

One-Sided Competition in Two-Sided Social Platform Markets? An Organizational Ecology Perspective

Completed Research Paper

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Abstract

Similar to love, competition can often be unrequited. This study explores the asymmetric pattern of competition driven by membership overlap in two-sided mobile social apps (MSAs) markets. Building on the niche-width dynamics framework, we theorize and validate the relative prevalence and survival capabilities of messaging apps and SNS apps, especially when membership overlap fosters current or potential competition between the two app categories. The analyses—based on panel dataset consisting of information on 8,483 panel members' exact amount of time used for 21 mobile social apps—show that competition between SNS and messaging apps can be asymmetric in favor of messaging apps. This asymmetric pattern is more pronounced for membership-based competition compared to usage-based competition. In addition, different MSAs developed by same platform providers exhibit synergistic effects, rather than destructive consequences, on each other's growth. The findings identify the complex nature of competition within-category and between-category competition in MSAs markets.

Keywords: mobile social apps; organizational ecology; asymmetric competition; membership overlap; panel data; mixed-effect model

Introduction

Mobile social apps (MSAs) have become both a modern day convenience and an essential component of societal and economic functionalities. Users of MSAs stay in touch with their friends and family in far-flung corners of the globe with ease and at no cost. The portability of mobile devices has allowed users to share and consume social content anywhere, and at any time. Among the flurry of MSAs available, social networking site (SNS) apps (e.g., Facebook and Twitter) and messaging apps (e.g., WhatsApp, Snapchat, and Viber) are the two most dominant categories of apps to emerge and ultimately compete against one another for human time and attention. Unlike SNS apps that are designed to facilitate rich social connectivity, messaging apps focus on simplicity and brevity in terms of features and functionalities.

Competition among social apps is far more unique and dynamic than that among any other industrial segments for a variety of reasons. Many MSA users are increasingly subscribing to multiple MSAs that are provided by competing developers; subscribers use those apps in tandem to avail themselves of the benefits of network size and compatibility (Doganoglu and Wright 2006; Mital and Sarkar 2011). This phenomenon is often referred to as “multi-homing,” and it is widely observed in two-sided platform markets where end users incur no fixed usage costs, and where network externalities largely determine the value of the platforms (Rochet and Tirole 2003). According to PewResearch, in 2014, 52% of U.S. online adults used two or more social media sites on a regular basis¹. Users’ propensity towards multi-homing has made competition among apps more relentless - not to mention more perplexing for MSA providers who must compete for new subscribers and increased time use. For these platform developers, multi-homing has created a unique competitive paradigm in which membership overlap shapes and governs the nature and state of that competition.

Moreover, the pool of competitors in MSA markets is growing rapidly in both size and number. Dominant leaders in MSA platform markets, such as Facebook and Twitter, constantly face competitive threats from both incumbents and new entrants that operate in adjacent markets and have the capability to offer multiplatform bundles (Eisenmann et al. 2006). For example, Facebook currently engages in an “arms race” with Google, which offers a menu of social networking services, including Google+ and Hangouts (messaging apps). In addition, more and more anti-Facebook users are embracing new, ad-free social networking services (e.g., Ello and Tsu) that run counter to Facebook’s business models. Furthermore, amid intense battles with rivals, Facebook faces new competition from messaging app developers (e.g., Snapchat, Line, Kakao Talk and its own Facebook Messenger), which offer social connectivity in different styles and tones. Heightened competition has forced established SNSs (e.g., Facebook) to proactively acquire developers of mobile messaging apps. Facebook successfully landed a very lucrative deal with Whatsapp for a final price of \$22 billion. In short, competition among online SNS services has become more sophisticated to define and quantify.

Given the presence of multi-homing in two-sided markets and the convoluted and dynamic nature of competition therein, it is not always clear in MSA markets what is competing with what, and who is competing with whom. Are mobile SNS apps in direct competition with messaging apps? If they are, is competition asymmetric with one side dominating the other? Alternatively, do these various MSAs complement one another, rather than compete, thus allowing users to enjoy the best of both worlds? These questions become more complicated and abstruse when the “who” factor comes into the equation. Do messaging apps (i.e., Facebook Messenger) developed internally by SNS companies (i.e., Facebook) indeed create economies of scale as theory predicts? With whom should messaging service companies form partnerships, rival messaging app providers or established SNSs? If current competitive structures are harbingers of how MSA players will compete in the future, what competitor will unseat Facebook and take the reins in the social networking wars?

