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The Competitive Dynamics of Openness

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Abstract

While firm competitive advantage is normally couched in terms of control, an increasing body of research is providing empirical and theoretical support of how firms use selective openness to achieve strategic goals. Such openness may be used both to grow the industry, and to gain competitive advantage within an industry. Here, building on a novel conceptualization of what firms open, how they open and to what degree they are open, we apply on the resource-based view to develop a theoretical model explaining the initial, unilateral, firm decision for openness. We then apply this model to predict differing impacts on the competitive dynamics of the industry, as well as upon firm and industry success, and discuss implications for theories of strategy and innovation.

Introduction

The traditional story of firm success through competitive advantage has been one of control. Firms vertically integrate to control their inputs and outputs (Chandler, 1977) and seek unique positioning that provide differentiation or cost advantage against all rivals (Porter, 1985). The best case is that the firm holds a monopoly on some scarce product, or be part of a small (and preferably highly cooperative) oligopoly (Tirole, 1988). Nowhere is this perspective of control stronger than in the resource-based view. In this view, a firm's competitive advantage (as defined by superior financial performance) is made possible by control of scarce and important factors of production (Barney, 1991; Peteraf, 1993; Wernerfeld, 1984).

However, the past decade has brought increasing evidence of a world of openness, both in practice and management research. Some of this has been offered as the antithesis to traditional models in both their approach and outcomes. For example, a policy enabling open distributed innovation entails weak firm control of intellectual property and greater consumer welfare (Henkel & von Hippel, 2005; von Hippel, 2005). In other cases, researchers have shown that firms will embrace openness to "grow the pie," even if it reduces their "slice of the pie" (Simcoe, 2006), or to establish reciprocal norms that reduce transaction costs (Henkel, 2006).

Perhaps more surprisingly, firms have surrendered control *to gain advantage*. Some examples have been limited in their scope, such as the out-licensing or sale of proprietary technologies to direct competitors (Chesbrough, 2003). In other cases, firms give away scarce and valuable technology or knowledge because it increases their attractiveness to customers and complementors (Alexy & Reitzig, 2013; West & O'Mahony, 2008). These approaches have been particularly common in information technologies where firms have been able to selectively open parts of their offering while keeping other parts proprietary (Varian & Shapiro, 1999; West,

2003). This does not mean to suggest that all such efforts at openness are successful. Consider two firm donations to establish open source software communities: IBM gained market share and influence by founding the Eclipse community, while Netscape went out of business when its proprietary revenues were too small to sustain the company.

Examples such as these make clear that there are yet unanswered questions about the long-term impact of openness upon the nature of industry competition and overall industry profitability. Generally, work on the competitive dynamics of openness is scarce (Christensen et al., 2005; Pisano & Teece, 2007). Put differently, while we have insight into the short term benefits of openness, it remains an open question how opening up today may affect a company's competitive position tomorrow (Alexy & Dahlander, 2013). However, knowing more about this issue is crucial, not only given that openness may fundamentally change industry architectures (and, thus firm and industry profitability) over time (Pisano & Teece, 2007), but also because it can enrich our understanding of why firms choose openness in the first place.

We consider these questions by applying a resource-based perspective to openness. Defining openness as a firm granting others access to its resource base, we show how at the very core of every openness strategy is a devolution of control, with firms taking compensatory actions to address the inherent risks of such devolution, mostly through coordination and collaboration with other actors in the industry. Yet, while such collaborative forms of openness seem common, we argue that they stem from the decision of a particular firm to initiate openness and then try to rally the support of others. In turn, this raises three questions: why would any individual firm introduce openness, what competitive processes does that choice set in motion, and what outcomes may occur at the firm and industry level?

To the first question, we show how a shift to openness will occur if a firm is not part of

the existing industry equilibrium position for one of three reasons: due to a deteriorated competitive position, major shifts in firm strategy, or the firm being a new entrant. To the second, we identify commoditization, a convergence of technological trajectories, and a shift to new forms of value creation. Finally, such openness increases value to customers, but the impact on the industry and firms will be negative unless they can (jointly or separately) shift competition to another layer of the industry architecture.

These arguments allow us to make three contributions to the literature on strategy and innovation. First, by answering the call for taking long-term effects of openness into account (Alexy & Dahlander, 2013), we show how established players in an industry should express little interest in the introduction of openness as, for cognitive reasons, they should not perceive it as a viable alternative, even if it were. Thus openness is only introduced by players that perceive a position of weakness in the extant industry structure. Second, taking a resource-based perspective allows us to elaborate on earlier ideas of the competitive dynamics of set in motion by openness (Christensen et al., 2005; Pisano & Teece, 2007). In particular, we show how openness causes a shift from resource-based to (dynamic) capability-based competition, a migration of value to customers, possibly culminating in the emergence of a service-dominant logic (Vargo & Lusch, 2004). Third, to facilitate our argument, we extend earlier efforts at providing frameworks (Dahlander & Gann, 2010) guiding research on openness. In particular, innovation scholars studying the governance of such strategies should find our efforts useful.

Understanding Openness as a Firm Strategy

Defining Openness

The recent interest in openness as a firm strategy is most closely associated with three bodies of research: open source software (e.g., Aksulu & Wade, 2010), open innovation (e.g.,

Chesbrough, 2003; Dahlander & Gann, 2010), and innovation communities (e.g., Jeppesen & Frederiksen, 2006; von Hippel, 2005; West & Lakhani, 2008). At the same time, it is clear that firm approaches to openness predate these areas (e.g., Allen, 1983; von Hippel, 1988). To synthesize these literatures and link to broader discussion in strategy and management research, we begin by asking: what does “open” actually mean?

The dictionary definition emphasizes reducing or eliminating access restrictions (OED Online, 2013). When used to refer to firm strategies, an “open” approach is normally presented in opposition to a proprietary (or “closed”) approach with the latter treated as the default case (e.g., Economides & Katsamakas, 2006). That is, “open” means that the firm grants other parties access to aspects of its resource base, whether constructed in the past or to be constructed in the future, tangible or intangible. In turn, we suggest that this access can be further classified alongside three further questions: what is open, how is it open, and to what degree is it open?

