, the strength and form of these network effects will shape the evolution of the platform itself and the market it serves.

The existence and importance of network effects has led to fairly concentrated market structures in many platform markets, raising questions of the most efficient market structure as network effects would call for more concentrated market structures because users benefit from a larger-sized network they can reach or interact with. Nevertheless, there are ongoing discussions about the market power of some of the big technology companies and whether they should be regulated ex-ante supplementing current ex-post competition law (Crèmer et al., 2019; OECD, 2018), and if they should be regulated, how.

Traditionally, utility industries were also highly concentrated until various regulatory measures were taken to introduce more competition to these markets. Many arguments made in today's discussion on whether and how to regulate big tech base part of their logic on the experience with utility regulatory frameworks.

We contribute to this discussion by first taking stock of the existing regulatory approaches in utility industries and their history. We contrast the idiosyncracies of utilities business models to platform business models. Building on this analysis, some of the proposed regulatory approaches and remedies will be discussed in the context of platform business models and their value drivers.

2. Existing regulatory approaches and their applications to utilities industries

We first note the difference between ex-ante regulation and ex-post competition policy. Where ex-ante regulation often consists of a set of sector-specific rules of conduct (behavioural rules) or firm organization (structural regulation), ex-post competition policy is more concerned with the detection and banning of anticompetitive behaviour once observed (Bosteo, 2018). This also has important differences for the impact on firms: While competition policy is typically a one-off intervention, regulation sets the rules of operation in a particular market in the long run (Motta, 2004). Hence, the conditions for regulatory intervention have to be clearly defined and set up to fully reflect the nature of the industry.

One group of sectors that have traditionally been subject to widespread ex-ante regulation are the utilities. This was due to the presumption that network effects and especially economies of scale in infrastructure provision render these markets natural monopolies in which multiple firms might inefficiently duplicate infrastructure, or might fragment the market and thus reduce network effects for consumers. This has led to a set of regulatory approaches applied in utilities industries.

Energy sector

In the energy sector, most of the regulation revolved around vertical relations and the geographical reach of electricity providers (Black, 2013; van Danwitz, 2006). As most countries had organized their electricity providers as a vertically integrated monopoly combining generation, transmission and sales, regulation often required a degree of unbundling to create competition for the end consumer but allow for economies of scale in electricity transmission. In the EU, operators had to grant access to their transmission infrastructure to generators from other countries, again "to deliver real choice for all consumers of the European Union, be they citizens or businesses, new business opportunities and more cross-border trade, so as to achieve efficiency gains, competitive prices, and higher standards of service, and to contribute to security of supply and sustainability" (EU Directive 2009/72/EC).

Transport sector

Railway, or long-distance transport more generally, was economically comparable to energy in that there were significant economies of scale through the initial infrastructure that may justify the organization of the sector as a natural regulated monopoly. Hence, here again regulation aimed at creating competition through access, especially in international transport and freight transport (European Commission, 2019a). Here, however, it should be noted that intermodal competition, i.e. competition among different means of transport (Bergantino and Madio, 2020), has mitigated the need for highly restrictive regulation of single sectors, especially rail transport, as the presence of effective competition, i.e. from air and road transport, is assumed to exert downward pressure on prices and upward pressure on service quality (Gremm, 2018; Blayac and Bougette, 2017).

Telecommunications sector

Finally, the sector most recently subject to regulation is the telecommunications sector. While the sector covers a range of services, including fixed and mobile telecommunications as well as internet services, regulation has been discussed most widely in fixed-line telecoms, not least because the "last

mile" is also what ultimately delivers internet services to homes, and because mobile telecoms had a predetermined market structure dictated through the issuing of spectrum licenses. The predetermined market structure, itself a form of ex-ante regulation, already had the goal of preventing operators from becoming too powerful, thus avoiding the monopolistic or near-monopolistic market structures present in many other utilities. Importantly, telecoms markets were more heterogeneous across (European) countries, which created a need for criteria determining the firms that fall under ex-ante regulation. Simply put, powerful telecoms operators had to grant competitors access to their infrastructure to ensure effective competition (EU Directive 1997/33/EC; Peitz, 2003). The operators subject to regulation were identified through a systematic process of defining the relevant market and subsequently assessing the operator's market power. If operators possess "significant market power (SMP)", they are prone to being regulated (Directive 2002/21/EC). Interestingly, this framework has been in place since 2003 (Cave et al., 2019), largely due to its flexibility to account for changes in technology and market structure through periodic reassessments of SMP. In this period, competition has gradually increased e.g. the incumbents' overall average market share on the fixed voice telephony market at EU level has decreased from 66% in 2004 to 51% in 2016, while in the mobile market countries had 3-5 physical mobile network operators and up to 50 virtual operators in 2017 (European Commission, 2017). Due to this pro-competitive development, mobile network operators are not generally regulated ex-ante anymore and the number of fixed-line sub-markets subject to ex-ante regulation has also declined significantly, currently covering only wholesale markets (Cave et al., 2019). Overall, effective telecom regulation relies on "a procedure to identify competitive bottlenecks in telecoms markets (typically in fixed markets) and to impose remedies to address such bottlenecks" (European Commission, 2019b). Particularly the regulation of telecoms networks has inspired early attempts to assess market power and potential regulatory interventions in platform markets (Unger, 2019). Importantly, some of the remedies applied in telecoms markets that have been considered

potentially relevant to platform markets were mandating interoperability, user portability, data access, and restricting bundling. Interestingly, the notion of "gatekeeping" functions has also been transferred to platform businesses.

3. Some Simple Economics of Utilities

Having outlined above the rationale for regulation of different utilities, we now take a closer look at the affected firms, analysing common features of their business models and how these shaped regulations.

Value Creation and (Economics of) Provision

As discussed above, many utility companies subject to regulation were former state-owned monopolies. Historically, these incumbents were given free rein in setting up an infrastructure that is often the only way to reach end consumers. Electricity ducts, water pipes, telecom cables and distribution stations were ubiquitous and all owned and operated by these monopolistic incumbents. The products and services delivered through these infrastructures, such as electricity, water and phone connections, were mature products and services with somewhat standardized features and quality. In Western economies, electricity and water supply were subject to given and mandatory quality standards which reduced the scope for additional value creation through differentiated or innovative offerings. Importantly, decisions over strategic variables, such as investments in infrastructure, are taken only by the utility provider. Given the service's comparably simple structure and the integrated mode of delivery (i.e. the consumer typically receives one bill by their utilities provider, regardless of the vertical arrangements between different stages of value creation), the value consumers derive from the product or service is delivered mainly by the provider and not by a set of firms offering additional complementary services.

