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PLATFORM COMPETITION: STRATEGIC TRADE-OFFS IN PLATFORM MARKETS

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Because the literature on platform competition emphasizes the role of network effects, it prescribes rapidly expanding a network of platform users and complementary applications to capture entire markets. We challenge the unconditional logic of a winner-take-all (WTA) approach by empirically analyzing the dominant strategies used to build and position platform systems in the U.S. video game industry. We show that when platform firms pursue two popular WTA strategies concurrently and with equal intensity (growing the number and variety of applications while also securing a larger fraction of those applications with exclusivity agreements), it diminishes the benefits of each strategy to the point that it lowers platform performance. We also show that a differentiation strategy based on distinctive positioning improves a platform's performance only when a platform system is highly distinctive relative to its rivals. Our results suggest that platform competition is shaped by important strategic trade-offs and that the WTA approach will not be universally successful.

INTRODUCTION

Many markets in today's economy, including PC operating systems, digital PDAs, video games, and Web-based systems are organized around platforms, which function as an interface between different groups of users and facilitate value-creation exchanges (Evans, 2003; Gawer, 2010; Rochet and Tirole, 2006). The recent literature on network economics (e.g., Armstrong, 2006; Caillaud and Jullien, 2003; Hagiu, 2005; Rochet and Tirole, 2003, 2006) refers to these competitive contexts as multisided markets. Multisided markets emerge to mediate transactions between distinct groups of users: for example, between video game consumers and the producers of a gaming platform's complementary applications and content.

The hallmark of the existing literature on platform competition is the concept of network effects, wherein consumers place a higher value on platforms with a larger number of users. This might be because consumers value direct links with other consumers (direct network effects) or because they anticipate that platforms with more users (a larger installed base) will also offer a wider number and variety of complementary products and services (indirect network effects) (Evans, 2003; Rochet and Tirole, 2003). As a result, 'systems that are expected to be popular—and, thus, have widely available components—will be more popular for that very reason' (Katz and Shapiro, 1994: 94). Because of these network dynamics, the literature generally predict a 'winner-take-all' (WTA) outcome, which the platform with the largest number of users will 'tip the market' in its favor in (e.g., Besen and

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Farell, 1994; Caillaud and Jullien, 2003; Katz and Shapiro, 1994; Shapiro and Varian, 1999).

A WTA paradigm in multisided markets suggests that platform firms should embrace aggressive strategies to expand both their installed base of users and their stable of application providers so that benefits achieved on each side of the market are mutually reinforcing. More specifically, a 'get-big-fast' (Eocman, Jeho, and Jongseok, 2006) strategy would compel platform firms to: (1) rapidly acquire and grow their platform's installed base of users; (2) lock in those users; and (3) undermine the ability of rival platforms to do the same. These goals could be achieved using an array of distinct strategies. For instance, platforms could set low price to penetrate the market and grow users' installed base and then leverage on this installed base to make money on the other side of the market—by charging developers of applications that access the platform to reach these potential customers (e.g., Clements and Ohashi, 2005; Eisenmann, Parker, and Alstyne, 2006). Or they could use licensing strategies like sweetheart deals to attract a larger number of application developers and/or exclusive contracting to secure content in exclusivity, thus limiting the supply of similar goods to rival platforms while enhancing the competitiveness of the platform's offering (e.g., Armstrong and Wright, 2007; Hagiu, 2009; Lee, 2007; Mantena, Sankaranarayanan, and Viswanathan, 2008; Yoffie and Kwak, 2006).

Existing studies illuminate the unique competitive dynamics in platform markets by analyzing aggregate network effects and the impact of individual 'get-big-fast' (GBF) strategies. However, this literature failed to consider the competitive effects of pursuing multiple GBF strategies simultaneously (McIntyre and Subramaniam, 2009). The unconditional logic of the WTA hypothesis has been questioned recently by several authors, who have demonstrated that multiple platform systems may coexist because of: (1) asymmetric or local network effects (Eocman *et al.*, 2006; Shankar and Bayus, 2003; Suarez, 2005); (2) modest costs of adopting multiple platforms (Eisenmann, 2007); or (3) differentiated consumer preferences (Armstrong and Wright, 2007; Eisenmann *et al.*, 2006) that may limit the benefits of individual GBF strategies. This article extends this strand of research by building theory based on mainstream competitive strategy literature to predict that combining multiple GBF strategies creates strategic trade-offs that may undermine a platform's ability to capture its whole market and empirically demonstrating this phenomenon in the U.S. video gaming industry. Video game consoles, such as Playstation or Wii, serve as platforms on which game titles are developed by independent producers (on the sellers' side) and played by consumers (on the buyers' side). Video game platforms are an excellent laboratory for empirically analyzing the competitive dynamics among rival platforms for several reasons. First, other studies have already documented the influence of complementary applications and the reinforcing feedback typical of multisided markets (Clements and Ohashi, 2005; Corts and Lederman, 2009; Shankar and Bayus, 2003; Venkatraman and Lee, 2004). Second, because multiple platforms coexist in the industry, we can exploit heterogeneity in the way distinct platforms manage their relationships with third-party game providers and the way they structure and position their portfolio of game titles. Finally, platform market leadership has changed markedly over time, allowing us to analyze the strategies pursued by the industry's losers as well as its winners.

We develop hypotheses about the presence of strategic trade-offs along two dimensions that are critical for the success of platforms in the market space. First, we examine potential strategic trade-offs that could arise when a platform embraces WTA strategies with its application and content producers. The WTA hypothesis stresses the benefits derived from network effects and implies that aiming to enlarge the base of users through the provision of a larger and unique number of applications will boost the competitive standing of the platform and help win the market. We question this general conclusion and examine when combining WTA strategies may actually reduce a platform ecosystem's competitive position. We show that pursuing with same intensity multiple distinct strategies aimed at boosting growth in the platform 'ecosystem' of applications and content can actually undermine performance by triggering conflicting incentives for application providers. Second, we examine the critical choice platform firms face about where to locate their offerings, relative to their rivals, in the map of consumer preferences. A straightforward WTA approach would imply positioning the platform only in the location space in which the largest number of consumers is available, effectively excluding the option of distinctive positioning. We question this conclusion and examine when distinctive positioning may actually improve platform performance. We argue that platforms can, indeed, differentiate successfully using distinct positioning and show that avoiding costly WTA-style competition with rival platforms is not only possible but beneficial if a platform's positioning is sufficiently distinct from its rivals. Our econometric analysis of the video game industry from 1995 to 2008 provides robust and nuanced evidence to support our arguments.

Documenting and understanding the potential trade-offs in platform markets is particularly important for the study of platform competitive dynamics. Platform markets represent a new competitive landscape wherein the nature of strategy can be altered, requiring a better understanding of the role of strategy in relation to the underlying competitive and technological dynamics that unfold at the platform's ecosystem and industry level (Bettis and Hitt, 1995; Gawer, 2010). Existing theories stress the self-reinforcing effects of network dynamics but neglect to discuss potential conflicts between the strategies platforms use to leverage or alter those network effects. They do this despite evidence that managing strategic conflicts is a critical task for platforms pursuing market dominance (Gawer and Cusumano, 2002; Yoffie and Kwak, 2006). Managers also tend to overestimate the benefits of network effects (e.g., Liebowitz, 2002; Porter, 2001; Shankar and Bayus, 2003; Suarez, 2005). In these cases, it is tempting to combine multiple GBF strategies in hopes of both growing the platform's ecosystem exponentially and limiting rivals' ability to do the same. This can be perilous without carefully considering the potential conflicts and disincentives these growth strategies create, particularly among the developers of complementary goods (e.g., Yoffie and Kwak, 2006). To date, there has been little empirical evidence about these dynamics as well.

Next we briefly review the existing theory on platform competition. Then we introduce our hypotheses about these strategic trade-offs and the methodology used to test them. We close by discussing our findings and their implications for the strategy and platform competition literatures.