Regarding the “what,” firms have a variety of choices as to what to open up. Simply put, they may be classified as: (1) outputs of the past, (2) ongoing processes, and (3) inputs for the future. The first case is richly described by companies sharing their existing intellectual assets, as IBM did for example with a pool of key open source-related patents (Alexy & Reitzig, 2013). Ongoing processes may on the one hand imply that firms give access to distribution channels, R&D labs, or other (usually tangible) assets. It may also include the ongoing collaboration with outsiders in formerly proprietary processes, as when firms provide opportunities to participate in software development in firm-sponsored open source software communities (Shah, 2006; West & O'Mahony, 2008). Others have suggested that a firm’s strategy process itself should be opened to outside participation through a process of “open strategy” (Chesbrough & Appleyard, 2007; Whittington et al., 2011). Finally, inputs for the future relate to activities in which firms disclose

knowledge to influence the evolution of technological trajectories. On the one hand, this may happen through the disclosure of problems the firm holds, in the hope the others will rally to solve it (Jeppesen & Lakhani, 2010). On the other hand, firms may choose to reveal future plans to customers, suppliers or complementors — a common practices in the semiconductor industry, as demonstrated by Intel’s 10-year roadmap of its microprocessor plans (Borkar et al., 2005).

Concerning the “how,” when designing their openness, firms must make governance choices across three (partly correlated) dimensions: legal, organizational and authority.

On the legal dimension, when opening up a resource, firms often retain important rights. For example, the application of the knowledge may be restricted by a license, as with open source software licenses (Hecker, 1999). Other firms unilaterally offer a non-assertion covenant for a group of patents, with the proviso that the rights to use the patents are revoked for any firm that sues the discloser (Bekkers et al., 2012). On the organizational dimension, choices range from a one-time disclosure to creating a separate independent organization with employees, as with an open source or standards consortium. A related organizational issue is to what degree the firm continues to fund internal efforts to support the open technology’s development (West & O'Mahony, 2008). Finally, there is the question of authority: to what degree does the firm release decision-making power to outsiders? Firms may assert explicit ongoing authority, by controlling the rules of collaboration to their own advantage (Shah, 2006). Or firms may choose to fall back to “lateral authority” (Dahlander & O'Mahony, 2011) and only exhibit a right to make decision of accept or reject further developments by others to the “official” common pool of knowledge. As a final option, the sponsoring firm can devolve all such forms of authority and instead focus on “soft” aspects of power, such as the ability to influence discourses (Alexy et al., 2013).

Even if a firm chooses for a resource to be open, there are different degrees of openness.

Firm try to be “open enough” to gain the benefits of openness without losing the control that enables profits, such as by providing partial openness for the firm’s technology or providing more complete openness for only parts of its technology (West, 2003). Firm may create hybrid strategies that combine open and closed approaches (Bonaccorsi et al., 2006; Shah, 2006). As such, a key challenge that remains is how to measure a “degree of openness.” Early work bifurcated firms into “open” and “closed” (whether at the technology or even the firm level), but more recent work has sought to develop nuances across a continuum of openness (West, 2007). For example, in studying open source software communities, Laffan (2012) calculated an “open governance index” for degrees of process openness for eight open source projects.

Openness, Industry Structure, and the Introduction of Openness

When devolving control may bring short-term benefits, there are inherent longer-term risks. For the benefits of openness to materialize in the long term, an industry structure has to emerge in which the firm actually benefits from its being open, most likely through some form of externality (see below). In turn, the literature presents two configurations in which openness may be introduced. Above we presented examples of how firms provide *unilateral openness*. A second form, *collaborative openness*, appears to differ in the role of multiple actors in providing openness, but we argue the two forms are directly linked.

Collaborative openness has long been used by two or more firms to address shared interests, if the parties can make sure that those interests are aligned (Dyer & Singh, 1998; Parkhe, 1993). For bilateral cooperation, this voluntary way of working-together is epitomized by the research on strategic alliances (Lavie, 2006; Mowery et al., 1996). Such alliances are often used to source technology or share R&D costs between firms with complementary interests.

Firms also engage in a variety of multilateral cooperation efforts, often to create a shared technology. For some efforts—such as R&D consortia—the mode and motives for cooperation are similar to those for bilateral alliances, but with more complex modes of organization and governance (Doz et al., 2000). Finally, firms may also come together to create interorganizational product compatibility standards (Farrell & Simcoe, 2012). Such standards enable a modular division of labor between firms (e.g., Langlois, 2002). In such cases, the individual efforts of firms to appropriate value for themselves conflicts with their shared goal to maximize the success of the shared standard and thus the value available to appropriate (Simcoe, 2006).

What is common to all these approaches is they reduce the uncertainty traditionally associated with the loss of control in openness strategies. Future firm behavior becomes aligned through shared interests, legal agreements, and formal governance bodies. With firms sharing a common technological trajectory, future industry structure becomes more or less predictable, and thus this form of openness seems a relatively safe bet.¹

With such cooperative openness, how does a firm gain competitive advantage? Some firms may be better at building a network or ecosystem of collaborators and accessing the knowledge available through the collaboration—as with R&D consortia (Carayannis & Alexander, 1999). Or firms may be part of competing consortia, in which case the firms as part of the winning consortium gain advantages over firms that are part of the losing consortia or no consortium at all (West, 2007).

However, in practice such collaboration does not arise because multiple actors have the

¹ Such careful collaboration efforts can be upset if an outsider (typically a new entrant) chooses not to play by the rules of collaboration. This is particularly true when an oligopolistic structure makes it impossible for a new entrant to otherwise profit from its technology, as with Rambus' efforts to license technologies to the semiconductor industry (Tansey et al., 2005).

idea to open up at the same time, and then set down to discuss the details. In reality, collaborative openness has to begin somewhere, almost always with the unilateral action of a single firm, as when IBM released a proprietary software implementation to seed what became the Eclipse open source community (West, 2003). Thus, to understand the origins of collaborative innovation, we must identify the specific act of *unilateral* openness that spawned it.² Because of this, studying the antecedents and consequences of an individual firm's choice of openness will inform a broader range of phenomena. Here we present a generalized model of such openness and the competitive dynamics it sets in motion (Figure 1), and in the next section explain this model using principles of the resource-based view of the firm.

--- Insert Figure 1 about here ---

Openness and the Value of Inimitable Resources

A core tenet of the resource-based view (RBV) is that companies need to control valuable, rare, in-imitable, and non-substitutable (VRIN) resources (Barney, 1991; Peteraf, 1993). In this context, notions of control in the RBV largely center on ownership—that is, companies need to build or acquire resources, and then protect them from the competition to ensure their VRIN status; only these resources may become a source of competitive advantage.