The economics of providing the basic service are also similar across utilities and predominantly displays strong economies of scale in providing infrastructure. Before a single call can be connected or electricity provided to homes, an operator would have to set up an extensive infrastructure, a common pattern of all utilities.

Business Model

As mentioned above, the business model of traditional utilities companies is simple: The firm sells a basic service (e.g. electricity, telephone services etc.) at homogenous quality charging a two-part tariff, i.e. a monthly fixed fee and a per-usage fee. Users typically had a menu of different two-part tariffs to choose from, allowing the firm to sort users into groups via self-selection (second-degree price discrimination). Further, there was some third-degree (or group-based) price discrimination between private and business customers. This was the most common (and in some cases the only) strategic lever available to utilities providers, as quality was largely given and demand quite inelastic to price and advertising efforts.

Competition and Entry

As outlined, entry in utilities is very costly because it requires large investment in infrastructure. For regulators, these high fixed costs imply that gains from competition have to be weighed up against the negative impact of duplicating investment into infrastructure. Infrastructure was the bottleneck that potential entrants had to bypass or gain access to, and most remedies relate to granting access and to determining the right price for it avoiding the need of replication. Following these remedies, in addition to operators who provide physical infrastructure to maintain decision rights about most aspects of their products and services, virtual operators using the infrastructure of a competitor have entered some utilities. For example, in the German mobile telephone market there are three physical providers plus four additional virtual operators that in turn maintain multiple sub-brands (European Commission,

2017). Having access to an established network gives virtual operators the option to build their own infrastructure gradually such that the required fixed cost does not need to be incurred all at once.

Several other market features made entry into utility markets difficult when regulators began to promote competition: As a near-essential service, most households had an existing commercial relationship with an incumbent – nearly everyone subscribed to electricity, telephone and water services from these dominant firms with contracts lasting up to multiple years. At the same time, switching was rare, partly due to active strategies by incumbents (e.g. the lack of number portability in the early stages of most telecoms markets), partly due to the successful branding of state-owned incumbents as "reliable" providers of essential services (Roberts, 2005), and partly due to consumer inertia given the lack of experience with potential entrants and the force of habit of using (and paying for) a particular service at a particular price. Importantly, there is obviously no value in subscribing to multiple providers (multihoming) for consumers as differentiation is too small compared to platform markets. Consequently, most incumbents were able to maintain a fairly high market share even after competition had been introduced, and they maintained their control of a competitive bottleneck, which in turn caused regulators to step in with a combination of both ex-post competition law enforcement and additional regulatory measures such as mobile number portability.

Innovation

In most utilities, innovation cycles are very long and there rarely is disruptive innovation (Monetero and Finger, 2019), e.g. water pipes in the UK are on average 70 years old (Speight, 2015). Hence, investment in physical infrastructure, which constitutes the competitive bottleneck in utilities, often lasts for several decades. In addition, final product offerings are relatively mature and consumers often view them as homogeneous resulting in low incentives to design innovative products (e.g. for electricity providers in the UK see Rutter et al., 2018).

This also places the focus of regulation towards static rather than dynamic efficiency and it was therefore a priority to ensure competition through mandating access to the incumbent's infrastructure. Innovation incentives, either for the incumbent providing the infrastructure or for potential infrastructure entrants, were a secondary consideration. If anything, mandating access may have had a negative impact on infrastructure innovation because the benefits from innovation accrue at least partly to competitors (Valletti, 2003; Bacache et al., 2014; Briglauer, 2014). This is empirically confirmed by Grajek and Röller (2012) who find that access requirements lead to €16.4bn less investment in infrastructure for fixed-line telecommunications by both incumbents and entrants in Europe in the 1997-2006 period, using data from more than 70 fixed-line operators in 20 countries. Further, they find that regulators permit easier access to infrastructure in response to increased investment by incumbents, identifying a commitment problem by regulators that further disincentivizes investment.

Special Case: The Evolution of the Telecoms sector

While the above is true for most utilities, the telecommunication sector has undergone a significant transition in many countries in the last decades. Thus, the description above is accurate mainly for the period just prior to deregulation and to some extent the early years of transitioning a state-owned monopolist to a privately-owned, regulated monopolist. Indeed, regulation has quickly centred on the existence and regulation of transmission infrastructure (especially the "last mile") as a bottleneck. Thus, the regulatory view on the sector has changed over time, and operators were classified as occupying a certain "path" through the following map. For example, a provider could use a fixed line network to produce, operate and sell a service and content to end consumers.

Customer	Consumer		Business Retail	Business Wholesale
Value Chain	Component	Subsystem	Network System	Device
	Network		Service	Content / Application
Business Activity	Production	Operation & Maintenance	Sales	After-Sales
Network	Fixed Line		Mobile	Satellite

Figure 1: Framework for categorizing telecommunications operators (Czarnecki, 2013)

This framework illustrates that telecommunications services can be delivered via different infrastructures, introducing a level of intramodal competition (Vogelsang, 2010; Grzybowski, 2014). Moreover, whereas in the early stages of the market the main part of the value creation of a telecommunications operator were the roll-out and operations of the required network infrastructure (Czarnecki and Dietze, 2017), this value became increasingly commoditized and additional (often competing) services by over-the-top (OTT) providers or virtual operators captured an increasing share of the consumer's willingness to pay. Much of the value creation of telecommunications services now lay in the delivery of applications services, as illustrated in Figure 2.

Compared to most other utilities, infrastructure innovation also plays a more important role in telecommunications because in addition to maintenance investments (as other utilities as well), telecommunications faced a set of underlying technologies that developed rapidly and independently of the actions of individual operator, e.g. broadband cellular network technologies like LTE or 5G. This created an additional incentive for telecom regulators to encourage innovation, i.e. investments into new and emerging technologies and to upgrade the network. Relatedly, Grajek et al. (2019) show that horizontal mergers in several EU countries (which affect market structure in a similar way that

regulation might) had differential effects on prices (indicating static efficiency) and investment (indicating dynamic efficiency) depending on the specific national circumstances.