THEORY AND HYPOTHESES

Network economics theory on multisided markets (e.g., Armstrong, 2006; Caillaud and Jullien, 2003; Evans, 2003; Hagiu, 2005; Rochet and Tirole, 2003, 2006) asserts that growth in the installed user base and the availability of complementary products are the main mechanisms driving a platform's value and market share. Different studies have analyzed these effects. For instance, Schilling (2002) found that technological platforms with a larger user base are likely to attract more developers of complementary applications, which, in turn, will increase a platform's installed base. In the microprocessor market, Wade (1995) found that a platform that garners a wide array of supporting products will be more likely to enlarge its installed base and outcompete rivals. In fact, Shankar and Bayus (2003) concluded that a firm's customer network is an important strategic asset in network markets. Clements and Ohashi (2005) and Corts and Lederman (2009) both examined the extent of indirect network effects in the U.S. video game industry. Their results confirm the importance of a platform's complementary products, along with penetration pricing, for a platform's success. At the same time, Venkatraman and Lee (2004) showed that game developers want to build their games on the most popular platforms.

Another set of studies has analyzed firm strategies for exploiting network effects. There has been an extensive focus on pricing strategies (e.g., Hagiu, 2005; Rochet and Tirole, 2006), while some attention has been paid to the effect that competition among producers has on the innovation and variety of complementary products (e.g., Armstrong, 2006; Boudreau, 2010), early market entry to capture customers ahead of rival firms (e.g., Eisenmann, 2006; Schilling, 2002), and the use of exclusivity contracts as a strategy to prevent rival platforms from obtaining valuable products (e.g., Lee, 2007; Mantena *et al.*, 2008). To date, these strategies have been examined only separately. As a result, there is little evidence to document the competitive effects arising when these strategies are used in combination or to show how those competitive effects might impact platform firms as they build and configure their ecosystems (McIntyre and Subramaniam, 2009). Later, we turn our attention to such issues. We explore the presence of strategic trade-offs in platform markets along two critical dimensions for the growth and

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market success of a platform's ecosystem: stimulating innovation of complementary applications and positioning the system in the map of consumer preferences.

The *AMC–apps exclusivity* trade-off

A platform mediates the relationship between end users and the universe of potential complementary goods. Because feedback between consumers and complementary goods is mutually reinforcing, strategies aimed at managing complementary goods can be even more critical than those designed to attract end users (e.g., Gawer, 2010; Yoffie and Kwak, 2006). In fact, because users and complementary goods are interdependent, ensuring that a platform offers a larger variety of complementary products than its rivals is one of the main mechanisms for increasing the installed base of users (Clements and Ohashi, 2005; Schilling, 2002). We focus here on two of popular growth strategies identified by the WTA literature: (1) stimulating competition among complementary goods providers to ensure that a large variety of platform applications are developed and (2) outcompeting rivals by securing a larger number of popular applications in exclusivity deals.

Improving a platform's content by promoting competition among applications providers

Promoting competition among applications providers—*apps market competition* (*AMC*)—is one mechanism platforms use to make their systems more competitive and to enhance their overall competitive positions (e.g., Armstrong, 2006; Armstrong and Wright, 2007; Boudreau and Lakhani, 2009). Platform providers can influence the degree of *AMC* in a variety of ways, including licensing policies (Khazam and Mowery, 1994), technical support for development programming (Schilling, 2003), and the use of 'soft power' inducements (Yoffie and Kwak, 2006). Armstrong (2006) suggests that a platform can boost its performance by encouraging increasing levels of competition on the supply side. This would effectively stimulate the production of a larger variety of applications and, by force of indirect network effects, increase user adoption. A larger installed base of users creates a larger market for application producers which, in turn, creates a cascade of reinforcing effects (Hill, 1997). Turner, Mitchell, and Bettis (2010) find that even when the market for complementary applications is concentrated, the threat of competition from other providers will induce incumbents to respond to rivals and introduce new products. The product life cycle becomes shorter as competitors angling for consumers' attention speed up the release of new games with innovative content (Boudreau and Lakhani, 2009; Turner *et al.*, 2010; Venkatraman and Lee, 2004).

Although application producers would prefer less competition (Boudreau, 2012; Turner *et al.*, 2010), the benefits of selling products on a popular platform can outweigh the negative effects of competition. One of the main reasons both users and producers decide to transact on one platform is the opportunity for exchange a platform creates (Evans, 2003; Rochet and Tirole, 2006). A high level of *AMC* increases value-exchange opportunities for its users and lowers transaction and searching costs by stimulating a larger production of applications which, in turn, attracts a greater number of consumers. Platforms that design their competitive strategy around a high level of *AMC* will emphasize efficient-scale activities so as to create value by increasing transaction opportunities and lowering searching and transaction costs for their users.

Outcompeting rivals for exclusive platform applications

Apps exclusivity captures the extent to which a platform's complementary products are denied to its rivals––i.e., developed for and sold only on the focal platform. The primary objective of exclusivity is to provide users with high quality applications they will be unable to obtain on other platforms (e.g., Lee, 2007; Mantena *et al.*, 2008). This approach can enhance a system's competitive position because consumers with strong tastes for specific (exclusive) products have no choice but to transact on the platform that controls them. By securing complementary applications with exclusivity agreements, and thereby denying access to rivals, a platform might also reduce its competitors' effective participation in the content and consumer markets (Armstrong and Wright, 2007; Mantena *et al.*, 2008). Finally, by contracting application producers into exclusivity, a platform can develop close relationships with those producers over time. This might facilitate enhanced coordination over the timing of releases and on the type and quality of content an application producer develops (Yoffie and Kwak, 2006; Stennek, 2007).

The trade-off

The literature we have reviewed clearly implies that platforms should encourage higher levels of *AMC* to attract as many titles and users as possible and boost market share using indirect network externalities. Furthermore, they should try to secure exclusive applications to increase their system's competitiveness relative to competitors. Some scholars have speculated that platforms pursing both high *AMC* and high *apps exclusivity* can better leverage network effects and gain a superior competitive position (Armstrong and Wright, 2007). However, we argue that promoting high *AMC* would actually have a marginal negative effect on performance when the platform is also boosting *apps exclusivity*.

Numerous studies in the competitive strategy literature show that firms that choose hybrid strategic profiles experience lower performance than firms with a purer profile (e.g., Campbell-Hunt, 2000; Spanos, Zaralis, and Lioukas, 2004; Thornhill and White, 2007). Porter (1985: 17) explains it as 'a manifestation of a firm's unwillingness to make choices about how to compete . . . (so that) it tries for competitive advantage through every means and achieves none.' This is because: (1) some configurations of value activities are mutually exclusive and involve trade-offs; (2) intermediate strategic profiles are vulnerable to attacks from specialized competitors and are easier for rivals to contest or imitate; and (3) hybrid strategies increase organizational complexity and create confusion and a lack of clear priorities when setting goals (e.g., Porter, 1985; Thornhill and White, 2007; see also Campbell-Hunt, 2000 for an extensive review). Other scholars have argued that mixed strategic approaches are viable and advocated a more contingent perspective (e.g., Hill, 1988; Murray, 1988; Spanos *et al.*, 2004). Along these lines, and also recognizing that firms regularly combine multiple strategies (as in our case), we treat the strategic trade-off between *AMC* and *apps exclusivity* as a problem of degree. Platforms must decide which elements of their concurrent strategies to emphasize and which to make lesser priorities. Thus, the critical issue is not whether platforms combine strategies, but how they manage and coordinate their resources and activities in a manner that is consistent with multiple strategic approaches, and in a way that creates complementary value. As Thornhill and White (2007: 555) maintain, the potential trade-offs in a hybrid approach should be assessed in terms of 'the ratio of the subset of activities consistent with one strategy relative to the subset of actions consistent with another strategy.' To that end, we must explore the potential conflicts inherent to combining high *AMC* and high *apps exclusivity* in platform markets.