While rarity, inimitability, and non-substitutability are largely uncontested concepts, a debate exists about what constitutes the value of a resource. In particular, Priem and colleagues (e.g., Priem & Butler, 2001; Priem et al., 2013) convincingly advocate a view of value being derived from the perspective of the customer. Simply put, value is created by solving a

² Even the exceptions support our point. In 1997, two similarly situated mobile phone makers — Ericsson and Nokia — separately approached Intel to create a wireless headset standard. The three then approached IBM and Toshiba to become cofounders of the Bluetooth SIG (Keil, 2002).

customer's problem better than any current option, at a price that is equal or lower than the customer's willingness to pay. The firm, in turn, captures some of this value for itself by charging a price that is higher than its costs. Yet, because of differences in baseline capability endowments, expectations of the future, and information about the customer, firms may arrive at different and idiosyncratic evaluations of specific resources and customer value propositions (Schmidt & Keil, 2013). This, in turn, explains why even firms with nearly similar strategies, in the same industry, may still look and perform differently.

When thinking about what openness means from the RBV perspective, the above summary points toward two important avenues of inquiry. First, how does openness affect the VRIN properties of firm resources, and its ability to capture value? Second, which idiosyncratic factors may alter this evaluation? In turn, answers to these questions should explain the antecedents and consequences of openness in general, and of unilateral openness in particular.

The Perceived Value of Openness

Building on recent theorizing on demand-side aspects of the RBV (Priem et al., 2013; Schmidt & Keil, 2013), we assume that a resource has neither inherent nor constant value, but that its role as source of competitive advantage is determined through customers as well as firm idiosyncrasies. In turn, we argue that the contribution of a *specific* resource³ to the firms' competitive advantage may be fundamentally altered through opening it up, as openness changes its VRIN status.

The customer perspective

In many cases, the firm's actions will be constrained by powerful other actors, most notably, customers with high bargaining power. For customers, firm openness should be strictly

³ Following our definition of openness, we use a definition of resource here that subsumes the firm's resource base as well as the application of static capabilities to this resource base.

value-accretive because of resulting lower cost, broader recombinatory possibilities, and lower perceived lock-in.⁴ In turn, powerful customers may be a source of (downstream) openness.

Customers value openness because it increases competition and thus reduces price (Varian & Shapiro, 1999). The reduced price of the resource pushes down the supply curve, increasing the number of customers who will consume the good — lowering the rate of non-consumption and increasing the market size (in units if not revenues). For example, the MySQL database was introduced to the market at a near-zero price,⁵ reaching customers who were deterred by the high prices of the established suppliers. In addition, lower prices through openness also increases the consumer surplus of existing customers (von Hippel, 2005). In turn, customers should choose the newly-opened resource (over still-closed competitors) if

$$V_{\text{open}} - P_{\text{open}} > V_{\text{closed}} - P_{\text{closed}} \quad (1)$$

Notably, what is implied in Equation (1) is that — as with traditional cost leadership strategies — the actual value of the open resource may be lower than that of the closed resource, as long as the differential in value is less than the differential in price.

However, openness may not only affect the price, but also the value generated to consumers by opening up the resource. Given openness entails disclosing (some of) the functionality of the resource, this increases customers' recombinatory opportunities in the present and decreases fear of lock-in in the future.

To facilitate recombination—particularly in industries where multiple parties cooperate

⁴ We do not analyzing supplier buyer power, because our arguments for firm and buyer power can be applied by analogy to such cases. Thus, powerful suppliers should not prefer openness, and will only consider it for the reasons we develop below.

⁵ Notably, nothing bars a firm to charge for providing an open resource *even in the absence of complements*. Examples include charging for the physical provision of the good, or the granting of specific reuse rights (MySQL originally followed the latter strategy). We would expect a *zero price* when openness makes self-production cheaper to customers than opportunity costs, and a price at *zero margin* when customers cannot self-produce cheaply (such as in the production of physical assets), but newly invited competitors can.

to create value in ecosystems (e.g., Adner, 2012)—compatibility between resources is a crucial issues to customers (e.g., Langlois, 2002). Only if resources (offered by the same or different organizations) are compatible with each other may they be recombined to solve the customer’s problem. In turn, customers should strictly prefer compatible offers given that (1) it increases the probability that one of the resulting combinations solves a specific problem at the true optimum and (2) it increases competition, thus driving down prices. Notably, these arguments suggest that compatibility is essential to solving customer needs: in the former case, because compatibility enables a novel recombination of resources, while in the latter, reduced prices enable adoption.

In turn, openness fosters *compatibility* when it is used to share the knowledge needed to effectively utilize a resource, i.e. a description of what the resource does, which outside inputs are required to do so, and which outputs are in turn produced. Such descriptions are commonplace in contexts that feature modularity (Baldwin & Clark, 2000) and standardization (e.g., Fleming & Waguespack, 2007). Because openness is an invitation to imitate the focal firm (West, 2003), it has been argued that openness may even be strategically used to achieve de facto standardization and build ecosystems of value creation (Alexy et al., 2013). The value that business customers realize from such standardization-through-openness means they may push for an upstream introduction of openness. In this context, Henkel and colleagues (2013) describe a scenario in which powerful downstream business customers coerce their (less powerful) supplier into opening up some of their resources to improve compatibility of supplied goods and facilitate their integration into the production process happening downstream.

While openness can increased choice, a credible commitment to long-term openness should decrease customers’ fear of being locked-into a monopolistic supply relationship (Farrell & Gallini, 1988). In turn, the perceived absence of this future potential of coercion should

increase the customer's current perceived value.

Taken together, we find that openness should strictly increase the value that consumers may extract from a resource—both by enhancing the use value they may derive as well as by lowering the cost at which they can do so. Accordingly, we posit:

P1a: From a demand-side perspective, openness increases the value of a resource.

In line with Henkel and colleagues (2013) as well as arguments from the literature on user innovation (von Hippel, 2005) and marketing (Vargo & Lusch, 2004), this should further imply that as long as negligible impacts on the nature of competition in their respective sector are to be expected, downstream customers may use openness to pro-actively increase the value they can extract from others' resources, leading us to propose:

P1b: Customers will seek to encourage the introduction of openness to upstream industries.

The firm perspective

When firms choose a unilateral openness strategy, it may have a direct pecuniary benefit, as when a firm licenses its outbound open innovations (Chesbrough, 2003; Dahlander & Gann, 2010): in these cases, the economic benefits of openness are realized through the licensing payments made to the IP holder. In other cases, firms share IP, knowledge or control without direct financial compensation,⁶ as when firms reveal knowledge to other firms in hopes of accelerating the availability of products that incorporate these insights (Harhoff et al., 2003).