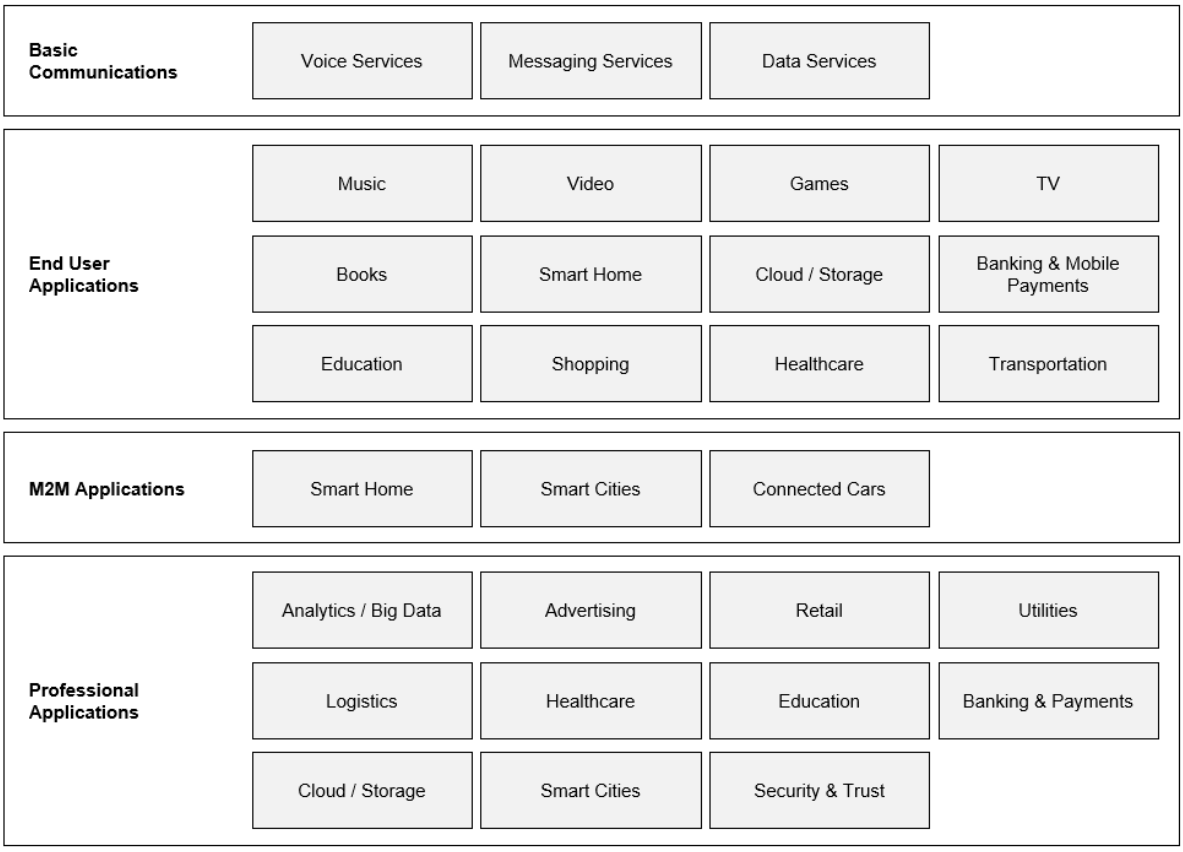

Figure 2: Selected innovative services of the telecoms value creation (Czarnecki and Dietze, 2017)

4. Platforms: Value Creation, Business Model and Competition

Platforms generally follow a very different business model and organizational paradigm than conventional utilities. In this section we contrast value creation, monetization, competition, entry and innovation of platforms to that of utilities described above.

Value Creation and (Economics of) Provision

Platforms are "intermediaries that enable exchange between other players" (Goldfarb and Tucker, 2019). The value that the platform provides stems primarily from facilitating connections and

transactions between the third parties on the platform such as users, businesses (the complementors) and advertisers, as illustrated in Figure 3 below.

In particular, platforms can create value through two types of network effects: First, direct network effect when consumers benefit of the presence of more consumers who themselves are highly active, e.g. more friends on Facebook who actively post content make Facebook more valuable to a consumer. Second, indirect network effects when consumers benefit of the presence of a wider set of

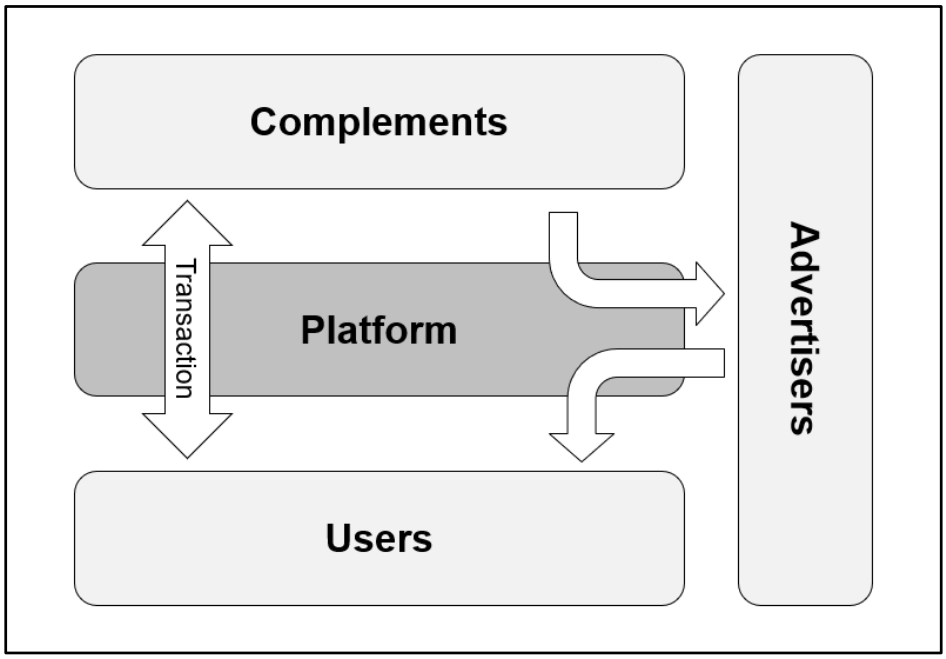

Figure 3: The platform ecosystem

complements that are providing high quality offerings (Church and Gandal, 1992), e.g. innovative iOS app-developers make an Apple device (access to the Apple platform) more valuable. Of course, the same effects can exist for other sides of a platform. Therefore, it would be inaccurate to think of a platform on its own as a sufficient organizational unit, not least because many of the decisions relevant for the platform's value proposition through products and content on the platform are taken outside the platform's control and instead by independent actors that are also part of the platform ecosystem. Hence, the most useful unit of analysis is a platform ecosystem, i.e. the platform combined with the

set of content, product or service providers ("complementors"), users and advertisers. A platform ecosystem resembles an organization of organizations (Ciborra, 1996), i.e. a metaorganization (Kretschmer et al., 2020). This has a number of implications: First, the value created is not fully under the control of the platform owner as it depends on the participation and investment decisions of independent complementors or content contributors. Second, the greater autonomy of participating complementors implies that platforms are much less in a position to dictate activities and terms to complementors than in a hierarchical organization. Rather, the platform owner has to take actions that positively affect the platform ecosystem's value, e.g. by facilitating the commercialization of innovations by complementors, promoting valuable content, and more generally create an environment for independent actors to invest in innovative new services and means of commercialization.