Platforms must overcome asymmetric information problems (Akerlof, 1970) when dealing with producers of complementary products. It is difficult for a platform to predict *ex ante* the quality and user satisfaction a complementary application will provide for the same reason that Hollywood studios find it difficult to forecast *ex-ante* which movies audiences will love (Tschang, 2007). These information problems constitute an important hurdle, particularly for high quality exclusive applications that require greater effort and resource investment (Brightman, 2008; Reimer, 2005). An application provider bound by an exclusivity agreement cannot distribute its up-front costs across several platforms. Higher sunk costs that are relationship specific imply, *a priori*, a higher exposure to hold-up problems (Hagiu and Yoffie, 2009). Developers of high quality applications may either refuse to sign exclusivity contracts or make suboptimal investments (Hagiu, 2009; Somaya, Kim, and Vonortas, 2011) if the platform does not provide them with proper incentives that could limit any *ex ante* adverse selection and *ex post* hold-up problems. These incentive mechanisms, ranging from more generous licensing deals to better marketing conditions, may be at odds, and may be ineffective in a platform's ecosystem where developers face high *AMC* since conflicting incentives and misaligned interests are likely to arise. For instance, platforms could compensate the providers of exclusive applications for the forgone sales on multiple platforms by accepting lower royalty fees, and so providing them with higher per unit margins. However, setting low royalty fees for exclusive applications may mute the incentives of providers of non-exclusive applications to release high quality products. They would face both intense competition (due to high *AMC*) and potentially aggressive price

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competition from exclusive applications (whose higher per unit margins would allow more price maneuvering). The platform would likely experience adverse selection problem vis-à-vis providers of nonexclusive applications, attracting lower quality content. This will eventually impair the benefits of higher *AMC* to the point that it will decrease, rather than increase, platform performance. Instead, royalty fees that are not low enough would hardly be effective to properly incent providers of exclusive content to deliver high quality applications (since otherwise they would be unlikely to cover development costs and make a profit by selling exclusively on a single platform). In this case, the platform will face an adverse selection problem with providers of exclusive applications. If so, the advantages of an *apps exclusivity* strategy diminish to the point that it could become detrimental rather than beneficial for the platform competitive standing.[1] Thus, pursuing *AMC* and *apps exclusivity* with the same intensity might limit a platform's capacity to build a competitive ecosystem and may ultimately undermine the platform's competitive standing in the marketplace.

Hypothesis 1: All else equal, embracing apps market competition and apps exclusivity strategies with same intensity will lower platform performance.

Distinctive platform positioning in the consumer-preference space

Platforms may choose to compete head-to-head with rivals in a densely populated market niche (defined by the market categories of their applications) or choose, instead, to target segments that, while oriented to a smaller number of consumers, have less intense competition. When platforms interact in a WTA paradigm (Eisenmann, 2007), the dominant strategy is racing to win the market by choosing the platform positioning that promises the fastest growth; namely, the position of mass market leader. Yet, in several contexts, multiple platforms coexist, either because platform differentiation is possible, fixed costs relative to market size are low, costs of adopting multiple platforms are not too high, or network externalities do not have enough strength (Eisenmann, 2007; Eocman *et al.*, 2006; Mingchun and Tse, 2007; Shankar and Bayus, 2003).

In these cases, platforms may underplay, to some extent, the role of network effects and choose market positioning that is distinct from rival firms'. This implies assembling and structuring a platform ecosystem that is different from competitors' portfolios. We refer to this choice as *distinctive positioning* to stress the strategic challenge platforms face in their pursuit of market niches: namely, selecting how similar or dissimilar a portfolio of applications should be, relative to its rivals'. Because platforms vary in the degree to which they embrace various market niches, the degree of difference required to create a distinctive position for any given platform will depend, in part, on the market niches its competitors pursue. For instance, in the current generation of video game consoles, the Sony Playstation and Microsoft Xbox platforms focus largely on the 'action,' 'fight,' and 'sport' segments of the market, while the Nintendo Wii console mostly targets 'general games' and 'platform character' to aim at casual gamers (Megerian, 2007).

Firms with similar content offerings fight over the same set of resources and customers (Chung and Kalnins, 2001; Markman, Gianiodis, and Buchholtz, 2009). This can ultimately lead to crowding in the product space, which increases rivalry and drives down performance (e.g., Chen, 1996; Ketchen, Snow, and Hoover, 2004). As the overlap between markets increases, firms may have incentive to escalate competition (Baum and Korn, 1999), which can have especially costly consequences in a market governed by WTA dynamics. On the contrary, firms competing with less market overlap face less competition for local customers, as their offerings are based on distinct functions in which they might develop a competitive advantage (Chung and Kalnins, 2001; Kalnins, 2003). In such cases, firms would approach the same product market from different positions in factor markets (Markman *et al.*, 2009). Distinct strategic positioning in firms' offerings

[1] Alternatively, platforms might also induce providers toward exclusivity by committing to more beneficial release conditions and marketing policies. For example, exclusive applications could be released over longer time intervals than nonexclusive applications. Similarly, platforms could offer to share a proportion of an application's expenses for commercialization and promotion. Nevertheless, offering better conditions to developers under exclusivity regimes will happen at the expense of application providers producing nonexclusive games, which would have to overcome worse release conditions and less marketing help from the platform.

may then allow those firms to enjoy increased market power in the market niches they target (Cottrell and Nault, 2004; Tirole, 1988). However, strategic dissimilarity with respect to rivals may be risky and sometimes less beneficial compared to a more balanced approach (Deephouse, 1999). Departing from mainstream positioning is even more risky in platform markets because one platform may eventually gain a head start and, by the force of network effects, quickly achieve the large scale necessary to outcompete rivals (Hill, 1997; Katz and Shapiro, 1994). Platforms might then be forced to cede the relevant market to rivals and compete instead in smaller, less profitable niches. For this reason, most platforms tend to mirror the content and application portfolios of their rivals and compete aggressively in head-to-head battles for market share and platform dominance (Suarez, 2004).

A platform that does want to de-escalate rivalry must choose between taking an intermediate position and enhancing the differences between its content and applications and those of its rivals. Different studies show that *distinctive positioning* will be beneficial only when firms maximize the distance, in the competitive space, between their offerings (e.g., Chen, 1996; D'Aspremont, Gabszewicz, and Thisse, 1979; Economides, 1986; Ketchen *et al.*, 2004; Porter, 1985; Salop, 1979). Firms that instead choose an intermediate position might both fail to reduce competition and fail to position themselves in a market with sufficient demand (Economides, 1986; Tirole, 1988). In fact, an intermediate position would imply offering a more similar array of content and applications, which could blur differences among platforms in the mind of consumers. The focal platform would overlap to a greater extent with competing platforms in several market segments, thereby failing to create a core of distinct content offerings. On the contrary, firms that do choose high degrees of distinctiveness might develop 'authentic identity' in the market niches they serve (Swaminathan, 2001) and become the preferred choice of consumers with dedicated preferences.

In all, this logic suggests that a platform with an intermediate profile of distinctiveness in its system positioning relative to its rivals risks locating ambiguously in the content and consumer market space. If this is the case, its market share performance will fall. Sufficient market distance from rival platforms can be achieved only when there is a high level of dissimilarity between one platform's portfolio and its rivals' portfolios. Though risky, a platform that embraces a high degree of *distinctive positioning* has the potential to accrue higher performance effects than a platform that chooses an intermediate degree of *distinctive positioning*. This suggests a U-shaped relationship between *distinctive positioning* and platform performance.

Hypothesis 2: All else equal, platform performance will decrease at intermediate levels of distinctive positioning and increase at high and low levels of distinctive positioning.