Ceteris paribus, the firm should support openness because it leads to a “growth in the pie”— particularly when buyers expect openness, openness will increase the size of the market

⁶ Here we exclude informal knowledge trading by employees (e.g., von Hippel, 1987), when such trading is not an explicitly authorized firm strategy.

the firm can serve (West, 2003). Firms also may offer openness with their technologies to win cooperation of complementors and other collaborators, whose interest in contributing depends on the degree of their future access to that technology (Shah, 2006; West & O'Mahony, 2008).

However, a simple *ceteris paribus* assumption will not hold: the negative effects of openness on the rarity and imitability of the opened-up resource means that the firm will only be able to capture a smaller share of a bigger pie. The firm benefits only if the benefits of market growth exceed the costs of shrinking share. This means that openness adds value *to the firm* if and only if the private value of the resource it has forsaken through opening up can be compensated for somehow (Henkel, 2004; West, 2003).

In turn, this opens two further avenues of consideration. (1) Firms with different idiosyncratic resource configurations may differently evaluate opening up a specific resource, because of the respective complementarities they may attain. At the same time, however, (2) given that firms that are members of the same strategic groups should be similar in their resource configurations and cognitions (Reger & Huff, 1993) and preference for isolation mechanism (McGee & Thomas, 1986), none of them should have an interest in introducing openness to the industry, given that it significantly decrease the profits that accrue from the specific resource to any member of the group. We thus posit:

P2a: Openness strictly decreases the value of a resource from the perspective of the supplying firm.

P2b: In a static industry equilibrium, no individual firm should have an incentive to introduce openness.

Triggers of Unilateral Openness

To explain the presence of openness, we must broaden our view to focus not only on the specific resource that is opened up, but on others that it may be coupled with. Firms not only consider the specific resource that is opened up, but other related resources. The logic of

complementarities in openness is well known (e.g., Varian & Shapiro, 1999). For example, the “razor” and “razor blade” model means selling a core product cheaply if high margins can be obtained from essential complements (Teece, 2000). However, the latter margins are attractive to potential competitors — as witnessed for example by third-party refilling of expensive printer cartridges. Thus we would expect that firms in a stable competitive position would not choose this strategy, given that it not only risks eradicating the value of the resource, but also the firm’s competitive position with respect to the complement.

Deteriorating competitive position

Firms may attempt such a strategy when the value of the specific resource or their competitive position more generally is under substantial pressure. In particular, if the firm cannot win adoption of its core products (because competitors offer superior value or lower prices), and capturing value through complement sales requires such adoption, companies under extreme competitive pressure may attempt such a strategy. In short, the company chooses openness in hopes of replacing a forlorn present with a better future.

In software, this strategy has often been used by firms that — facing exclusion from a market due to strong network effects — drew on openness as a last resort. Most famously, the strategy was used by Netscape in the Browser Wars of the 1990s, to prevent Microsoft from monopolizing the Internet browser market, in hopes of boosting sales of Netscape’s complementary web server product (Hecker, 1999). Netscape succeeded in giving away its razor but failed at selling its razor blades.

Another manifestation of this strategy is found in patent races, where opening-up a resource could reset the completion and eliminate advantages that other companies may have gained on the market (Parchomovsky, 2000). For example, Eisenberg (2000) suggests that Merck

launched its Gene Index project in the early 1990s to prevent earlier entrants from obtaining patents on the human genome.

What all these points have in common is that competitive forces have rendered a resource held dearly by the strategic group less valuable, if not valueless, to the focal firm. In such cases, in which firms thus cannot idiosyncratically perceive significant value to emerge from the specific resource, they are willing to accept the risk that betting on a complement may entail:

P3: The more that competitive forces decrease the idiosyncratic value of a specific resource, the more the firm should be willing to open it up.

Strategic shifts

Second, we posit that major internal or external shocks may cause a fundamental re-evaluation of a firm's resource portfolio. The origin of the shock—a change in the CEO, a financial, liquidity, or other crisis, etc., or a combination of these—is not important as long as it leads to a strategic reorientation of the company. Specifically, resources should only be considered valuable when they contribute to what the company intends to achieve (Schmidt & Keil, 2013). Thus, their value may change when the company alters its goals or how it intends to get there.

In turn, this change in valuation may affect both a specific resource considered to be opened up as well as its complements. After suffering record losses, IBM hired Lou Gerstner as CEO, who then shifted the company's business model away from hardware sales to software and integration services. With this shift, the idiosyncratic value of service provision and related resources increased. It also decreased the value of proprietary hardware-related resources, particularly those that were not necessarily differentiators on the product market—and these became candidates for opening-up if they were considered complementary to IBM's service-

provision capabilities. Enabling competition in hardware increased the need for integration services, a new competency for IBM. Unsurprisingly, IBM has since become one of the strongest advocates of open standards, with numerous example of them opening up resources for free, in order to enable, foster, or defend service-focuses business models in the markets in which they are active. We thus posit:

P4a: Strategic shifts that lead to a re-appreciation of resource value will increase the likelihood of a firm opening up a resource.

P4b: Companies that shift to new models of value creation will be more willing to open up resources that were valuable for previous models.

New entry

Finally, new entrants will naturally arrive at a different evaluation of resources than established players. Completely new players are unlikely to overcome the isolation mechanisms of any existing strategic group, but instead are founded to exploit a novel, idiosyncratic resource composition. At the same time, given the resource scarcity of most start-ups, they should be happy to work with openly available resources (Baker & Nelson, 2005; Gruber & Henkel, 2006).

Openness should be most interesting for companies entering a market via related diversification. Such a company will have a strong complement in its resource portfolio; more specifically, the firm owns resources on a complementary layer of the industry architecture (Jacobides et al., 2006; Pisano & Teece, 2007). In turn, through openness, such diversifying entrants may commoditize those layers of the industry architecture in which rival strategic groups have established a competitive strongholds through isolating mechanisms, and shift instead competition—and with it, industry profits—to another layer.

The enterprise telecommunications industry presents a fitting example. With the advent of the open IP (Internet Protocol) technology, players with strengths in other areas entered this market, strongly advocating for the new open standard that would allow them to draw on their

existing resource base from other, established markets. In particular, Cisco tried to leverage its competitive advantage in generic hardware, and IBM its strength in services, and both emerged as new market leaders soon after entry. We thus posit:

P5a: The higher the complementarity with their existing resource portfolio, the more likely new entrants will engage in openness.

P5b: Actors for whom market entry is diversification should be more likely to engage in openness than truly new firms.