While there are both physical and digital platforms, it is notable that digital platforms have risen in importance over the last years. There are two main reasons why value creation by platforms is particularly high in digital contexts (Goldfarb and Tucker, 2019): First, platforms facilitate matching using digital technologies to lower search cost which creates significant value especially in large and fragmented markets. Second, platforms increase the efficiency of trade through low digital reproduction and transaction cost, which can be especially beneficial in high-volume, low-surplus markets, as frequently present in digital contexts. Interactions on a platform generate data (on completed transactions, the participants on both sides of the transaction, the surrounding environment, but also on transactions that were initiated but not completed), which in turn feeds the respective mechanisms to improve matching and lower transaction costs. Importantly, the gathered data can be used to increase value generation across different business areas and thus amplifies economies of scope. Notably, this has implications both for the internal organization of platform ecosystems and for the interaction with the platform's end users.

Business Model

At first glance, revenue generation of platforms and their ecosystems seem similar to utilities providers: Where an integrated firm selling a utility makes money from the subscription to its service and the corresponding per-use charges of the service they provide, a platform may also charge a fee for participating on the platform (similar to a monthly subscription fee) and a per-transaction fee that may be proportional to the value of the transaction (as in the case of, e.g. ebay), or, often additionally, a fixed fee per transaction (as, e.g. Paypal).

However, there are important differences in the pricing logic of platforms and utilities stemming from the fact that platforms typically charge a share of a transaction they facilitated and rather than selling a product themselves. The transaction fee of a platform has a crucial impact on participation on all sides of the platform and hence on value creation itself (through network effects). Therefore, platforms may charge different mark-ups for different market sides, depending on the extent of cross-side network effects and the respective demand elasticities for the different market sides to increase value creation within its ecosystem (Weyl, 2010; Armstrong, 2006). Intuitively, if indirect network effects are strong and asymmetric (e.g. advertisers on a search engine benefit from a high number of searching users while users usually dislike more advertisers), the balance of prices on both sides of the market will reflect this such that the market side with the stronger (positive) indirect network effect on the other side is subsidized compared to the profit-maximizing price ignoring these positive externalities (e.g. advertisers pay a fee while consumers search for free). This implies that pricing above or below marginal cost is not necessarily a sign of market power or predation (Wright, 2004), in contrast to utilities markets which are one-sided.

The platform owner's ability to monetize activity on a platform depends crucially on the quality of connections and the content or service provided. Thus, while taking a share of the transaction value

sounds straightforward, a successful platform business model will necessarily include measures to enhance the quantity and quality of transactions. This can be achieved, for example, through advertising that matches users' interests, content that engages users and motivates them to share it with their connections, or recommendations that rely on a mixture of established interests and new content (Kretschmer and Peukert, 2020). Further, the platform's business model will have to include mechanisms and incentives to improve match quality between platform participants. This can be achieved by involving users in the value creation process and using information on past behaviour and stated and realized interests to improve matches, but also by analysis of past match quality (Claussen et al., 2013). To summarize, a successful platform business model requires active management of quantity and quality of the interactions within its ecosystem using various instruments such as pricing, matching algorithms, advertising and designing incentives.

Competition and Entry

In contrast to many utilities companies, platforms are often active in multiple sectors of the platform economy, with possibilities to cross-subsidize and/or to expand into new fields through developing new services internally by leveraging some core competencies of the existing platform or through acquisition of smaller firms. The Big Tech group of firms (the so-called GAFAM: Google, Apple, Facebook, Amazon, Microsoft) all hold strong market positions in different parts of the digital economy. In the past, each of the firms has attempted to enter domains in which one of the other firms was dominant to leverage economies of scope across different applications. Thus, the existence of a bottleneck in one domain often provoked rather than deterred entry by another big player into

this domain.[1] Acquisitions of competing platforms that gain traction in other domains of the platform economy often go in the billions (e.g. Facebook bought Whatsapp for approximately $19 bn in 2014[2]). In the past five years alone, GAFAM firms have made 770 acquisitions[3] to expand their respective presence in all aspects of the digital economy to leverage economies of scope (e.g. the search engine operator Google acquired Fitbit which sells fitness products), and to place bets on potential future applications and use cases (e.g. Amazon bought Zoox, an autonomous driving company).

At first glance, the sizable network, learning and scale effects make it difficult for newcomers to beat the established platform infrastructures at their own game. Whereas in the early phases of digitization the "applications barrier to entry" (Gilbert and Katz, 2001) enabled Microsoft to hold on to their lead in the operating systems market, these days the "data barrier to entry" (Varian, 2018) in the platforms' core businesses gives an advantage to incumbents. However, this advantage is (at least partly) eroded by the fact that first, there are multiple Big Tech firms that have similar strengths in data quantity and processing and could (potentially and actually) challenge each other's position in some parts of the digital ecosystem. Second, and equally important, the fact that the value of a platform stems from the connections of users with other users and/or content provider on the platform implies that the notion of "gatekeepers" is much less stringent in platform ecosystems than in utilities markets. It is possible that smaller platforms act as gatekeepers for a focused group of consumers such that a large incumbent offers less (both functional and network) value to these consumers than the smaller niche player. This is the consequence of one of the specific features of platform ecosystems: The value derived from the platform ecosystem can vary for each user and can comprise different connections,

[1] Consider, for example, the attempt of Google to challenge Facebook by launching Google+.
[2] https://www.forbes.com/sites/parmyolson/2014/10/06/facebook-closes-19-billion-whatsapp-deal/
[3] https://www.cbinsights.com/research/tech-giants-billion-dollar-acquisitions-infographic/

content and applications. Therefore, successful entry in platform markets often starts with a differentiated value proposition generating network effects within or between focused groups of users. Consider the recent success of TikTok, Instagram or Fortnite in social media: all three were able to attract a large share of users from a specific socioeconomic group and use case despite their relative recency and small size. Reinforcing this effect is the fact that consumer preferences and habits change rapidly so that an entrant in a different, novel market segment may gain a strong market position there, which in turn may turn out to be highly popular. TikTok for example has quickly moved from a niche service to a global phenomenon, with over 100 million regular monthly users in Europe[4] only 3 years after its global launch. Finally, we note that competition is not only at the *user* level, but also at the *user-attention* level. That is, many users are multihoming, e.g. have multiple social networking apps installed and may even use all of them regularly, but shifts in usage share may occur gradually so that even small networks can survive and ultimately thrive despite strong incumbents.