DATA AND METHODS

Our data set consists of monthly observations of console and game title sales from the NPD Group, a leading U.S.-based market research firm that surveys approximately 65 percent of game retailers in the United States and formulates estimates for the entire U.S. market.[2] Other scholars have recently used this source (e.g., Clements and Ohashi, 2005; Corts and Lederman, 2009; Shankar and Bayus, 2003; Venkatraman and Lee, 2004). We have compiled information for the period from January 1995 to June 2008 on a total of 5,865 unique video game titles and 14 home video consoles, for a total of 860 platform-month observations.[3] We know the introduction date of each game title and console, the quantity sold in units and dollars, the average selling price, and other descriptive information such as the game genre.

Dependent variable

We use market share to measure platform performance. This is an important measure of firm

[2] These are the 12 largest video game retailers in the U.S. market. Sales to rental outlets (e.g., Blockbuster) are excluded from these estimates.

[3] We truncate a platform-time series at the month where the platform no longer has active sales and titles entries. Nonetheless, as robustness check, we replicated the analysis on a subsample covering generation 4 and 7 of the video consoles, where all platforms belonging to the generation actively sell through the whole cycle of the console market. Though weaker, as one would expect due to the limited number of platforms (just five out of 14) and observations (223 versus 846), we find results consistent with those of the full sample. This suggests that our analysis is not affected by any potential survival bias.

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performance in markets subject to network effects (Hill, 1997; Suarez, 2004; Tanriverdi and Lee, 2008). One of the primary and most important objectives of platform firms is increasing their installed user base compared to rivals (Clements and Ohashi, 2005; Hill, 1997). Platform market share is measured here as the console's unit sales in a given month over total unit sales of active consoles that month. This variable captures the monthly competitive dynamics of the industry and the overlap of incumbent and new generation consoles. Clements and Ohashi (2005) and Corts and Lederman (2009) also use this variable to account for competition over time in their estimation of the cross-sides network effects. We introduce a one-month lag to assess how the independent variables and controls in month t impact market share in month $t + 1$. We also use, as a robustness check, different time windows, as well as an alternative variable (sales), and find similar results. Findings about the latter are presented in the sensitivity analysis section.

Independent variables

Apps market competition refers to the actual as well as the potential competition that producers of applications would face in a given platform market. In order to capture both dimensions of competition, we follow recent studies on dyadic competitive interactions that define potential competitors and competition on the basis of whether, and the extent to which, firms overlap on their market domains (e.g., Baum and Korn, 1999; Venkatraman and Lee, 2004). This is consistent with theory in the competitive strategy literature that conceives rivalry between two firms as the potential level of competition for underlying resources, determined by the extent to which such firms occupy the same or overlapping market segments (see Ketchen *et al.*, 2004 for an extensive review of this literature). In these terms, competition among video game producers will be higher in the platform console market segment that is more crowded, i.e., the one in which a larger number of producers with similar market domains are vying for consumers' attention. Venkatraman and Lee (2004), who study our same sector, captured this potential competition with an overlap density measure (Baum and Singh, 1994). We have borrowed their operationalization; accordingly, the level of *apps market competition* in a given console-platform j at time t is the overlap density for platform j on date t, and is given by $AMC_{j,\,t} = \sum_i p_{ij,\,t} + \sum_{k \neq j} w_{kj,\,t} \left(\sum_i p_{ik,\,t}\right)$. The term $p_{ij,\,t}$ denotes the proportion of titles that developer i released to platform j over all titles developed by developer i at time t, whereas $p_{ik,\,t}$ is the proportion of titles that developer i released to platform k. Taking the sum over all developers will lead to a representation of the total amount of effort (i.e., market focus) developers devoted to platform j and k. The term $w_{kj,\,t}$ represents the overlap weight between platform j and k (that is, the extent to which the two platforms attract the same set of game providers), and is measured through Sohn's (2001) overlap metric,

$$w_{kj,t} = \frac{\sum\limits_i a_{ik,t} \min\left(a_{ik,t}, a_{ij,t}\right)}{\sum\limits_i \left(a_{ik,t}\right)^2},$$

where $a_{ij,\,t}$ and $a_{ik,\,t}$ are the numbers of titles released by developer i to platforms j and k, respectively. Basically, this overlap density formula captures the total number of game producers for a given platform on date t as adjusted by the degree of market overlap these producers share over the different console platforms. This is because, when viewed from the perspective of market domain overlap, the level of competition in one market (platform k) is expected to affect the intensity of competition in another market (platform j) if firms interact to a greater extent over both markets (Baum and Korn, 1999; Baum and Singh, 1994). Baum and Singh (1994) explain that using such a formula offers advantages for measuring market niche competition for two primary reasons: (1) it differs by market niche; that is, the level of overlap density for the different market niches is different (unless there is perfect overlap between firms over the different market niches), also because the overlap weight w_{jk} is usually not equal to w_{kj}; and (2) it is time variant, therefore it captures not only cross-sectional but temporal information on the distribution of competitors across market niches.[4]

[4] To illustrate, take the case of two platforms, J and K, and three game providers, A, B, and C, releasing respectively the following number of titles for J and K: (10;0), (0;5), and (70;30). In such a case, the number of producers per platform is equal (two); however, developers spend more effort (proportion of titles) in platform J compared to K. According to the formula mentioned earlier, AMC in platform J (2.96) will, in fact, be higher than

We also used alternative, simpler measures of the degree of competition among apps providers, like the cumulative number of titles[5] released for that console at time t (e.g., Clements and Ohashi, 2005), and the Herfindhal-Hirschman index,[6] computed on past cumulative sales of game titles (at the level of individual games and at the level of game providers). Our results did not change qualitatively when using these alternative measures of *AMC*, as we explain in detail in the sensitivity analysis section.

Apps exclusivity is the proportion of a platform's titles at time t that are exclusive.[7] Following Corts and Lederman (2009), we define a title as exclusive if it has never been released at any point in its whole life cycle (i.e., before and after time t) for any of the other rival platforms in the same technology generation. As an alternative measure, we also used the simple number of exclusive titles and found similar results.

Distinctive positioning is measured here by comparing the proportion of games offered by a platform in each genre (as in Table 1) with the average figure for that genre at time t (from rival platforms belonging to the same technological generation). Table 1 shows the distribution of titles by genre (i.e., titles' categories) for consoles of the same generation. Not every platform follows the same portfolio's structuring path. Nintendo's console Wii, for instance, has a very diverse composition relative to Sony's Playstation 3 and Microsoft's Xbox360.

$$Distintive\ positionin\,g_{it} = \sum\nolimits_j abs\left(g_{jt} - \overline{g_t}\right);$$

where $g_{j,\,t}$ denotes platform i's proportion of games in genre j at time t and g_t upper bar represents the mean of this variable at time t for all the consoles belonging to the same generation. We take the absolute value of these deviations from the mean and sum them over the nine game genres. Thus, this variable measures the distinctiveness of platform positioning in terms of the distance between the focal platform's composition of games by genre and that offered by rival platforms. It takes a value of zero when the distribution of a platform's titles across genres coincides with that of its competitors, and it takes positive values as the distance increases. This value would be at its maximum for the extreme case where the platform's offerings did not overlap at all with those of its peers. In our sample, this variable reaches its maximum value of 1.12 in October 1996 by Nintendo's N64 console.