The literature has been largely reticent in addressing these original issues, despite the fact that the competitive paradigm within which MSA players compete is rapidly and continually shifting and mutating. To redress this oversight, the current study seeks to determine how the competitive dynamics driven by membership overlap have transformed the MSAs’ business landscape and influenced its ecosystems. Conceptually, we underpin our work with organizational ecology theory (Hannan and Freeman 1977; Hannan and Freeman 1993) in which competition for resources (i.e., usage and

¹ <http://www.pewinternet.org/2015/01/09/social-media-update-2014/>

membership) can be understood in terms of the environmental forces that shape the ecological structures and dynamics of organizations (i.e., MSAs). Building on Freeman and Hannan's (1983) niche-width dynamics frameworks, we explore the relative prevalence and survival capabilities of specialists (i.e., messaging apps) and generalists (i.e., SNS apps), especially when membership overlap fosters current or potential competition between the two camps.

To gain full empirical insights into the ecological aspects of competition among MSAs in a diversity of categories, we obtain and analyze a unique panel dataset that includes actual MSA consumption information for 8,483 members who used 21 MSAs over a 184 day period. These longitudinal-based app consumption data allow an unusual opportunity to analyze competition both within and across MSA categories. To the best of our knowledge, this study is among the first to employ time usage data to examine patterns of membership overlap and to investigate implications vis-à-vis the nature and consequences of interdependencies and competition among MSAs.

Theoretical Background

Theories on Organizational Ecology

Organizational ecologists view an organization as a corollary of competition and selection processes. The survival and success of an organization often depends on, among other factors, its capability to acquire necessary resources from the environment in which it is embedded. Because available resources are limited, competition progressively intensifies, thus affecting the founding and evolution or demise of organizations (Carroll and Hannan 1989; Hannan and Freeman 1977). Popielarz and Neal (2007) illustrate this competitive landscape and ecological lifecycle by referring to "carrying capacity" defined as the maximum number of organizations that can survive in environments where companies and enterprises aggressively vie for market dominance. Contrary to the implications of this definition, however, competition is no longer typified as "the war of all against all" but rather an engagement that occurs within a subset of environments often referred to as a "niche." In this corner of a market, organizations battle one another to gain control over common resources (Popielarz and Neal 2007). A niche can be apprehended as an independent segment in the multi-dimensional space defined by the resources that an organization needs to survive and compete in the environment (McPherson 1983). When the number of organizations sharing the same niche increases, market structures and competitive dynamics accordingly change, which may subsequently threaten a firm's competitive positioning and diminish its performance. Under these conditions, rivalry over limited resources creates a zero-sum game that involves uneven resource distribution.

An environment is a moving target that constantly transforms and mutates. Encumbered by the operational practices cemented by their founding conditions, organizations often fail to adapt to environmental changes that midwife new organizational forms (Hannan and Freeman 1984). An oft-repeated argument is that organizational vulnerability to environmental changes depends on the extent to which an environment varies and the range of niche markets wherein organizations operate (i.e., specialists vs. generalists) (Freeman and Hannan 1983). The rationale that buttresses this perspective is that the size of a niche relative to organizational populations is essentially related to organizational slack and the capacity with which an organization can tolerate environmental variability. This association shapes and regulates competitive dynamics. The premise of this argument serves as a theoretical vantage point from which to explain how organizations in two different categories (specialists and generalists) compete against each other in a market that is dynamically evolving and sensitive to resource limitation.

An Ecological View of Mobile Social Apps

Drawing from an ecological paradigm that construes organizational environments as battle-fields for competition over resources that are in short supply, we examine the salient quality of competition among MSAs that operate in two-sided platforms. We first articulate users' multi-homing behaviors and then identify various forms of rivalry among MSAs. We also explore the effects of diverse competition mechanisms on MSA performance. To apply an organizational ecological view to MSAs, a paramount requirement is to identify the core concepts that constitute organizational ecology in the context of MSAs. As a point of departure, attention should be directed toward pinpointing the population of interest (or competing groups), which usually refers to a set of structurally identical organizations that compete for

common resources. Given that most users have devices equipped with a specific mobile OS platform (e.g., iOS or Android), MSAs that run on the same mobile OS can be construed as competing groups. To adequately distinguish among the numerous MSAs available, their scope and functional features should be clearly recognized. Today, SNS and messaging apps are MSAs that are most extensively adopted by end users with selection typically determined by the specific social purposes that these innovations can fulfill. Proceeding from the identification of populations of concern, membership overlap density must be disentangled. Overlap density indicates the number of organizations in a population with partly coinciding niches as the focal organizations weighted by the extent of niche overlap among them (Baum and Singh 1994). Given that membership constitutes the most critical resource shared by MSAs, we define membership overlap density as the number of MSAs that share members with a focal MSA in a particular mobile OS weighted by the extent of membership overlap between each MSA-focal MSA pair.