This points to another reason for why diversifying entrants may support openness. Open technologies enable the creation of open platforms (Boudreau, 2010; Pisano & Teece, 2007). A platform may be understood as a baseline or general purpose technology that provides an underlying, unifying framework for more targeted downstream applications, and customarily includes both standards and an ecosystem of suppliers (Gawer & Cusumano, 2002). The example of enterprise telecommunication also shows that open platforms may facilitate the convergence of previously separate industries. Specifically, Cisco and IBM diversified from the computer industry into enterprise telephony. With the advent of Internet Protocol telephony, they used the open IP standard to merge these two industries into one that dominated by a platform technology to which they possessed strong complements. This platform provided customers all the advantages associated with openness, suggesting that openness might be thought to increase not only the odds of establishing platforms in a void, but also at outcompeting rival attempts at doing so (Gawer & Cusumano, 2002).

P6: The higher the chance of market convergence, the more likely new entrants will engage in openness.

The Industry Dynamics of Openness

After a firm initiates openness, openness may *permanently* alter the basis of competition.

We identify three potential outcomes that may occur separately or in parallel: commoditization, convergence, and competition on delivery.

Commoditization

Commoditization implies that a resource is no longer of direct value to the firm because customers can easily replace the resource with competing offers; price drops and bargaining power shifts downstream. In turn, competing in a newly-commoditized market requires becoming a successful low-cost producer at a substantially decreased price level, possibly one that is lower than established firms' per-unit costs. In this case, strong inertial forces should hold back incumbents to embrace the production methods necessary to profitably engage in openness (Henkel et al., 2013), including managerial cognition, human capital, and costly existing resources. Lacking such inertia, new firms can align their strategies to the business opportunity and the production methods chosen, as openness may allow them to compete in markets dominated by incumbents that enjoy scale economies (Gruber & Henkel, 2006).

A fitting example comes from database management software company MySQL, which provided a completely open product (Dahlander & Magnusson, 2005). Historically, it made sales only when customers wished to purchase an almost identical “closed” version that allowed them to incorporate MySQL more easily into their respective offerings—only a fraction of customers had that need. Yet, the increased diffusion of the software package allowed MySQL produce at extremely low cost—with users providing invaluable assistance in testing and error-proofing the software. MySQL further had no large office, but developers worked from home, distributed all over the world. This way, MySQL could ensure further development at a fraction of the cost, yet much higher speed, than competitors.

As a consequence of commoditization, “growing the pie” may grow the number of

consumers, but not necessarily the number of *paying* consumers or even revenues. A drastically cut price will assure customer growth as more customers' willingness-to-pay is met—MySQL's official strategy in the mid-2000s was to battle non-consumption, not necessarily to take away market share from the competition. Such strategies can create a new disruptive market segment (in the sense of Christensen, 1997) with little immediate negative effects on the current industry structure. Over time, however, the disruptive entrants will try to move up-market—as did MySQL—and can chase current competitors away to premium niche segments or to other layers of the industry architecture. Yet, given the resource remains permanently open, even an extinction of the open competitor (such as MySQL⁷) cannot completely eradicate the dynamic, as other new ventures may simply replicate the strategy.

In short, even if firms seek to compete on other dimensions, commoditization will tend to favor new entrants given customers will seek out the open alternative because of higher use value. Even if stable sub-markets emerge, incumbents will lose market share to the open competition (Casadesus-Masanell & Ghemawat, 2006). Even worse is that the dynamics of disruptive innovations may lead to the industry being increasingly subsumed by the open alternative.

Convergence

As mentioned earlier, firms may choose to partly open up a resource that is no longer generating profits, but is still needed as part of a larger offering they intend to provide. An example of this would be IBM providing commoditized hardware as part of its integration services. If this resource is required in the present, then firms may use openness to coordinate on its joint production and protection (Alexy & Reitzig, 2013). If it is a resource that is only

⁷ In 2010, the largest database company (Oracle) bought Sun Microsystems, which had previously acquired MySQL AB.

required in the future, firms may use openness as bait to lure other actors: free resources may entice collaborators to support the focal firm's market-making or standard-setting (Alexy et al., 2013). Either way, openness is a way for the firm to shape the technology or market direction in an advantageous direction — particularly if that direction increases demand for the firm's unique value-creating activities (Jacobides et al., 2006).

However, what if every actor in the industry were to simply replace their own resources with the open one? In theory, this would imply that an entire layer of industry architecture would be commoditized as firms adopted the open alternative, as shown by many examples from open source software. But even in this case, firms will invest in the joint production of the open resource. As they need to ensure that strong complementarities exist and continue to exist between the open resource and the rest of their resource portfolio, these firms have powerful incentive to continue contributing to the open public resource (West, 2003). Thus, rather than free-riding, we find that self-governed structures or industry associations emerge to coordinate between the joint interests of all the players of ensuring functionality of the open resource and their respective individual interest (Alexy & Reitzig, 2013). Notably, even if the open resource were completely standardized, participation in the standardization process may create private knowledge benefits (Fleming & Waguespack, 2007) or lower cost of future production by ensuring that firm-specific requirements are incorporated into the public pool of knowledge (Henkel, 2006; West, 2003).

In turn, it is clear that organizations who see the least value in a given resource⁸ should be first to launch attempts at its standardization — particularly if it is valuable to other firms.

⁸ We would expect the initiative to be taken by the firms who have the greatest gap between their gains from the complement and their loss from opening a resource. It is an open empirical question whether firms will be driven by the potential gains, minimal losses, degree of urgency or some other (cognitive) factor.

Commoditizing the layer of a competitor reduces their profits (that could be used to attack the focal firm). Making the commoditized layer more broadly available increases demand for the focal firm's complements and also frees "wallet share" from the old layer to spend on the complement. For example, facing a challenge from Facebook, LinkedIn and other social media startups, Google promoted standardized OpenSocial interfaces to increase competition and reduce switching costs between social media firms — while keeping its own advertising interfaces proprietary (Hagi & Yoffie, 2009).

Competition on Delivery

The above dynamics suggest the possibility that openness might eventually pervade *all* layers of the industry architecture. There are several reasons why. First, customers who come to expect openness will come to prefer it at any opportunity. Secondly, any layer capturing significant rents will attract competition that will erode (and perhaps eliminate) lock-in and other sources of monopoly power (Teece, 2000). For example, standardization of various personal computer technologies in the 1990s commoditized most of the component technologies, maximizing the choices both for PC makers and end-users (Kraemer & Dedrick, 1998).