Control variables

We control for a number of factors in our analysis. Price is an important driver of platform penetration capacity, especially in multisided markets (Hagiu, 2005; Rochet and Tirole, 2003). By lowering the access price, a platform can increase its user base and offer a more attractive market to producers of the platform's complementary goods. *Platform price* is defined here as the average price of each console at time t, computed by dividing the console's dollar sales by its unit sales. We then use the log transformation of this variable in the analysis. We also control for *platform age*, measured as the number of months since the first month the console entered the industry and generated sales. Controlling for platform age is particularly important in our setting. It can capture consumers' expectations about the number of new games that are likely to be released for a given console and/or the launch time of the next generation of consoles and, thus, it affects the console adoption decision (Clements and Ohashi, 2005). Also, as time passes and the platform system evolves, its installed base will grow, further activating positive indirect network

AMC in K (2.01). As a real example, consider these different levels of AMC between the Playstation 3 and Wii consoles. In April 2008, Wii shows a value of AMC equal to 19 which, though below the average of the sample, is the highest level for generation 7. Contrary, at the same date, Playstation 3 shows a very low figure (just 4.43). Wii had a total number of 40 developers and 244 game titles, while Playstation 3 had only 20 developers and 135 games. Of those 20 developers, 19 were also producing titles for the Wii, and all of the 20 developers were producing for the Xbox 360. Instead, of the 40 developers of Wii, 19 were also producing for the Playstation 3 and 25 for the Xbox 360. The overlap weight between Wii and Playstation 3 in this case was 0.26, whereas the overlap between Playstation 3 and Wii was 0.18. Accounting also for the other active platform (Xbox 360) and summing the proportion of titles supplied by individual developers to each platform according to the formula, we get the AMC figures cited in the text.

[5] Although one would generally expect this to reflect the level of competition among producers, a more precise measure of competition should also account for the fact that the same firm produces different titles.

[6] Given the reduced life cycle of titles and that the index is computed on past sales, this measure will fail to capture the potential competition that producers face.

[7] We account here only for exclusive titles provided by third-party producers. However, results do not change when we also include exclusive titles that are produced by a platform's owner.

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Table 1. Software distribution by genre

Platform	Action fight	Action	Sport	Children games	Classic arcade	General games	Strategy	Platform character	Others
Generation 4									
SNES	17%	9%	21%	2%	2%	5%	3%	36%	4%
GENESIS	19%	9%	25%	2%	2%	4%	3%	34%	3%
Generation 5									
JAGUAR	29%	21%	16%	0%	8%	7%	3%	17%	0%
N64	24%	22%	26%	2%	2%	7%	1%	11%	3%
3DO	33%	20%	12%	9%	1%	14%	3%	4%	4%
PLAYSTATION	24%	21%	24%	3%	2%	7%	2%	8%	8%
SATURN	34%	15%	24%	0%	2%	3%	4%	14%	5%
Generation 6									
DREAMCAST	27%	33%	19%	0%	2%	5%	1%	5%	7%
GAMECUBE	17%	23%	41%	1%	0%	6%	1%	8%	2%
PLAYSTATION 2	19%	31%	23%	2%	1%	7%	2%	6%	10%
XBOX	23%	33%	25%	1%	1%	4%	1%	6%	6%
Generation 7									
PLAYSTATION 3	28%	26%	31%	0%	0%	3%	1%	5%	6%
WII	15%	39%	15%	1%	0%	14%	2%	9%	5%
XBOX 360	30%	27%	26%	0%	0%	4%	3%	3%	8%

Note: Percentages reported are platform means over the observed period of number of titles in each genre over total number of titles for the platform each month.

effects. Therefore, we can expect an 'older' platform to have an advantage over new consoles—a 'network inertia' effect (Katz and Shapiro, 1994). Because of this potential curvilinear effect, we also control for the squared value of platform age.

Competition across consoles is another important factor that may affect a platform's capacity to gain market share. One would expect that as the number of platforms belonging to the same technological generation grows larger, competition among platforms would become more intense, impairing performance. Corts and Lederman (2009) show, though, that there may be positive externalities across platforms within a generation when the majority of titles are not exclusive. Therefore, it may affect performance positively. We control for these effects by including in our estimations the number of *rival platforms* of the same technological generation that are active at time t. Summary statistics and correlations are shown in Table 2.

Statistical method and analysis

We test our hypotheses using a cross-sectional time series fixed effects model of the following form: $Market\ Share_{i,\ t+1} = \Phi_i + T_t + \beta\ \ X_{i,\ t} + \xi_{i,\ t;}$ where Φ_i represents platform fixed effects, T_t the set of dummies for time fixed effects, $X_{i,\ t}$ the vector of the independent variables and controls, and $\xi_{i,\ t}$ the specific residuals. Platform fixed effects capture unobserved heterogeneities across platforms that are constant over time, such as differences in technological features or consumer perceptions of quality. These platform-specific characteristics, although not observed by the researcher, are likely to affect platform performance and, at the same time, may influence the adoption of distinct strategies by a given platform. The platform fixed effects estimation method addresses these issues and its association with any other model variables (Greene, 2003). With this methodology, *de facto*, we are exploiting within-platform variation to identify the effect of changing strategies on the variation in market share. Additionally, we account for unobserved time trends at the consoles-generation level that could jointly determine *AMC*, *apps exclusivity*, *distinctive positioning*, and platform market share. To this purpose, we introduce additional fixed effects that identify each generation-year couple. Though these fixed effect specifications put demanding restrictions on our data, we decided to follow this conservative approach to control (to the extent possible) for potential omitted variable biases.

Given the characteristics of our sample (namely the presence of a reinforcing circular effect due to the indirect network externalities), we expect

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Table 2. Summary statistics and correlations

Variable	Mean	St Dev	Min	Max	1	2	3	4	5	6	7	8	9
Platform market share	0.18	0.19	0.01	0.71									
Apps market competition (AMC)	30	21	0.05	67	−0.04								
Apps exclusivity	0.42	0.17	0.02	0.66	0.11	0.67							
AMC x apps exclusivity	0.64	0.89	−1.8	3.5	−0.24	0.06	−0.14						
Distinctive positioning	0.15	0.13	0.04	1.1	−0.03	−0.62	−0.50	0.17					
Distinctive positioning squared	0.04	0.08	0.01	1.3	0.09	−0.19	−0.19	0.24	0.62				
Platform age	51	35	1	153	−0.41	0.77	0.48	0.09	−0.6	−0.17			
Platform age squared	3,848	4,633	1	23,409	−0.22	0.09	0.23	0.31	−0.09	0.15	0.38		
Platform price	4.6	0.75	2.8	6.4	0.48	−0.43	−0.33	−0.03	0.38	0.15	−0.75	−0.11	
Rival platforms	3	1.2	1	5	0.11	−0.56	−0.46	0.07	0.66	0.13	−0.57	−0.30	0.23

Note: Absolute correlations greater or equal to 0.09 are significant at $p < 0.01$.

platform price, *AMC*, *apps exclusivity* and its interaction with *AMC* might be endogenous to the model (i.e., correlated with the error $\xi_{i,t}$). For example, the error term will capture variations of unobserved value and/or quality of console i in month t from its overall mean. Since over time a platform's price generally reflects these variations in unobserved quality, which will likely be perceived by consumers, price can be correlated with the error term. This violates one of the assumptions of the OLS model, causing potential biases. As a result, to properly identify the model, we would need instrumental variables (hereafter, IV) that are correlated with our endogenous variables but uncorrelated with the error term. Both Clements and Ohashi (2005) and Corts and Lederman (2009) address these issues in their analysis of the video game industry, and we follow their identification procedure.