The third step in using organizational ecology as a framework for examining MSAs is zeroing in on performance (i.e. outcomes of competition). Studies on organizational ecology typically employ the founding and failure rates of organizations as standard proxies for gauging resource competition (Barron et al. 1994; Hannan 1986). Unlike the failures of traditional organizations, however, those of MSAs cannot be clearly defined and measured. Even an MSA with no active user can persist because continued existence necessitates minimal operating costs. Additionally, measuring founding rates in this context can be meaningless and potentially misleading because, on a daily basis, developers launch more than 600 mobile apps², most of which exert negligible effects on existing competition among such innovations. Founding and failure rates may therefore be inappropriate mechanisms for quantifying MSA performance. In mobile app businesses, the number of users and their total usage are the most critical and popular measures of success. These standards are applied by numerous market research firms (e.g. Google Analytics) in ascertaining the success of each mobile app. Examples of such measurements include daily average users or *DAU*; the number of unique users who use a focal mobile app daily and the amount of time spent on a focal mobile app, as in *Time in Apps*. In keeping with established practice, we use membership growth rates and total time usage to measure app performance.

Hypothesis Development

Membership Overlap and Usage/Membership Growth

Organizations can be defined as “goal-directed, boundary maintaining, and socially constructed systems of human activity” (Aldrich 1999). In adherence to this definition, then, not all mobile apps should be considered organizations. Conversely, MSAs in two-sided platforms can be regarded as a legitimate organizational form for the following reasons. They are developed and consumed for specific goals, such as establishing and promoting social exchange (Kwon et al. 2014). Most MSAs also require users to acquire membership as a means of preserving boundaries (e.g., restrictions on available functions) and securing exclusive possession of consumer loyalty. Furthermore, similar to the customers of traditional firms (Freeman et al. 1983) and newly emerging organizations (e.g., online news groups) (Wang et al. 2013), MSA users sustained patronage and fidelity and reinforce the purpose, norms, and values of MSAs. On the basis of these justifications, we argue that the building- blocks of organizational ecology paradigms can lay a solid foundation for understanding the nature and consequence of the interdependencies (e.g. collaboration and competition) among MSAs.

In contrast to traditional organizations, however, MSAs do not depend extensively on physical assets, natural resources, labor, or financial capital to create competitive advantage. In essence, the most valuable and necessary resources for MSAs are users (i.e. membership) and their active and sustained engagement. MSAs’ primary functions include the provision of social instruments that motivate interpersonal exchange and camaraderie among users. As for business profits, advertising becomes a primary source of revenue, and the size of a user base heavily determines the advertising income critical to MSA operation and longevity. During the first quarter of 2015, for example, the sales generated from advertising campaigns accounted for 94% of Facebook’s US\$3.54 billion revenue³.

² <http://readwrite.com/2013/01/07/apple-app-store-growing-by>

³ <http://www.reuters.com/article/2015/04/22/us-facebook-results-idUSKBN0ND2F020150422>

The MSA market has recently witnessed explosive growth owing to the influx of many prospective entrants and niche players. Competition for acquiring and retaining users has escalated and has been driven by increasingly perplexing mechanisms. Market research firm GlobalWebIndex reported that 91% of Internet users have at least one social media account. Moreover, user resources are non-exclusive because many consumers exhibit multi-homing behaviors, in which they register for and subscribe to multiple social network services simultaneously (Kwon and Oh 2014). Given that most individual users have limited time resources for social attachment and intercourse, Internet users' multi-homing propensities inevitably engender fierce competition among MSAs, thus further elevating the complexity of membership overlap density.

Congruent with this organizational ecological perspective, we postulate that overlap density exerts negative ramifications on organizational performance in a mature population wherein the aggregate of MSAs serves a particular market. MSA markets are mature in the sense that they lack significant growth in user bases and usage patterns. In this context, a mature market is one that has peaked, thereby preventing further development. Under these circumstances, competition for existing users (resources) becomes increasingly aggressive because the only way to increase market share is to "poach" users from rivals. Previous studies have theorized and validated the inverse association between membership overlap density and performance in diverse contexts, including service industries (e.g. day care centers) (Baum and Singh 1994), manufacturing sectors (e.g. semiconductor electronics manufacturers) (Podolny et al. 1996), nonprofits (e.g. social movement organizations) (Stern 1999), and online organizations (e.g. online groups) (Wang et al. 2013). In a mature MSA population, additional user resources are scarce and competition for existing members is fierce and costly. Increased overlap density, as a result of the escalating number of new competitors that are in need of common user resources, hinders the survival and growth of MSAs in all spectrums of the population. These arguments lead us to formulate the following hypothesis:

Hypothesis 1: Membership overlap is harmful to performance in a mature MSA population.