Conceptually, the fact that the value of a platform and its ecosystem depends not only on the technical product quality, but also on the number and quality of complements, and on the contributions and size of the user base poses additional challenges for entrants to compete with an established platform (Schilling, 2003). Specifically, where in conventional markets without network effects offering a superior technology or product can suffice for a successful market entry with an innovation, in platform markets the overall value proposition has to dominate the existing one. Hence, for successful entry the new technology must compensate for the disadvantage in the value provided by the established complements and the installed base of users. This is challenging by purely focusing on technological value (see Entrant B in Figure 4). For example, consider the launch of the Windows Phone operating

[4] https://www.businessinsider.com/tiktok-surpasses-100-million-monthly-users-europe-2020-9?r=DE&IR=T

system for smartphones which competed against the established operating systems of Google (Android) and Apple (iOS). While many viewed the Windows phone operating system as a competitive technology in terms of usability and easiness to develop apps for it, it had a small number of complementary apps and no user generated content. The stand-alone technological value of Microsoft's operating system did not compensate for the lacking value of complements and an installed user base which its competitors had. Therefore, Microsoft's entry in the smartphone operating system market was ultimately not successful.

A way to circumvent this is to achieve compatibility with the incumbent's installed base and complements and hence obtain access to the value created in the incumbent's ecosystem (see Entrant A in Figure 4). However it also reduces the scope for differentiation from the established platform.

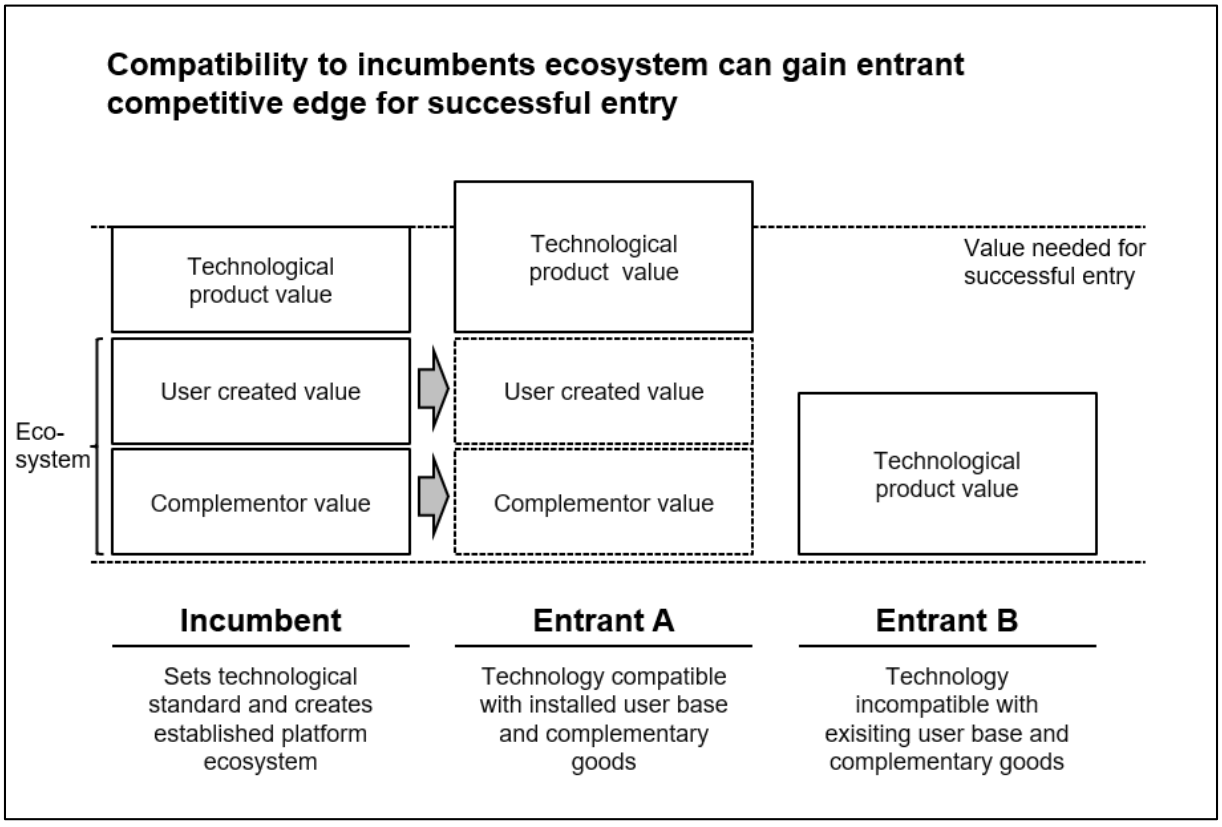

Figure 4: Entry in platform markets with ecosystem value creation (adapted from Schilling, 2003)

Innovation

Related to the arguments above, platforms evolve continuously and innovation takes place at different levels. First, the economies of learning and technical progress in general lead to the platform itself improving over time. Simply speaking, if an algorithm is augmented with more data, it allows for better matching of market participants due to improved recommendations, which in turn allows for more value-creating transactions to be completed. For instance, Netflix estimated that its recommendation system is generating a value of more than $1bn per year through enabling better matches between consumers and films (Gomez-Uribe and Hunt, 2015).

This in turns enables the second level of innovation, namely innovations by complementors that take advantage of the increased functionality of the platform. An innovative increase in functionality of Apple's device/operating system platform, e.g. introduction of a fingerprint sensor or more computing power, enables subsequent complementor innovation, such as increased security mechanisms for banking apps or the development of new computing-heavy games by third-party iOs app developers. The same is true for user-created innovation through finding a new use case of the platform's innovative functionality, e.g. using the Facebook Groups functionality (launched in October 2010) to create a community in which to share food leftovers in your city.