Exploiting the fact that the consoles are manufactured outside the U.S., we use the monthly exchange rates between the U.S. Dollar and the currency of the country where the console is manufactured as an instrument for price. Information about the manufacturing countries of the different consoles comes from Corts and Lederman (2009), while currency exchange rates are obtained from Thompson's Financials. These ratios are a good proxy of the production cost of the console and, therefore, should affect its U.S. retail price. At the same time, they should be independent from the unobserved variations in quality of other platform-level missing variables that compose the error term in our regressions. We use the average age of titles active in a given month to instrument for *AMC*. This variable is an indicator of the residual life (or obsolescence) of game titles and can be used by producers to guide their decisions about when to introduce their games. At the same time, a higher average age may also indicate the presence of 'blockbuster' titles with an extended life, which may also affect introduction decisions. Yet, this should not be correlated with the error term. We use the number of exclusive titles in the previous generation of the console as an instrument for *apps exclusivity*. This represents a console's past capacity to attract exclusive titles; therefore, we expect it to affect, to some extent, the platform's current ability to secure titles in exclusivity. Yet the previous-generation titles have no reason to be related to the future variation across time of next-generation platform quality. Henceforth, they should be independent from the specific residuals. Finally, to instrument for the interaction of *apps exclusivity* with *AMC*, we use the interaction of their two instruments, a procedure that is considered good practice when the instrumental variables are independent of one another (Baum, Schaffer, and Stillman, 2007).[8] We implement these instruments and estimate our models via standard IV estimation using two-stage least squares (2SLS). The Sargan-Hansen post-identification test, which explores the joint null hypothesis that the instruments are uncorrelated with the error

[8] This is a quite plausible assumption in our case, as we do not see any clear interdependence between the average age of current-generation titles and the number of exclusive titles released for the console in the old generation. Like Clements and Ohashi (2005) and Corts and Lederman (2009), we also use the squared terms of the instruments in our estimation.

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term and are correctly excluded from the estimated equation, reveals no issues and confirms the validity of the instruments (Hayashi, 2000). We also checked potential issues of weak instruments. In-depth analysis of first-stage results for each instrumental variable equation and relative high F-statistics lead us to reject this possibility.[9]

Because of the interaction and squared terms, as well as the correlation of some of the key variables, there is a potential for multicollinearity problems. We have attempted to reduce them by standardizing the main components (*AMC* and *apps exclusivity*)[10] for the interaction term before multiplication (Smith and Sasaki, 1979) and by mean centering the squared term variables. More generally, results from the extra analysis indicate a mean VIF of 4.27 and a condition number of about 9, well below the thresholds (10 and 30, respectively) that indicate potential multicollinearity problems (Belsley, Kuh, and Welsch, 2004; Grewal, Cote, and Baumgartner, 2004).

RESULTS

Results from the formal test of the hypothesized trade-offs are presented in Table 3. Model 1 contains only the control variables. In Model 2, we add *AMC* and *apps exclusivity*, while in Model 3 we introduce their interaction to test the trade-off effect predicted in Hypothesis 1. In Model 4, we introduce *distinctive positioning* and its quadratic term to test Hypothesis 2. All models provide adjusted errors that are robust to arbitrary heteroskedasticity and autocorrelation. As Model 2 shows, *AMC* (0.01; p-value < 0.001) and *apps exclusivity* (1.71; p-value < 0.001) each has an independent, positive, and significant effect on platform market share, suggesting that in isolation these two strategies have beneficial effects on platform performance. However, as Model 3 indicates, the interaction term (-0.13; p-value < 0.05) has a strong negative effect on platform market share. Additional simple slope test analysis (Aiken and West, 1991) reveals that the impact of *AMC* on platform market share is negative and significant (-0.0021; p-value < 0.05) for levels of *apps exclusivity* one standard deviation above the mean. Instead, AMC has a positive and significant impact (0.0078; p-value < 0.001) for levels of *apps exclusivity* one standard deviation below the mean.[11] We provide further details about this finding in Figure 1 by graphically representing the effect of *AMC* on platform performance for high (mean + 1 standard deviation) and low levels (mean − 1 standard deviation) of *apps exclusivity*. These results hold when *distinctive positioning* is also included in the analysis (Model 4), strongly supporting Hypothesis 1.

[9] Due to limited space, we do not report these results here. The problem of weak instruments, as discussed extensively in Stock, Wright, and Yogo (2002), rest on the inconsistency of the instrumental variable estimator, such that the estimator can be biased to the extent that the asymptotic distribution of the estimated parameters deviates substantially from the normal distribution when the instruments are only weakly correlated with the endogenous variables. Staiger and Stock (1997) suggest, as a simple rule of thumb, that there would be no concerns for weak instruments if the F-statistic exceeds 10. However, Stock et al. (2002) and Stock and Yogo (2005) warn about the use of such simplistic approach, as such a rule would be valid only in the presence of one endogenous variable. Stock and Yogo (2005) have computed Monte Carlo simulations to provide a table of critical values for the weak instrument test at the 5 percent significance level for up to three endogenous variables (unfortunately values are not available for the case of 4 endogenous variables) and varying number of instrumental variables. For instance, in the case of three endogenous variables, this threshold ranges from a minimum of 9.53 (with five instruments) to a maximum of 20.27 (with 30 instruments). For these reasons, besides the general rule of thumb, different authors suggest relying also on statistical tests for joint significance of the instruments, like the Anderson-Rubin Wald test or the Stock-Wright statistic (e.g., Stock et al., 2002; Stock and Yogo, 2005; Wooldridge, 2002). Both tests examine whether excluded instruments are 'relevant,' that is, whether they are, in fact, correlated with the endogenous regressors. The null hypothesis is that the equation is underidentified: failing to reject the null indicates potential problems of weak correlation between instrumental and endogenous variables (Baum et al., 2007). In our case, the null is rejected in both tests, and F-statistics from the first-stage regressions are well above 10 (the minimum value we get is 39.42 for the apps exclusivity equation). A recent, additional test about the potential weakness of instruments, which is centered on chi-squared and first-stage F statistics, is the Angrist-Pischke test. Angrist and Pischke (2009) introduced first-stage F statistics for tests of under- and weak identification when there is more than one endogenous regressor. It is constructed by 'partialling-out' linear projections of the remaining endogenous regressors. In contrast to other statistics, the AP first-stage F statistics have the advantage of testing individual instruments; that is, it tests the null that the particular endogenous regressor is unidentified. Confirming the results of other tests reported above, the Angrist-Pischke test (for the chi-squared Wald statistic) rejects the null hypothesis (of weak- or un-identified regressor) for each of our endogenous regressor.

[10] The results do not vary if we do not standardize AMC and apps exclusivity.

[11] We have also computed a simple slope test on the symmetrical effect, that is, the impact of apps exclusivity on platform performance for high-low levels of AMC. We find the same evidence.

Table 3. Results from 2SLS estimation

Variables	Model 1	Model 2	Model 3	Model 4
Apps market competition (AMC)		0.01**	0.02**	0.02**
		(0.004)	(0.01)	(0.01)
Apps exclusivity		1.71**	0.78+	0.84+
		(0.51)	(0.54)	(0.53)
AMC x apps exclusivity			−0.13*	−0.13*
			(0.06)	(0.06)
Distinctive positioning				−0.63**
				(0.26)
Distinctive positioning squared				1.38**
				(0.38)
Platform price	−0.09*	−0.35**	−0.40**	−0.38**
	(0.04)	(0.04)	(0.08)	(0.07)
Platform age	−0.01*	−0.01*	−0.02**	−0.02**
	(0.00)	(0.01)	(0.00)	(0.00)
Platform age squared	0.001	0.08**	0.12**	0.11**
	(0.00)	(0.00)	(0.00)	(0.00)
Rival platforms	−0.01	−0.02	−0.01	0.01
	(0.01)	(0.01)	(0.02)	(0.02)
N obs.	846	846	846	846
Within R^2	0.19	0.31	0.33	0.42
F	75**	49**	23**	26**

Note: Number of panels (consoles) = 14.
** significant at 1%;
* significant at the 5%; + significant at the 10%. Standard errors in parentheses. All specifications include time (at generation-year level) and platform fixed effects. All models report results with errors robust to arbitrary autocorrelation and heteroskedasticity. Coefficients of platform age squared have been multiplied by a factor of 1,000 for presentation purposes.