Membership Overlap Density between and within MSA Categories and Usage/Membership Growth

Competition is progressively recognized as frequently characterized by asymmetry (Amit and Schoemaker 1993; Carpenter et al. 1988; Chen 1996). Competitive asymmetry can occur when the degree and direction of competition between firms is unequal (DeSarbo et al. 2006). An illustrative scenario is the asymmetric competition manifested when Firm A competes more aggressively with Firm B than vice versa. Under certain conditions, competitive market structures are often established in an asymmetric fashion so that these structures favor one firm over another. Previous studies have documented the reinforced presence of asymmetric competition in various contexts. For example, price reductions for high quality brands entice more consumers than those for low-quality varieties. This occurrence reflects asymmetric competition between brands in different tiers (Allenby and Rossi 1991; Blattberg and Wisniewski 1989). In a similar vein, Sivakumar and Raj (1997) find that high-quality brands are less vulnerable to losses than are low-quality brands when prices rise. Another example is the nature of competition among retail stores that are organized with a range of store formats (e.g., supermarkets vs. local convenience stores). Gonzalez-Benito et al. (2005) propose that (1) the rivalry within store formats differs from that across store formats, and that (2) rivalry in the former is more intense than that in the latter. These suppositions point to a two-step hierarchy in the process of retail store choice, wherein users first choose store formats and then search for a specific store within the selected format. Early research suggests that asymmetric competition is not uncommon and often plays a critical role in defining competitive dynamics among diverse groups of players in a specific market.

In a broad sense, MSAs can be classified into two categories: *SNS apps* and *messaging apps*. Although both apps facilitate user communication and interaction, they differ in terms of functional orientations and intended modes of communication. Whereas SNS apps provide features that enable users to communicate in diverse communication modes (e.g., one-to-one, one-to-many, many-to-many), messaging apps specialize exclusively in private communications (e.g., one-to-one). According to an industry report⁴, people use messaging apps for specific purposes (e.g., communicating privately with

⁴ http://ipglab.com/wp-content/uploads/2014/04/MessagingApps_Whitepaper_Final.pdf

close peers and family members) rather than for general objectives (e.g., socializing, communicating, and sharing information with people in their circles). While messaging apps focus on a single specific service, SNS apps offer diverse functions and options. In this light, we can categorize messaging apps and SNS apps as “specialists” and “generalists,” respectively, on the basis of the ecological perspective espoused by Freeman and Hannan (1983).

Freeman and Hannan (1983, p. 1118) define specialists and generalists on the basis of *niche-width*, which refers to “a population’s tolerance for changing levels of resources, its ability to resist competitors, and its response to other factors that inhibit growth.” Populations with broad niches are considered generalists and those with narrow spectrums of niches are characterized as specialists (Freeman and Hannan 1983). Restaurants, for instance, can decide on the scope of their niche-width in diverse dimensions to cover type of cuisine and price range. Such decision ultimately affects their competitive positions and growth potential (Freeman and Hannan 1983). In addition, because of inherent differences in niche-width strategies, specialists and generalists face different prospects for survival when confronted with a rapid environmental shift. Specialists fully exploit their surrounding environment and take on the risks presented by environmental changes; generalists do so to a lesser extent given the desire for greater safety (Hannan and Freeman 1977). Specialists may therefore outperform generalists in a stable environment because the former can more optimally adapt to environmental demands than can the latter. Amid unstable environments, however, generalists are a more solid form of organizations because they can operate with more agility and accommodate the demands of diverse environmental configurations. Freeman and Hannan (1983) delve into specific conditions under which specialists can outperform generalists and vice versa. The authors suggest two dimensions that deserve close attention when it comes to measuring environmental changes: the level of environmental variability and the pattern of environmental variation (e.g., fine- or coarse-grained). In the context of restaurants, generalists outrival specialists only under large-scale and coarse sales variations (i.e., unstable environment). Conversely, specialists exhibit performance superior to that of generalists under fine-grained environments or small-scale environmental variations. The MSA market has reached a stage of maturity, wherein the growth of user bases is limited. Accordingly, demand for MSAs cannot be expected to considerably and coarsely fluctuate.