With such layer-by-layer commoditization, some actors may still profitably produce components. However, for most firms, the value that they can capture will only be attained in the actual delivery to the customer—a service provision, in fact. In this case, we identify three possible dimensions of competition: integration, complementary assets, and speed.

Regarding integration, an increased choice of standardized options leaves customers with two problems: a lack of attention, time, or skill to (1) select specific options and (2) to customize and deliver them to fulfill the customer's needs. Many customers have no time to become experts in the goods they purchase, and so will pay experts to choose and deploy a combination of open

resources if the price is less than the cost of doing it themselves. In turn, integrators can combine common packages of open components, and deploy them in a unique fashion for each customer (Vargo & Lusch, 2004). One example is the entrance of many small firms to provide IP telephony equipment for large firms, integrating standardized configurations available at all layers of the industry architecture. In turn, large service providers retain an advantage when works require a particularly large, well-trained sales and support force.

This shift to standardized offerings highlights the continuing importance of complementary assets, whose value will naturally depend on their inimitability or non-substitutability. For example, companies that own natural resources such as mines should have little to worry from openness. In manufacturing industries, learning and scale economies have traditionally provided entry barriers (Wernerfeld, 1984). However, more recently, large capital investments required for LCD and semiconductor manufacturing has not prevented commoditization of these industries (Kraemer & Dedrick, 1998). In the future, such manufacturing scale is being displaced by increased digitization and wider availability of 3D-printing and co-production facilities (Anderson, 2010).

Speed is of importance where the delivery of open goods creates additional willingness to pay in the consumer. A quick organization will be ahead of the curve in identifying or defining new customer needs, which can be used to build transient competitive advantage either through unique configurations of the open components or through proprietary technology. However, in a world of short product life cycles, such advantage will be temporary (e.g., D'Aveni & Gunther, 1994). In turn, the reputation to be continuously different may also allow the organization to create legitimacy (Navis & Glynn, 2011; Smith, 2011), another complementary asset potentially valuable in a fast-moving and open environment.

The Effects of Openness on Value Accretion to Firm and Industry

Finally, we consider the outcomes of openness strategies. To do so, we distinguish its effects on the value of resource portfolios, the firm launching openness, and the industry in which it does so. Because openness is strictly value-accretive to consumers (Proposition 1), we largely disregard them in this analysis. We consider four possible effects of openness: whether firm and industry fare better or worse, that is, whether openness positively or negatively affects the value they can ultimately capture. These four quadrants are depicted in Table 1.

--- Insert Table 1 about here ---

From the perspective of the firm, initiating openness is often a gamble. On the one hand, the firm creates openness to stimulate demand for the revealed resource and with it, increase sales of a complement. Thus, a first precondition for firm success is increased adoption of the opened-up resource. On the other hand, openness is inherently imitable and adaptable, so creating demand for openness can be a prisoner's dilemma race to the bottom for commoditization. It seems necessary when using openness to win adoption that there be some sort of switching costs or lock-in, at the very least ensuring that a significant portion of customers will purchase the complement (West, 2003). Thus, only if firms can increase diffusion and establish new isolating mechanism will they be able to benefit from openness. Otherwise, the value created through openness will be reaped by customers or competitors in the industry.

From the perspective of the incumbent firms, openness represents an attack on the current industry equilibrium, with two potential outcomes. The first possibility is the prompt emergence of a new equilibrium in which established players either successfully embrace or push back openness: in this scenario, the industry participants may improve their value created and realized. The other scenario is that the openness spawns an irreversible shift in the industry, with the value

once created by incumbents moving to the newly open players, to customers, or both.

Case #1: Firm Better off—Industry Better off

The case in which everyone benefits from openness requires increased diffusion and isolating mechanisms on the one hand, and the establishment of a stable and universally beneficial new industry equilibrium on the other hand. In short, this requires newly-open as well as established players to achieve some sort of coordination about how openness will affect the industry in order to prevent a downward spiral (see case #2): this is the case of “collective production” and “collaborative openness” described above.

Extant literature suggest that this coordination may be achieved by actors within a current strategic group, or actors of converging interest who might form a strategic group in the future. By opening-up a resource, the focal firm signals that it is willing to give up exclusivity over a certain part of its value chain—usually one which is not crucial to its competitive advantage (Henkel, 2006). For all other actors in whose value chain this resource also features, and also in a peripheral role, openness may be interpreted as an invitation to collusion (Alexy et al., 2013). This is equivalent to saying that actors coordinate on separating formally integrated processes of value creation in a way that is similar to the separation of layers of industry architecture, with the opened-up resource and all remaining activities being strong complements. In turn, this implies that increased diffusion of the opened-up resource is strictly beneficial to all coordinating actors (who might still differ in the specifics of the remaining steps of their value chain). At the same time, pooled production of the common resource should be substantially cheaper than manufacturing it individually. If the strategic group collectively embraces this model of production, it represents a de facto standard as long as customers cannot substitute for the bundle of the jointly-produced open resource and its proprietary complements.

An example of this is the Structural Genomics Consortium (SGC), an association of several leading pharmaceutical companies and universities formed in 2004 (Perkmann, 2009). Their goal is to determine the three-dimensional shape of proteins, an essential step in the pharmaceutical process that needs to be carried out by all the actors involved in the SGC, yet in which none of the companies had any particular source of competitive advantage. Put differently, the SGC has turned into a pre-competitive public-private drug discovery partnership, the outputs of which may be used by anyone. While the corporate members share in the benefits of the SGC, they compete fiercely on downstream drug development, where they can add most value.

Case #2: Firm Worse off—Industry Worse off

The opposite case is characterized by an unwillingness or inability to coordinate. In the absence of coordination, the above-described coordinated split of the value chain cannot happen. With openness decreasing profits in the resource to zero, firms will be dragged into a price war, with each firm desperately hoping that its complements will sustain it through the increased competition. The decreasing price and increasing commoditization will dismantle existing barriers to entry, further increasing competition. Without technology differentiation, production advantages are sustained based on cost leadership and scale economies. The result is that most of the value generated in the industry will be realized by the consumer, in form of lower prices.

How could such a detrimental dynamic be set in motion? We see several potential avenues. First, it may be triggered by a firm opening up carelessly or recklessly—opening parts of the value chain that were of competitive relevance to its industry, perhaps due to desperate competitive pressures. Second, industry structure, firm rivalries, communicative barriers, laws, or other factors must prevent firms from coordinating. For example, the core opponents of Netscape and Merck, Microsoft and Celera, employed strategies strongly focused on the

protection of intellectual property that were simply incompatible to large-scale openness—it would have eradicated the very foundation of the value capturing activities. In these cases, mixed duopoly scenarios may emerge in which newly-open and traditionally-closed actors compete.