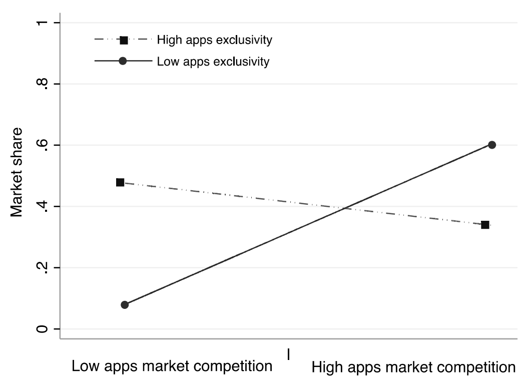

Figure 1. Impact of AMC on platform performance as a function of apps exclusivity

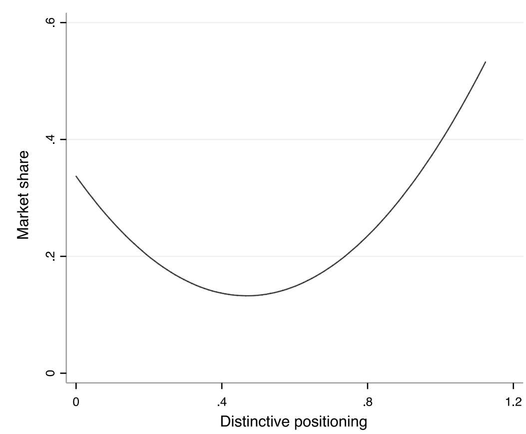

Figure 2. Impact of distinctive positioning on platform performance

Hypothesis 2, about the U-shaped effect of *distinctive positioning* on platform market share, is also supported. As the full model in Table 3 shows (model 4), the coefficient of *distinctive positioning* is significant and negative (−0.63, $p < .001$); yet, the squared term is positive and significant (1.38, $p < .001$). Figure 2, which uses the coefficients obtained in model 4, graphically represents this effect. Note that the curvilinear, flexing point is around 0.4 and, therefore, for levels higher/lower than 0.4, distinctive positioning is associated with a higher/lower market share.

Sensitivity analysis results

We conducted multiple robustness tests to assess the sensitivity of our results to different model specifications and alternative measures of our variables. First, to eliminate potential issues implied by the use of a ratio measure for our dependent variable, we used the logarithm of *platform sales* as a proxy for platform performance and introduced the logarithm of *industry sales* as an additional control variable.[12] When using this variation on the dependent variable side, we got results (not reported here) very much in line with those from our core analysis. Second, we investigated the robustness of our results to the use of alternative measures for *apps exclusivity* and *AMC*. We measured *apps exclusivity* as just the number of exclusive titles released to a platform at time t. With regard to *AMC*, we tried number of titles, the Herfindhal-Hirschman index for titles' sales in each platform at time t for publisher's sales and for publisher's title genre weighted sales. Since this index measures concentration rather than competition, we took its inverse. Using these alternative measures for our independent variables, we got results consistent with our hypotheses (see Table 4). Third, we utilized a different approach to test the effect of a dual strategy with equal (distinct) emphases on *AMC* and *apps exclusivity*, following the methodology of Thornhill and White (2007). Conceiving the dual strategy as a space with two main orthogonal dimensions, *AMC* and *apps exclusivity*, the strategic focus of each platform can be represented in terms of the angular distance from one or the other axes in the bidimensional space and measured as an arc tangent (*apps exclusivity/AMC*). Firms close to the 45-degree slope line occupy the middle ground in the strategic space and should, all else equal, be outperformed by those firms closer to either one of the two orthogonal dimensions. When using this approach in our estimations (see Table 4, Model 5), we did find a U-shaped relationship between the arc tangent and platform performance, which again corroborates our first hypothesis. Finally, we explored potential issues with the direction of causality and we investigated whether, indeed, platform market share would decrease because of wrong choices in the *AMC-apps exclusivity* and *distinctive positioning* trade-offs or whether platforms end up in this position as a result of their attempts to switch from one strategic emphasis to another because of underperformance. We tried to address it by using a one-month lag between the independent and dependent variables. As a robustness check, we used higher time windows (a 3- or 6-months lag). Our results (not reported here) were invariant to the use of these different lags.

DISCUSSION AND CONCLUSIONS

This study analyzes the performance implications of potential trade-offs created as firms build, manage, and position platform systems, an overlooked phenomenon in the literature on multisided markets (Gawer, 2010; McIntyre and Subramaniam, 2009). Managing the supply side of the market is an important lever platforms use to influence the external environment and final market outcomes. Despite increasing attention paid to the effects of individual strategic options at a platform's disposal, the existing literature does not address the potential for interdependence among these strategies, the trade-offs they might present, and the performance implications of balancing these trade-offs. This study addressed these issues and contributed contextual, nuanced evidence of the trade-offs present in a large and vibrant platform market: the U.S. video game industry. In such markets, it is tempting for firms to overestimate the potential for combining different strategies to quickly grow their networks (of users and complementary apps). It is even more tempting when they believe their market is destined for a winner-take-all (WTA) result. However, the findings of this study call for managers to be cautious. We find that implementing a dual strategy based on securing a larger fraction of exclusive titles (*apps exclusivity*) and, at the same time, growing the number and variety of titles via greater competition among game producers (*apps market competition*) is detrimental for platform performance because of the conflicting incentives they imply for application providers and because the configuration of activities they jointly require can be incompatible. Also, we find that simply positioning platforms in the segment with the largest mass of users may not be a sufficient strategy for winning the market as a whole because, at least in our context, it is possible for platforms to differentiate with *distinctive positioning*. The strategic dilemma inherent in choosing that market position should not be underestimated, however, given our finding that an intermediate

[12] An anonymous reviewer, whom we want to acknowledge here, has suggested this extra sensitivity analysis.

Table 4. Robust analysis: alternative measures for the AMC-apps exclusivity trade-off

Variables	1	2	3	4	5
Apps market competition (AMC)	0.001**	0.002**	0.04**	0.28**	
	(0.00)	(0.001)	(0.007)	(0.06)	
Apps exclusivity	0.001**	0.65**	0.73*	0.08*	
	(0.00)	(0.66)	(0.45)	(0.04)	
AMC x apps exclusivity	−0.72**	−0.39**	−0.05*	−0.25**	
	(0.08)	(0.17)	(0.02)	(0.04)	
Relative strategy emphasis					
					−7.34**
					(1.44)
Arctan(apps exclusivity/AMC) squared					11.18**
					(3.72)
N obs.	846	846	846	846	846
F	48**	51**	27**	16**	25**

Note: Number of panels (consoles) = 14.
** significant at 1%;
* significant at the 5%; + significant at the 10%. Standard errors in parentheses. Control variables not shown in the table. All specifications include time (at generation-year level) and platform fixed effects. All models report results with errors robust to arbitrary autocorrelation and heteroskedasticity. Apps exclusivity is measured in Model 1, as number of exclusive titles, whereas in the other models, it is our base measure (percent titles that are exclusive). AMC is measured in Model 1 as number of titles; in Model 2 as (inverse of) Herfindhal-Hirschman Index computed at title's sales level; in Model 3 as (inverse of) Herfindhal-Hirschman Index computed at publisher's sales level; in Model 4 as (inverse of) Herfindhal-Hirschman Index computed at publisher's title-genre weighted sales level; in Model 5, AMC is our base measure.

level of distinctiveness relative to rivals is negatively correlated with performance. These findings and their insights extend our understanding of winner-take-all and competitive dynamics in platform markets.

Our study adds to recent research challenging the unconditional value of the winner-take-all hypothesis (e.g., Eocman *et al.*, 2006; Mingchun and Tse, 2007; Shankar and Bayus, 2003; Suarez, 2005), as well as to studies highlighting the importance of managing the incentives of external content providers to stimulate ecosystem growth and, ultimately, a platform's success (Boudreau, 2010; Gawer, 2010; Hagiu, 2009; Yoffie and Kwak, 2006; Suarez, 2004).