Carroll (1985) put forward resource partitioning theory, a model for the dynamics of niche-width that is applicable to markets typified by certain conditions such as the existence of economies of scale and the absence of real price competition. Using the newspaper industry as the specific context of investigation, the author finds that a high concentration of generalists (i.e., a few generalists dominate the market) enhances the life chances of specialists. In other words, the rate of death (i.e., competitive performance) of generalists and specialists increases and decreases, respectively, as the concentration of generalists increases. At some point, these niche markets will intersect, implying that specialists outperform generalists beyond a certain level of generalists concentration. Markets for MSAs can also be characterized by not only free but also strong economies of scale owing to the fact that most MSAs aim for social platforms where network externalities dominate competition. Moreover, we can assume that the concentration of generalists (i.e., SNSs) is sufficiently high because a few of these niche players, such as Facebook and Twitter, wield a commanding influence on the SNS market. In accordance with the niche-width perspectives and resource partitioning theory, we can thus expect messaging apps (i.e., specialists) to outcompete SNS apps (i.e., generalists). Accordingly, the differential effects of membership overlap density within and between MSA categories (e.g., SNS apps or messaging apps) on the performance of MSAs are foreseeable. We therefore posit the following hypotheses:

Hypothesis 2: For SNS apps, membership overlap with messaging apps is more harmful to performance than that with SNS apps in a mature MSA population.

Hypothesis 3: For messaging apps, membership overlap with messaging apps is more harmful to performance than that with SNS apps in a mature MSA population.

Membership Overlap Density between the MSAs of a Single Developer and Usage/Membership Growth

As MSAs continue to face fierce competition, some developers have begun launching different MSAs or acquiring other MSAs. One of the most recent plays for domination is Facebook’s launching of a

standalone messaging app (Facebook Messenger) and acquisition of WhatsApp (a messaging app) and Instagram (an SNS app). Another case is Google whose entry into the mobile market was secured through Google+ and Hangouts. Although each MSA is an independent app, the MSAs provided by a single developer are functionally connected to one another and are designed to create synergy in various ways. Some of these apps share user networks, while others offer functionalities that are intended to ease the end-to-end transmission of content (e.g., links, posts, photos, and videos). These functional connections may set off effects similar to those that trigger the expansion of user networks into different MSAs. Because the user utility derived from spending time on a particular MSA increases exponentially in consonance with its network size (Katz and Shapiro 1985), the usage of a typical MSA increases as a user's network over the MSA broadens (Kwon et al. 2014). This being the case, we expect the positive effect of networks to alleviate the negative consequences of membership overlap on the growth of MSAs. Accordingly, we advance the following hypothesis:

Hypothesis 4: Membership overlap between the MSAs of a single developer is less harmful to performance in a mature MSA population than membership overlap with other MSAs.

Methods

Data

We used a unique panel dataset consisting of information on the exact amount of time that 8,483 panel members spent on 21 Android MSAs provided by Nielsen KoreanClick, a Korean market research company. Nielsen KoreanClick selects a panel of Android mobile app users by stratified sampling to ensure that panels represent the target population. Gender, age, and geographical region were used for the stratified sampling. It then collects data on their exact consumption (i.e., time spent using the apps) over the 21 Android MSAs via self-installed tracking application. The Android MSAs were selected on account of their popularity, measured by their ranking on Google Play during the sample period. Our raw dataset includes the exact daily consumption of the 8,483 panel members over the 21 Android MSAs from May 1, 2013 to October 31, 2013 (184 days). The 21 MSAs can be classified into two groups in accordance with Google Play's categorization: social and communication programs. Most apps perceived as SNS apps fall under the social category, and the majority of apps regarded as messaging apps are classed as communication programs.

A qualification is necessary here because some MSAs grouped under the social category do not correspond with Ellison (2007) definition of SNS: web-based services that enable individuals to (1) construct a public or semi-public profile within a bounded system, (2) articulate a list of other users with whom they share a connection, and (3) view and traverse their list of connections and those made by others within the system. Among the MSAs studied in the present research, five programs do not satisfy the second and third conditions. We therefore excluded these from the set, in effect operationalizing the concept of population to the remaining 16 Android MSAs, over which 9 SNS apps and 7 messaging apps are accessible.

To substantiate Hypothesis 4, we identified the apps developed by a single developer in accordance with the information provided by Google Play. For instance, the information page of Google Play indicates that Google+ and Hangouts were both developed by Google Inc. We therefore regarded them as the MSAs of a single developer. To further validate the proposed hypotheses, we shifted our analysis of the raw panel dataset, treating it as an MSA-time structure instead of a user-time structure for the 16 MSAs over the period May 1, 2013 to October 31, 2013.