Third, complementors (or first-party complements) may develop and invest in increasing quality even without a change in the underlying technology. This is the result of learning occurring at the level of the complementor. Sellers on Amazon's Marketplace continuously improve their offered products based on the information (e.g. customer feedback, return rates or large-scale A/B testing of product variants) they can gain by selling through Amazon's platform.

Finally, complementors may innovate not just by improving upon existing complements, but they may also provide more variety in the market, i.e. horizontal innovation (Panico and Cennamo, 2020). This is also facilitated by the technological improvements and the corresponding reduction in minimum efficient scale for complements, which allows a more complete coverage of the product space. For example, there are more than 250 different "PDF-Creator" applications downloadable on the Google Play Store that are horizontally differentiated in functionality, usability and design.[5]

Hence, contrary to many other markets, including most utilities markets, innovation does not simply depend on the efforts of a single firm, but rather on the activities of an entire ecosystem of independent economic actors. This creates important interdependencies among actors, and it is possible that the private incentives to invest in platform or complement quality fall short of the platform-wide incentives because some of the benefits accrue to other participants on the platform.

Summarizing the above arguments, we adapt Figure 4 to include the effects of ecosystem innovation on the value proposition and ultimately the opportunities to gain a competitive advantage over competitors in Figure 5. Crucially, the figure illustrates that a platform innovation in the narrow sense (Platform Innovator) will find gaining a competitive edge more challenging than innovations that trigger second- and third-stage innovations as these will all contribute to the value proposition of the platform ecosystem. Both platform owners and other platform participants therefore have a joint incentive to generate "broad" innovations and to foster an environment that lets other platform participants develop their own innovations on the back of the initial one. Ultimately, platforms that

[5] Own numbers based on Google Play Store's results for the key word "PDF-Creator" on November, 5th, 2020.

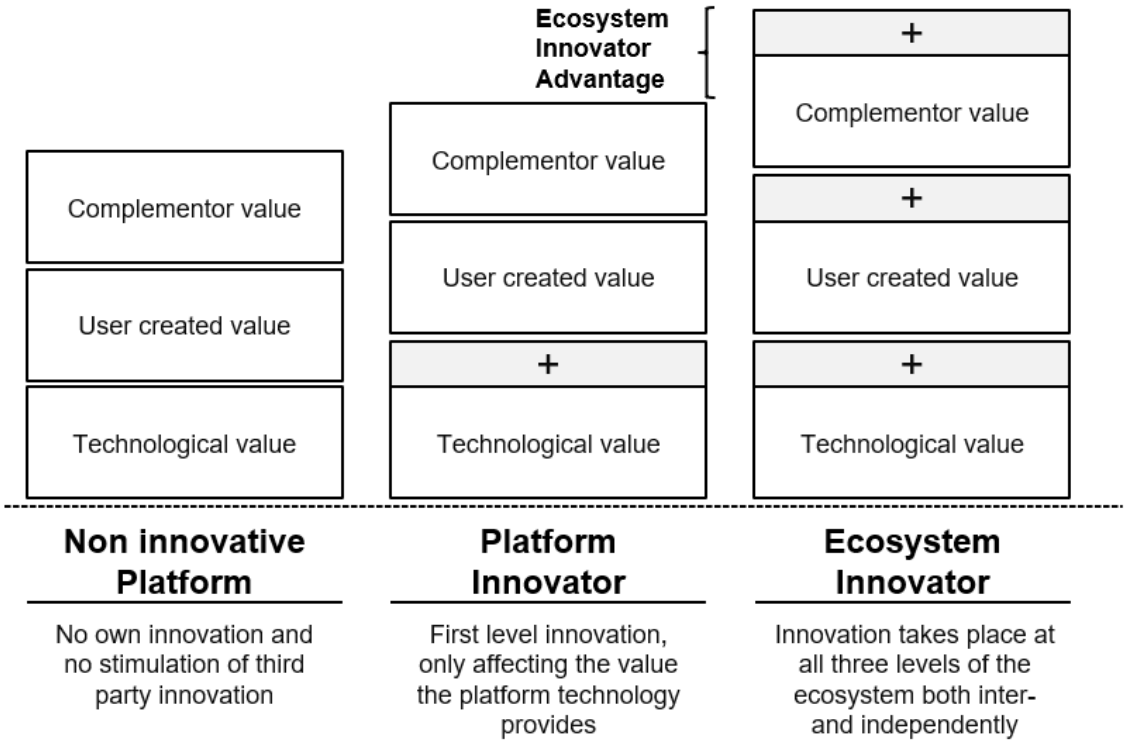

Figure 5: Platform ecosystem innovation

are ecosystem innovators, meaning that they manage to innovate themselves while stimulating and incentivizing inter- and independent third-party innovation, will outperform competitors.

Having outlined various aspects how innovation on platform ecosystems differs from traditional markets, note further that innovation cycles in digital markets, including most platform markets, are significantly shorter compared to conventional markets such as innovation in physical infrastructure in utilities markets (Monetero and Finger, 2019). Platforms constantly test and roll out new features to improve their offering, while investment in physical infrastructure often lasts for decades.

5. Discussion of ex-ante regulation and possible remedies

Superficially, utilities and large digital platforms share a number of features. First and foremost, both typically occupy dominant market positions and can act as “gatekeepers” for users and complementors. Moreover, the existence of economies of scale, either on the demand side (for

platforms) or the supply side (for utilities), makes dislodging incumbents from their dominant position difficult for de-novo entrants. However, several differences between utilities and platforms in their economic principles and their business models were presented in the previous chapters and are summarized below in Table 1. These differences suggest that remedies rooted in the experiences of utilities regulation may not always be appropriate for broad application across platforms: First, value creation and innovation by platforms involves a complex ecosystem of independent contributors while in utilities value creation is rather static and one-dimensional. The assessment of effects of potential remedies is therefore much more complex for platforms as it should account for potential adverse and self-reinforcing side-effects within the ecosystem. Remedies must carefully weigh up intended gains and unintentional harm, considering that ex-ante regulation of ecosystems has no clear precursor. Second, in contrast to dominant utilities who build on long-lasting infrastructure, many platform markets are constantly evolving and feature successful differentiated entrants bypassing the 'gatekeeper', e.g. TikTok in social media. Therefore, not all platforms should be considered dominant per se and remedies should consequently be carefully targeted and frequently reassessed. Third, note that utilities were considered sufficiently similar in their structure and economics of delivery that a common regulatory approach was chosen for most of them, with perhaps the most significant departure in the case of the telecommunications sector, which was sufficiently different in terms of its dynamics and the state of competition (especially inter-modal competition) that a more nuanced regulatory approach was chosen. It seems prudent to apply a similar principle to platform markets.