Gawer and Cusumano (2008) suggest that in the competitive arena, platforms need to address two different sets of strategic issues: (1) developing a core function to encourage other companies to develop complementary applications that grow the platform ecosystem (coring); and (2) shaping market dynamics by gaining control over an installed base to win platform competition (tipping). The first strategic dilemma we study here rests on the fact that platforms' incentives for 'tipping' the market tend to collide with the incentives external firms require to contribute apps and innovate as part of a 'coring' approach. In our setting, growing the number and variety of games through greater competition among game producers (*apps market competition*) and increasing the proportion of those games that are exclusive to the platform (*apps exclusivity*) might enhance a platform's attractiveness to final users. But it will also create a hostile market environment for game producers, undermining their incentives to innovate and provide higher quality games on that platform. A platform's long-term prospects require a balancing act between growth and quality−−both for the competitive environment for game producers and of games for final users (e.g., Feng and Iansiti, 2007; Liebowitz, 2002). This is critical for 'coring.' Our findings indicate it also has strong implications for 'tipping.'

Recent theoretical models show that the market might not tip in favor of one dominant platform and that multiple platforms can coexist if the quality and positioning of their ecosystems is sufficiently distinct (e.g., Eisenmann, 2007; Eocman *et al.*, 2006; Mingchun and Tse, 2007). A 'get-big-fast' strategy would imply choosing the platform content that satisfies the preferences of the largest number of consumers. This will position the platform in the running for mass market leader and−−if it accumulates the largest installed base of users (Katz and Shapiro, 1994; Shapiro

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and Varian, 1999)−−position it to win the market outright. However, a WTA outcome may fail to manifest because of industry-specific factors or other factors that 'act as a brake on the winner-take-all process' (Eocman *et al.*, 2006: 1839). Distinctive features of the video game industry include the heterogeneity of consumer preferences for the type of games (i.e., gaming genre), the variety of novel games available in dedicated niches and their quality, which might induce users with different tastes to cluster around separate market niches. This creates the potential for market segmentation and makes room for different positioning in the market, depending on the segment(s) a platform targets. We find that adopting a distinctive position in the map of consumer preferences can be a successful strategy−−providing the first evidence for recent theoretical claims that a WTA outcome is neither universal nor unconditional.

However, our result holds true only when systems are distinctive enough to achieve a unique identity and positioning in the market. This speaks to a fundamental strategic dilemma a platform firm faces: how much must its positioning diverge from its rivals' in order to be perceived as distinct, given the forgone potential advantages from occupying the market's populous middle ground? In other words, a 'specialist' platform must also pile up to some degree applications for the market segments targeted by 'generalist' platforms, because users who want 'specialist' content might also want 'generalist' content. When users have to bear switching costs, they may decide to join just one platform, most likely the 'generalist' (Eisenmann *et al.*, 2006; Eisenmann, 2007; Mingchun and Tse, 2007). A specialist platform that focuses on a few market niches would then lose ground and, eventually, cede the whole market to a generalist platform.[13] The positioning dilemma is not, then, a question of generalist versus specialist, but a question of degree: what proportion of a platform ecosystem can be tailored to the needs and preferences of niche consumers, relative to competitors' ecosystems? On this issue, our study reveals that, at least for an entertainment industry like video gaming, platforms need to define a distinct target group and differentiate their positions by maximizing the distance between their portfolios of applications and their competitors'. A platform with intermediate degrees of dissimilarity in the composition of its ecosystem will stall in an ambiguous competitive position where it is unable to deliver a distinct identity and value for its users. At the same time, it will also miss the potential economies of scale that might derive from matching mass market demand.

Implications

These findings imply that an unconditional WTA paradigm, in which platforms try to 'get big fast' (Eocman *et al.*, 2006) at all costs, might be a myopic strategy and may ultimately prove detrimental to performance. Pursuing a WTA victory creates trade-offs between multiple growth strategies, which are often discounted by platforms imagining exponential growth in their installed base of users (Liebowitz, 2002; McIntyre and Subramaniam, 2009). Managers should avoid the temptation to rapidly grow network size without controlling the trajectory of its evolution. Platforms, as market facilitators and regulators (Boudreau and Hagiu, 2010), should have a more holistic approach to building and positioning their ecosystems: a clear vision and business model that account also for the level of competitiveness and distinctiveness of a platform system relative to its rivals. In short, platform competition is not just about building the largest network.

Enhancing a platform system's competitiveness requires a fundamental and complex balancing act between a platform's incentives to keep growing its portfolio and attracting larger number of users and its external apps providers' incentives to provide unique, compelling content. A platform must facilitate and preserve an apps market environment that stimulates innovation and the provision of valuable applications. This suggests a new focus might be necessary. Instead of crediting platform performance to the size of the installed base alone, it may be prudent to shift our theoretical inquiry to the level of platform system competitiveness. This would reflect the quality-variety dimension (not just size) as well as the underlying conflict between incentives for the platform and incentives for its apps

[13] For instance, in the mobile phone OS market, RIM has clearly positioned the BlackBerry and its ecosystem as a functional, business-oriented platform system. Nonetheless, RIM has recently moved to stimulate the provision (from external developers) of entertainment-oriented applications in order to face competition from the platform leader in those market segments—the iPhone, which also offers business-oriented, functional applications.

developers. Other scholars have also challenged the view that WTA is the natural outcome of platform competition and the logic that the installed base (alone) drives platform performance (e.g., Evans, 2003; Liebowitz, 2002; Liebowitz and Margolis, 1994; MacCormack and Iansiti, 2009; Rangan and Adner, 2001). We extend this line of research by showing that the strategic trade-offs platforms encounter represent hidden constraints to WTA dynamics. The challenge for future research will be reshaping existing theoretical models on competitive dynamics in platform markets to account for these additional dimensions and their interplay with other main drivers of performance.

Limitations and future research

The richness of our data set allows for the use of sophisticated econometric procedures and multiple robustness tests. We find the same results using standard OLS techniques, alternative measures of the independent variables, econometric specifications that take care of potential endogeneity, and platform fixed effects specifications that prevent potential biases arising from unobservable platform characteristics constant across time. Nevertheless, our work is not free from limitations. The empirical evidence we provide in favor of our hypotheses may be industry specific. The video game industry has very heterogeneous complementary applications, yet a few hits achieve the bulk of total sales. In our sample, the top 10 percent of titles generated about 53 percent of total sales, while the lowest 10 percent represented only 0.2 percent of total sales. This means that the *AMC-apps exclusivity* trade-off may be more important and severe in our setting than in other industries where the *ex ante* quality of complementary applications may be more homogeneous. The quality of the products supplied to a platform is another important issue implied in our trade-off arguments for Hypothesis 1. Unfortunately, we do not have a good, direct measure of the quality of video games. Though outside the scope of this study, certainly, the question of how competition within and across platforms affects the quality of the products developed for a platform is highly relevant and deserves attention in future studies of competitive dynamics in multisided markets. Also, this work did not consider governance-related strategies that platforms may undertake to alleviate strategic trade-offs. Complex organizational arrangements may align firms' objectives and alleviate the lack of strategic focus and the hold-up problems that high quality application producers experience under exclusivity licensing. Another critical characteristic of the video game industry that may drive our results is the strong competition in all generations. For platforms operating in less competitive environments (e.g., Windows, Google), the trade-offs may be less apparent or nonexistent. Quasi-monopoly platforms may have enough bargaining power to push for a higher number of applications in an exclusive regime without harming platform performance.

Future research might tease out these effects. In the meantime, and consistent with recent calls for more contingency approaches to the study of strategic trade-offs (e.g., Campbell-Hunt, 2000; Thornhill and White, 2007), we believe these limitations delineate the contingent factors affecting our results. These should be examined in future research at a more general level for elaborating on the theory's boundaries.

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