A third option triggering these dynamics may be involuntary openness. On the one hand, this may happen by the organization carelessly or needlessly opening up a resource. For example, companies that sloppily bundle their own proprietary resources with open source software may become legally required to open up these resources (Rosen, 2004). Intriguingly, bottom-up initiatives, in which individuals engaged in openness locally to solve technical problems, may be particularly prone to causing such problems, highlighting the need for coordinated openness strategies and activities across the firm (Henkel, 2004).

Case #3: Firm Better off—Industry Worse off

Closely related is the case in which the firm uses openness to gain competitive advantage over the rest of the industry. In this scenario, the firm can actually sustain the commoditization of the focal resource through openness because it holds superior complements. This may apply both for actors that are currently in the industry (those facing a Strategic Shift) as well as players from the outside (the New Entry mentioned above). In these cases, the focal firm purposefully initiates the commoditization of the resource to shift to a competition on delivery.

What is underlying both this setting is a fundamental difference between the firm and the rest of the industry in the appreciation of the focal resource: the firm thinks of it as a potential commodity, the industry considers it a core value driver. Such a difference in cognition is at the heart of disruptive innovations (Christensen, 1997). From an RBV perspective, the latter case suggests that through continuous improvements, incumbents seemingly increase the use value of a product to customers, but they are overperforming the customer expectations to a degree that

not all of the product's benefits can be reaped by the customer. In turn, an offering that superficially seems worse in performance might still be good enough, in particular if it offers customers a new dimension of value on which it outcompetes existing offerings. Steel production is an interesting example: while steel from iron ore is purer than recycled steel, the latter is produced in mini-mills, which provide lower cost, shorter delivery times, and can be placed anywhere. From the perspective of a car company, as long as the steel is good enough, having a mini-mill next door allows for just-in-time production, with improved cost and production flexibility compared to (higher quality) traditional steel suppliers (Christensen, 1997).

In short, we argue that such disruptions succeed because they offer higher use value, and that this logic may similarly be applied to openness. While new, open technologies may initially underperform existing proprietary offerings, they may allow customers to achieve other, new benefits. For example, in the case of enterprise telephony described above, while the actual quality of phone calls may have decreased initially when switching to IP telephony, it allowed for companies to route all their data over one instead of two networks, and facilitated integration into other existing information technology systems. Anticipating upcoming improvements in the quality of phone calls, many of them were happy to change to the systems provided by IBM and Cisco. In turn, establishing the open standard was a prerequisite for IBM and Cisco to be able to deploy their complements in this new industry.

Case #4: Firm Worse off—Industry Better off

Finally, we turn to the case where openness does not improve the situation of the focal firm, but those around it. As said before, the two necessary conditions for individual firm success are increased adoption and some form of lock-in to ensure value increase in the complement. Alas, this case may happen if one of these conditions is not met, and the industry can adjust to

openness quickly.

This is easy to see when openness leads does not bring increased adoption or market growth. Instead of shifting the industry's competitive structure, rival firms can draw on the knowledge revealed by the open firm as in the case of (inadvertent) knowledge spillovers. For example, over 400,000 open source projects have been created by individuals and firms on SourceForge.Net, but the vast majority fail to gain significant product or market success (cf. David & Rullani, 2008)— meaning the authors gained nothing from their openness.

Even if openness leads to increased adoption, an absence of lock-in possibilities can prevent the focal firm from benefitting from such a move. However, the existing players around the firm may be able to shift their value configurations to create such lock-ins, and ensure that they reap the benefits of diffusion. This may happen on a firm-by-firm basis, or because existing actors coordinate on exploiting a specific firm's openness. One example is the Asterisk open source software package that transforms a PC and inexpensive hardware into a viable replacement for industrial-grade telephony equipment worth tens of not hundreds-of-thousands of dollars. The firm that created Asterisk, Digium, initially had a business model of selling related proprietary hardware and providing Asterisk for free. However, this strategy created market opportunities for many new entrants who chose to bundle Asterisk with off-the-shelf hardware and offered services based on that— while even incumbents combined Asterisk with their equipment to improve performance or reduce costs.

Discussion and Conclusions

In this paper, we have sought to explain the antecedents and consequences of openness. After defining openness, we showed how all openness is unilateral and ultimately beneficial to customers. Conversely, from the perspective of a firm and its strategic group, strong cognitive

barriers against openness seem to exist, leading us to suggest the importance of three triggers: a deteriorating competitive position, strategic shifts, and new entry. In turn, we identify three industry-level processes set in motion by openness: commoditization, convergence, and competition on delivery. From this, we show how the dynamics of these processes may help or hurt the performance of the firm and the surrounding industry.

Theoretical Implications and Future Research Opportunities

By linking recent thinking on openness with the resource-based view and industry dynamics, we offer three contributions to the literature on innovation and strategy.

First, we elaborate on the antecedents of openness. Prior research has taken an opportunity-driven approach to openness: given a specific setting, openness should be considered an option, a business case may be set up, depending on which the decision to open up should be taken (Henkel, 2006). Our argument extends this perspective by including the complex downstream competitive consequences that openness may bring. While the more immediate consequences of openness are relatively easy to predict, potential adverse future competitive implications have largely been disregarded (see also Alexy & Dahlander, 2013). We show that by accounting for them, a very strong argument can be built *no well-performing firm inside a stable industry should have a particular interest in introducing openness*: the homogeneous cognitions and resource configurations of similar actors within a stable strategic group means they all think to benefit from the participation in the existing proprietary industry equilibrium. Notably, this inertia is a cognitive one: firms in stable industry equilibria should be less likely to perceive openness as a viable competitive strategy, *irrespective of the fact* whether openness, objectively, would be a smart competitive move. The ability to escape such mindsets while in good competitive standing is an important opportunity for future research.

We further identify two paths for punctuating this equilibrium. First, openness may be introduced from the outside, either by customers or new entrants. Second, beyond accidentally opening up, players within the industry will learn to appreciate openness in response to firm-idiosyncratic competitive problems or shocks that prompt dramatic shifts in the firm's strategy. Such shifts are required for a novel cognitive value framework to emerge within a firm. This framework deviates from other group members and is a prerequisite for a firm-idiosyncratic positive evaluation of openness, and the subsequent decision in favor of unilateral openness.