	UTILITIES	PLATFORMS
VALUE CREATION / ECONOMICS OF PROVISION	• Delivery of mature and homogeneous product by utility operator • Supply-side economies of scale in infrastructure provision	• Operation and governance of ecosystem which connects users, complements and advertisers and fosters value creation by all parties • Demand-side economies of scale in user/complementor participation (network effects)
BUSINESS MODEL	• Focus on optimal extraction of consumers' willingness to pay using two-part tariffs (fixed fee plus per usage charge) and price discrimination • Mark-ups reflect market-power	• Two-sided pricing to balance user and complementor participation, value creation and rent extraction • Mark-ups vary across sides reflecting asymmetric market-power and participation externalities on each side
COMPETITION / ENTRY	• Competition and entry require access to infrastructure or high fixed cost to build own transmission network • Small differentiation between competitors, thus small incentives to change operator or to multihome	• Competition and entry require sufficient traction on both market sides • Differentiation through hosting different sets of users/complementors, creating benefit of multihoming • Small-scale competition possible when strong network effects between focused group of consumers exist
INNOVATION	• Investment in improving/maintaining infrastructure by utility operator • Long innovation cycles and rarely disruptive innovation	• Platform creates incentives for innovation by users and independent complementors on top of the platform's own innovation (ecosystem innovation) • Short innovation cycles

Table 1: Comparison of utilities and platforms

We now discuss some of the possible regulatory remedies in platform markets and their likely (intended and unintended) consequences.

Blacklisting self-preferencing

Many platforms are not "pure-play" platform owners, but also provide some complements themselves. For example, Nintendo routinely develops games for their game consoles, Amazon sells their own products through their platform, and Apple develops some of their apps itself. One potential remedy revolves around the conduct of platform owners regarding these first-party complements (FPC). The logic behind seeking a remedy in this domain is clear: There is a danger that self-preferencing the firm's own products stifles competition and innovation in the complementary goods market, so first-party complements and third-party complements should compete on the merits of the product itself. Blacklisting self-preferencing, or delinking the FPC from the platform itself will achieve that. At the same time, FPC may serve a number of functions that would ultimately benefit the development of the entire platform: First, FPC are provided more frequently in the early stages of the platform's life cycle to generate sufficient indirect network effects to overcome the chicken-and-egg problem (Böhmer-Horländer and Kretschmer, 2020). Hence, the existence of a FPC can benefit the entire ecosystem by helping overcome the start-up problem. Moreover, FPCs into novel market niches may pave the way for subsequent independent complementors (Ozalp and Kretschmer, 2019). As the market niche at that point will not be established, such an investment comes with considerable uncertainty, and self-preferencing may increase the platform's willingness to invest in a novel complement, similar to a patent granting exclusive rights for a limited period of time.

This logic is reflected in De Corniere and Taylor's (2019) model which shows that the welfare consequences of self-preferencing (or biased intermediation in their terminology) depend on the extent to which goals of consumers and firm are congruent or not. For example, if price is the key strategic variable, a higher markup implies lower consumer surplus so that the goals are in conflict.

Conversely, if e.g. quality is the key strategic variable, a bias towards one option increases the incentives to invest in quality, which in turn may lead to higher markups *and* higher consumer surplus.

Second, offering FPCs and subsequent self-preferencing might help the platform owner steer innovation efforts of complementors to new product spaces and thereby to avoid duplication of wasteful development efforts. Studying several instances of Google entering the mobile app market, Wen and Zhu (2019) find that Google tends to enter product spaces where many complementors with similar offerings are already present. Googles (threat of) entry makes these product spaces less attractive for complementors and hence pushes developers to focus their efforts on other, potentially new applications.

Third, Wen and Zhu (2019) highlight that platform owners might use FPC strategically to establish specific quality standards for complements. For example, Google's launch of its own pre-installed flashlight Android app coincided with rising users' privacy concerns about some complementor flashlight apps. In such cases self-preferencing benefits users by reducing uncertainty about product quality and search effort. Relatedly, Gawer and Cusumano (2002) find that Intel steered clear of competing with complementors through first-party complements unless their complement's product quality was insufficient.

Interoperability and multihoming requirements

One of the defining features of platforms is that platforms do not only compete on the market for end users, but also on the market for complements. Indeed, the complementor ecosystem is a source of differentiation and competitive advantage for platforms (Panico and Cennamo, 2020). However, competitive differentiation can only occur if the complements are provided exclusively, i.e. competing platforms do not have access to the same complements. Especially once one platform has gained a strong market position, complements are often provided exclusively on the leading platform, which

may further reinforce the platform's dominant position. Two potential remedies that aim to curb this competitive advantage of the leading platform and to increase competition are to facilitate multihoming and to require interoperability between platforms.

Facilitating (or even requiring) multihoming ensures that more complements and/or users can be active on multiple platforms and hence benefit from higher participation on the other market side on their respective platforms. This can be achieved by reducing switching and entry costs to join a new platform for consumers and/or complements, e.g. decreasing the necessary physical, informational and time investment.

One step further, requiring interoperability enables users to directly communicate and transact with the same complements as users of any other platform (Belleflamme and Peitz, 2015). This allows a user to increase their de-facto network to stretch beyond a single platform – note for example WhatsApp's compatibility across different mobile operating systems that has led to its network growing rapidly and their subsequent rise to a strong position in the messenger market (Datareportal, 2020). Another example are email providers who use a common standard such that users can send emails to users of not just their own, but also other providers.

The first-order effects of mandating multihoming or compatibility are a global increase in de-facto network effects because networks exceed platform boundaries, the so-called market expansion effect (Belleflamme and Peitz, 2015), and a reduction in the possibilities for platforms to differentiate from each other as they all offer access to the same network. The longer-term effects on innovation incentives have not been discussed in detail. Importantly, interoperability and multihoming imply that some of the benefits of an improvement of the base technology may go to competitors as multihoming complements gain attractiveness, which in turn raises the attractiveness of the competing platform. Consequently, the effects on innovation incentives have to be assessed carefully: On the one hand,

platforms may be less inclined to invest in innovations that facilitate follow-on innovation by complementors and/or users, while on the other hand other platform participants may see their network effects and market size grow, which may result in increased innovation incentives.