Measures

Dependent Variables

We measured each MSA's membership and usage growth by dividing membership or usage on the current day by that on the immediately preceding day. Suppose $N_{i,t}$ represents the number of active users of MSA i at time t . Then $MembershipGrowth_{i,t} = \frac{N_{i,t}}{N_{i,t-1}}$ represents the membership growth of MSA i at time t .

Similarly, let us say that $C_{i,t}$ represents the entire time consumption of all active users over MSA i at time t . Consequently, $UsageGrowth_{i,t} = \frac{C_{i,t}}{C_{i,t-1}}$ shows the usage growth of MSA i at time t .

Independent Variables

Membership Overlap Density: Wang et al. (2013) consider two online groups as “sharing” a member if that particular participant not only uses but also posts on both the online group forums at a given time. We adopted a more concrete standard in that two MSAs were regarded as sharing an active user at time t on the condition that the user used both MSAs at time t . This stronger assumption is necessary because most MSA users spend a considerable amount of time reading or skimming without writing or posting notes on MSAs. Yet, consistent with Wang et al. (2013), the degree of membership overlap between focal MSA i and another MSA j was calculated as the number of active users shared by the two MSAs, divided by the total number of active users of MSA i at time t . Through this approach, membership overlap density was computed as the sum of the degrees of membership overlap between the focal MSA and each of the other MSAs with which it shares active users. Suppose J represents the set of all the 16 MSAs, and i (and j) represents MSA which is an element of J . Then $\#SharedMembers_{i,j,t}$ indicates the number of active users shared by MSAs i and j at time t . Moreover, $\#Members_{i,t}$ points to the number of active users of MSA i at time t . $MOD_{i,t}$, which refers to the membership overlap density of MSA i at time t was therefore calculated as follows:

$$MOD_{i,t} = \sum_{j \in J, j \neq i} \frac{\#SharedMembers_{i,j,t}}{\#Members_{i,t}} \quad (1)$$

Membership Overlap Density within and between MSA categories: To test Hypotheses 2 and 3, we divided membership overlap density into membership overlap density within and between MSA categories. Suppose G_1 and G_2 are subsets of J and represent a set of SNS and messaging apps respectively, then they satisfy the conditions below:

$$G_1, G_2 \subset J, G_1 \cap G_2 = \phi, G_1 \cup G_2 = J \quad (2)$$

Then, $MOD_{Within_{i,t}}$ and $MOD_{Between_{i,t}}$ which represent membership overlap density within and between MSA categories can be defined as below:

$$MOD_{i,t} = MOD_{Within_{i,t}} + MOD_{Between_{i,t}} \quad (3)$$

$$MOD_{Within_{i,t}} = \sum_{\substack{j \in G_k, j \neq i \\ s.t. i \in G_k}} \frac{\#SharedMembers_{ij,t}}{\#Members_{i,t}} \quad (4)$$

$$MOD_{Between_{i,t}} = \sum_{\substack{j \in G_k \\ s.t. i \notin G_k}} \frac{\#SharedMembers_{ij,t}}{\#Members_{i,t}} \quad (5)$$

$MOD_{Within_{i,t}}$ represents the membership overlap between the focal MSA i and other MSAs, which belong to the same MSA category with i , and $MOD_{Between_{i,t}}$ indicates the membership overlap between the focal MSA i and other MSAs, which are classified into a different MSA category with i .

Membership Overlap Density between MSAs of a Single Developer: To test Hypothesis 4, we define membership overlap density between MSAs of a single developer. When the focal MSA i has another MSA which is created by the same developer as i , $MOD_{SameDeveloper_{i,t}}$, which refers to the membership overlap density between MSAs of a single developer can be calculated as below:

$$MOD_{SameDeveloper_{i,t}} = \frac{\#SharedMembers_{i,j,t}}{\#Members_{i,t}} \quad s.t. \ i \text{ and } j \text{ are developed by a same developer} \quad (6)$$

However, if the focal MSA i does not have another MSA which is developed by the same developer as i , then $MOD_{SameDeveloper_{i,t}}$ takes a value of 0.

When we incorporate both $MOD_{Between_{i,t}}$ and $MOD_{SameDeveloper_{i,t}}$ into a model, their effects will be biased because they take account of some users twice. In other words, since MSAs developed by the single developer in our dataset belong to different MSA categories, $MOD_{SameDeveloper_{i,t}}$ is a part of $MOD_{Between_{i,t}}$. To address this issue, we define membership overlap density between MSA categories except the single developer MSA as below:

$$MOD_{i,t} = MOD_{Within_{i,t}} + MOD_{BetweenExceptSD_{i,t}} + MOD_{SameDeveloper_{i,t}} \quad (7)$$

$$MOD_{BetweenExceptSD_{i,t}} = MOD_{Between_{i,t}} - MOD_{SameDeveloper_{i,t}} \quad (8)$$

From this modification, $MOD_{BetweenExceptSD_{i,t}}$ represents the membership overlap between focal MSA i and other MSAs, which belong to a different MSA category with i and developed by different developers.