This argument comes with two potentially interesting extensions. First, we are implicitly saying that "good firms" will not do openness. However, this seems to clash with one of the premises of the behavioral theory of the firm which argues that successful firms with excess resources will engage in more search to sustain their overperformance⁹ (Cyert & March, 1963). Second, openness may be a weapon to wield to attack industries with stable equilibria in which all actors are earning reasonable profits. It is exactly such industries that firms would like to enter, and openness may provide an entry strategy to tear down previously insurmountable barriers to entry and raising customer value through increased choice. Both questions warrant detailed empirical investigation.

Our second contribution pertains to the consequences of openness. Here, we see how strategies incorporating openness change the nature of competition in a resource-based perspective. In this context, we contribute to recent debates on openness as a tool to reshape value chains and industry architectures (Alexy et al., 2013; Pisano & Teece, 2007). We elaborate on these studies by explicating more clearly the processes of industry dynamics emerging from deploying openness. In doing so, we identify the tension between the positive and negative

⁹ Openness has long been associated with search, as with Laursen and Salter (2006).

effects of openness, by specifying the conditions under which these strategies may harm the firm or its industry. At the same time, our arguments on competition on delivery point toward the increased importance of a service-dominant logic (Vargo & Lusch, 2004) for our understanding of where value from openness ultimately comes from (see also Priem & Butler, 2001; Priem et al., 2013): the more open industries become, the more value migrates from the individual layers of industry architecture toward service provision and integration. From a resource-based perspective, this development would imply that competition shifts from static resources and control over them, to ensuring access to these resources and then developing superior capabilities at deploying them. In this vein, openness is a clear facilitator of the shift from resource-based competition toward (dynamic) capability-based competition (Pisano & Teece, 2007), with firms strong in integration and services positioned strong even in case of eventual hypercompetition (D'Aveni & Gunther, 1994) on all layers below. It also suggests the feasibility of novel cost leadership strategies and extreme nichification, leveraging the lower cost and wider variety of components that broaden the market that may be profitably served with an integration model. We would further expect complementary assets, ownership of unique natural resources, and lead time to matter in such a world, and leave the exploration of their relative efficacy to future work.

Finally, the framework we develop in the beginning of our paper may allow researchers to aptly study the governance and evolution of openness strategies. In particular, the respective literatures (Chesbrough, 2003; von Hippel, 1988, 2005) are characterized by a rich account of important phenomenological observations. Yet, theoretical abstraction to bring together and generalize individual argument are rare (see Dahlander & Gann, 2010 for a notable exception). We believe the above dimensions may provide building blocks for future research on openness, research that should further consider the essential role of execution and evolution of processes

over time. Here, it is important to note that while we have added considerable flexibility to existing lines of argument, we are still static in saying that once openness has happened, it cannot be taken back. In our original conceptualization, however, we made clear how companies are given a wide array of choices in how to design their engagement into openness. In this vein, van Burg and co-authors (2013) describe gravely varying levels of openness over time in multi-partner technological collaboration in the airline. As such, the inter-temporal dynamics of openness still hold considerable promise for future research.

Managerial Implications

From the perspective of managers, our argument is both a warning and an encouragement. It is a warning, on the one hand, not to be blinded by the promises of openness, but to acknowledge that failure is a likely outcome, and to take active steps to prevent it from happening. On the other hand, it is a warning that others may consider entering the firm's industry using openness, a line of attack against which traditional defensive barriers may prove useless. Our research does not conclusively suggest a winning response to such attacks, beyond Christensen's (1997) suggestions for isolating mechanisms to respond to disruptive innovations. At the same time, our arguments show how a wide variety of firms — particularly those in difficult competitive situations — may find openness an opportunity worth considering. And for firms in stable competition situations, they are an encouragement to consider how openness could potentially be of long-term benefit to them as well.

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Tables and Figures

Figure 1: Illustrating the competitive dynamics of openness

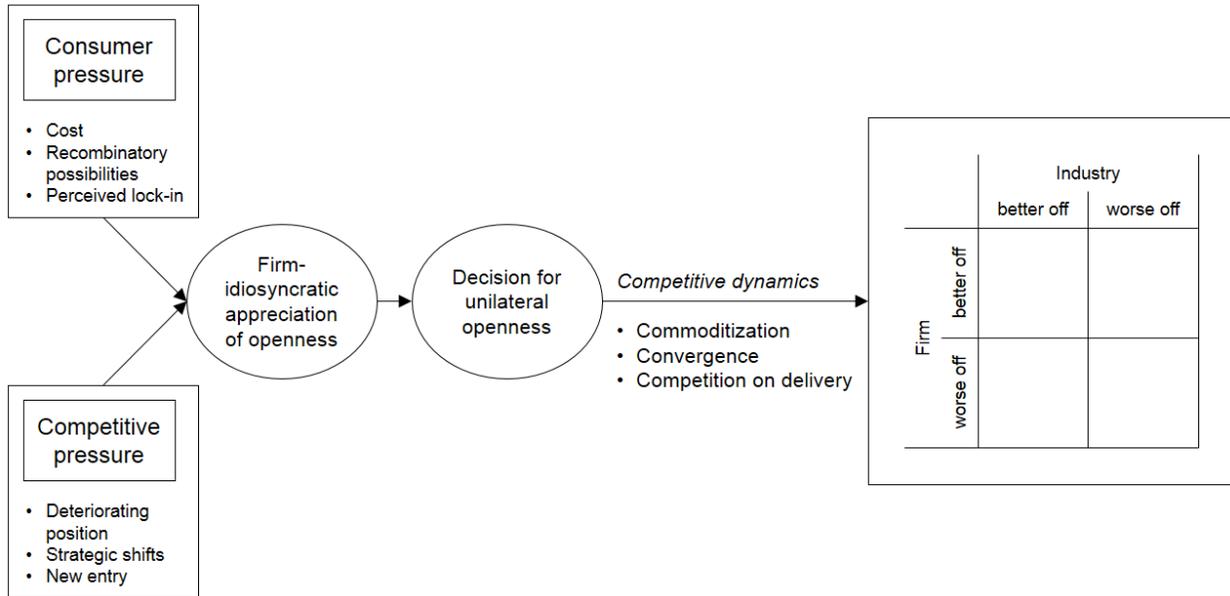


Table 1: Competitive dynamics of unilateral firm openness

	<i>Industry Better Off</i>	<i>Industry Worse off</i>
<i>Firm Better Off</i>	Cooperative standardization Collaborative R&D	PNE, pre-empting the market, lock-in
<i>Firm Worse Off</i>	Rapid imitation Weak complementary assets Zero-sum competition	Price war