Enabling personal data portability

One remedy that has been discussed extensively[6] is mandating or enabling data portability, that is, the ability for any user to take their data to another platform. The enactment of GDPR in the EU was a first step in this direction, with tangible consequences for different tracker markets (Peukert et al., 2020). Data portability more generally, however, has been designed to level the playing field for smaller suppliers of platform services or complements as larger platforms gain advantages from having more data, which in turn enables them to gather even more data and refine their algorithms even further. Ensuring data portability has the dual effect of reducing switching cost for users and therefore widening the range of realistic options, but also reducing the competitive gap between large and smaller platforms or complementors. Thus, the immediate and direct effect of data portability is expected to be a reduction in switching cost, akin to the introduction of (mobile) number portability on the degree of competition in the telecommunications market (Shi et al., 2006).

The longer-term effects on incentives to collect data are less straightforward. In a theoretical analysis, Wohlfarth (2019) shows that the incentives for entrants to collect data may increase with data portability. The intuition is that the entrant can collect more new data because users who switch from the incumbent experience less disutility due to the possibility to port the previously shared data. Further, competition for users with their own data may have two effects: First, competition will

[6] e.g. in the Financial Times (https://www.ft.com/content/bbbce328-5f64-11e8-9334-2218e7146b04)

increase because it is easier to attract such users (due to their reduced switching cost) and it is easier for firms to achieve data learning economies, which enhances the value of transactions with the user in question. Second, the ease of switching may reduce the incentives of platform owners to "invest" in their users by developing customized solutions or offerings because the likelihood of switching is higher than under non-fungible data. The net effect on the competition for consumers is not obvious.

Two further consequences may arise from mandated or facilitated data portability: First, competitors may become more similar in their offerings. Having access to the same data increases the likelihood that for instance targeting algorithms end up recommending the same content, thus reducing scope for truly novel offerings.[7] This would be another consequence of levelling the playing field among competitors: Although more data is available for all competitors, the competitive setting might resemble largely undifferentiated products and services. In terms of actors' innovation incentives, Anderson and Cabral (2007) show that lagging competitors have stronger incentives to take risks, which may well translate into more innovative outcomes. In more level situations, competitors are inclined to invest in more incremental, safer innovations. Finally, the portability of data may lead to the emergence of "data intermediaries" that, unlike existing tracking services, gain access to a user's entire data and sell it on behalf of the user to the highest bidder. In a way, this may create a platform to connect platforms to users. Clearly, this may create value for firms and users because the best match may be achieved and because users may be compensated through a share of the sale price or a subsidy on the newly joined platform, but the design and functioning of such a market for data has to be watched closely.

[7] Note, for example, the common practice to maintain multiple profiles on social media platforms, some reflecting one's professional "persona", others reflecting the individual's personal life.

Sharing of platform data

Platforms, as enablers of transactions between users and complements, gain access to vast amounts of exclusive data from which they can extract valuable market insights e.g. trending search key-words, growth rates or return rates of specific product categories. On the one hand, this enables the platform to improve its service such as recommendation algorithms. On the other hand, this knowledge can be used to give a first-party complement an advantage over complements. For example, Zhu and Liu (2018) report that Amazon frequently enters successful product spaces with own FPC offerings.

To level the playing field between first- and third-party complements, one possible remedy is to mandate platforms to share all data that the platform uses for its own first-party complement with third parties. Such a policy has diverse effects which have not been studied in detail: First, the remedy might reduce the incentive of platforms to invest in own complements as it has to share proprietary data with competitors. This would harm users who benefit from first-party complement entry through higher competition in the product space. Second, having access to such data, independent complementors would be able to use this data to innovate themselves and improve their product offerings. Third, if exclusive usage of the data is not ensured, platforms might reduce collecting and structuring data depriving consumers of the above sketched benefits. Thus, while this policy mainly benefits complementors, consumers may not be beneficiaries of this.

6. Summary

We provide an overview of regulatory approaches that have traditionally been applied in sectors with strong economies of scale either on the supply or demand side that possibly lead to natural monopolies. As platform markets display strong demand-side economies of scale, some of these regulatory approaches may appear attractive in platform markets as well. Indeed, the tried and tested regulatory remedies are likely to operate in similar ways for platforms as for utilities, with a number of

important caveats. In particular, the fact that platforms have to ensure sufficient participation on multiple "sides" implies that cross-subsidization of one market side through the other need not constitute anticompetitive behaviour (which would raise competition policy concerns) (Wright, 2004). Moreover, since users and complementors contribute data or information, which can improve the platform's service, and they contribute to network effects of the platform's installed base, the range of strategic variables affecting the benefits and costs is much wider than simply fixed and variable prices. Nevertheless, existing remedies have largely been judged by the conventional goals of facilitating entry and/or avoiding market dominance ex-ante rather than taking the ecosystem dynamics and innovative activity into account.

It is noteworthy that this approach has worked well in the telecommunications sector up to a point where regulation is the exception rather than the rule there. However, this was feasible because the ex-ante frameworks used and implemented in the telecoms sector have placed a burden of proof on regulators in two dimensions: First, which firms fall in the scope of ex-ante regulation? Here, the SMP test has been sufficiently flexible, but consistent to provide predictable guidance on which firms should be regulated. Second, which remedies should be applied? Here, the overarching principle was one of proportionality, and regulators had to demonstrate that the same or comparable market outcome could not be achieved with a less severe regulatory intervention. Heavy interventions in any market (like mandated interconnectivity, blacklisting self-preferencing etc.) should not be imposed without a corresponding careful assessment of the applicability and proportionality of the regulatory intervention.

However, some of the key differences in the business model and typical structure of a platform market imply that regulatory interventions may affect other crucial dimensions of platform performance. Specifically, the incentives to innovate, both for the platform owner and the complementor ecosystem

have to be considered carefully as platforms are much more dynamic than conventional utilities. Further, the overall composition of the complementor ecosystem has to be taken into account. This is to a considerable degree the outcome of the innovative efforts of platform and complementors, but also of the horizontal positioning and dynamic considerations of platform participants. As a result of the dynamic nature of platforms, business strategies that shape future preferences or that allow for a "complete" set of complements through horizontal positioning should be evaluated carefully.

We do not aim to propose a new regulatory framework for platform markets. Rather, by illustrating the common business models and structural solutions in platform markets, it is an attempt at starting a constructive debate about the importance to consider the specifics of platform markets and their actors in the design of possible remedies.

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