Control Variables

Given that the growth rates of SNS and messaging apps can systematically differ, we incorporated a dummy variable, SNS_i , which indicates whether a focal MSA i belongs to the SNS or messaging category. Specifically, SNS_i takes a value of 1 if a focal MSA i falls under the aforementioned classification. Although the moderating effects of organization size on the relationship between overlap density and performance are beyond the scope of this study, we controlled the membership size of an MSA on a given day. Thus, $MembershipSize_{i,t}$ represents the number of active users of focal MSA i at time t . Social media are accessed relatively less frequently during weekends and holidays because users prefer to engage in outdoor activities on these days (Jung and Lee 2010). The growth rate of MSAs can therefore diminish during these periods. To control for this potential effect, we included a dummy variable, $Holiday_t$, which is assigned a value of 1 when day t is either a weekend or a holiday.

Model Specifications and Results

Model Specifications

Table 1 presents the descriptive statistics. During the sample period, average usage and membership growth are approximately 1, and their standard deviations are large relative to the means. These results indicate that although competition among MSAs appears stable, fierce competition exists between them, thus creating a huge difference between winners and losers. Additionally, the median of membership overall density is 2.19. When we excluded sample sizes from the equation, we derived a medium substantially larger than that reported by previous studies related to online groups (Kim et al. 2015b; Wang et al. 2013). This indirect comparison suggests that MSAs' competition for user resources is tremendously more intense than competition in other online contexts.

Table 1. Descriptive Statistics

Variables	Mean	Median	Std. Dev.	Min	Max
<i>UsageGrowth</i>	1.177756	.9958864	0.993767	0.02881	18.31673
<i>MembershipGrowth</i>	1.038829	1	0.313391	0.2	4
<i>MOD</i>	2.164209	2.192582	0.535995	0.858557	4.5
<i>MODWithin</i>	1.024422	1.10877	0.436373	0	3
<i>MODBetweenExceptSD</i>	0.95761	1.043157	0.335753	0.085129	2.5
<i>MODSameDeveloper</i>	0.182177	.043978	0.311538	0	1

After carefully considering both skewness and distribution shapes, we applied a natural-log transformation to $UsageGrowth_{i,t}$, $MOD_{Between_{i,t}}$, and $MOD_{SameDeveloper_{i,t}}$ to enhance their normality. For a smooth log-transformation, we added a small value (i.e., 0.1) to the involved parameters. The lagged values of all the independent variables and $MembershipSize_{i,t}$ were used to identify their effects on growth rate. A multicollinearity analysis shows that the mean variance inflation factor (VIF) for the independent variables is 2.18. Hair et al. (2006) suggest that a VIF lower than 10 is indicative of inconsequential collinearity; therefore, multicollinearity is not a serious problem in the current analysis.

To corroborate the proposed hypotheses, we employed a mixed-effect linear regression, which enabled us to take account of the multilevel structure of our panel dataset through both fixed and random effects (Rabe-Hesketh and Skrondal 2008). In other words, the variances of each MSA are likely to be heterogeneous because our panel dataset consists of multiple observations over time nested within each MSA. This possibility dictates the use of mixed-effect models, which allowed us to employ the unique variance component of each MSA addressing possible violations of homoscedasticity. On the basis of another dataset that includes information on each panel member's exact amount of time usage over all Android apps, we found that the 16 MSAs represent more than 95% of the total MSA usage. The selected MSAs are therefore highly representative of the population that uses Android MSAs. The variations across different MSAs were assumed random and uncorrelated with the independent variables. Accordingly, we used random effects to control for the unobserved heterogeneity specific to MSAs. McCulloch et al. (2011) attest this model specification possesses capabilities superior to those of general linear models in dealing with correlated and unequal variances. Although heteroscedasticity is unlikely a concern in mixed-effect regressions because of the aforementioned features of the mixed-effect model, we additionally ran the most conservative fixed effects model and found that the results remain unchanged. We also used REML which generates unbiased estimates of variance and covariance parameters (Cressie and Lahiri 1993). We present the models for the proposed hypotheses on the basis of the forms recommended by Laird and Ware (1982):

$$\begin{aligned}
 & UsageGrowth_{i,t} \text{ or } MembershipGrowth_{i,t} \\
 & = \beta_0 + \beta_1 MOD_{i,t-1} \\
 & \quad + \beta_2 SNS_i + \beta_3 MembershipSize_{i,t-1} + \beta_4 Holiday_t \\
 & \quad + u_i + \epsilon_{i,t}, \\
 & \quad u_i \sim N(0, \psi^2 \mathbf{I}) \text{ and } \epsilon_{i,t} \sim N(0, \sigma_\epsilon^2 \mathbf{I})
 \end{aligned} \tag{9}$$

$$\begin{aligned}
 & UsageGrowth_{i,t} \text{ or } MembershipGrowth_{i,t} \\
 & = \beta_0 + \beta_1 MODWithin_{i,t-1} + \beta_2 MODBetween_{i,t-1} \\
 & \quad + \beta_{11} MODWithin_{i,t-1} * SNS_i + \beta_{21} MODBetween_{i,t-1} * SNS_i \\
 & \quad + \beta_3 SNS_i + \beta_4 MembershipSize_{i,t-1} + \beta_5 Holiday_t + u_i + \epsilon_{i,t}, \\
 & \quad u_i \sim N(0, \psi^2 \mathbf{I}) \text{ and } \epsilon_{i,t} \sim N(0, \sigma_\epsilon^2 \mathbf{I})
 \end{aligned} \tag{10}$$

$$\begin{aligned}
 & UsageGrowth_{i,t} \text{ or } MembershipGrowth_{i,t} \\
 & = \beta_0 + \beta_1 MODWithin_{i,t-1} + \beta_2 MODBetweenExceptSD_{i,t-1} \\
 & \quad + \beta_3 MODSameDeveloper_{i,t-1} \\
 & \quad + \beta_{11} MODWithin_{i,t-1} * SNS_i + \beta_{21} MODBetweenExceptSD_{i,t-1} * SNS_i \\
 & \quad + \beta_4 SNS_i + \beta_5 MembershipSize_{i,t-1} + \beta_6 Holiday_t + u_i + \epsilon_{i,t}, \\
 & \quad u_i \sim N(0, \psi^2 \mathbf{I}) \text{ and } \epsilon_{i,t} \sim N(0, \sigma_\epsilon^2 \mathbf{I})
 \end{aligned} \tag{11}$$

In Equation 9, β_0 is the constant and β_{1-4} are the fixed-effect coefficients. $UsageGrowth_{i,t}$ and $MembershipGrowth_{i,t}$ are the dependent variables; $MOD_{i,t-1}$ is modeled as the independent variable; and SNS_i , $MembershipSize_{i,t-1}$, and $Holiday_t$ are used as control variables. Finally, u_i is the random-effect variable for MSA i assumed to be multivariately normally distributed with mean 0 and constant variance ψ^2 . Thus, u_i captures the heterogeneity shared between observations of the same MSA and $\epsilon_{i,t}$ captures the remaining heterogeneity unique to each observation. We incorporated MOD in Equation 9 to test the hypotheses regarding the negative effect of membership overlap density on usage and membership growth (Hypothesis 1). Equation 10 is intended to validate Hypotheses 1, 2, and 3 for which MOD was dividing into $MODWithin$ and $MODBetween$ for the purpose of clarifying the effects of membership overlap with MSAs under the same and different categories. In addition, including the interaction terms of SNS_i in the two main covariates enabled us to determine how the effects of the two main covariates are distributed across the different MSA categories. Finally, we used Equation 11 (the most elaborate model), which divides $MODBetween$ into $MODBetweenExceptSD$ and $MODSameDeveloper$ to simultaneously verify the validity of all the proposed hypotheses and to precisely examine the effects of membership overlap in accordance with its characteristics (e.g. overlap with same or different category MSAs and overlap between the MSAs of a single developer).

We determined whether different MSAs have a competitive or synergistic relationship by the sign of the estimated coefficients of membership overlap densities. For instance, if a coefficient of membership

overlap density within a particular MSA category is significantly negative, we regarded apps within that category as competing against one another for user resources because this coefficient indicates that the growth rate of focal apps decreases with increasing number of users shared with other MSAs in the same category. Conversely, a significantly positive coefficient of membership overlap density points to a synergistic effect among MSAs. The fact that they share more members with one another boosts the growth rate accordingly. Furthermore, we considered the estimated coefficients of membership overlap densities to represent the degrees of competition among relevant MSAs. In Equation 11, for example, the sum of the estimated coefficient of *MODWithin* and *MODWithin*SNS* is less negative than that of *MODBetweenExceptSD* and *MODBetweenExceptSD*SNS* under the assumption that Hypothesis 2 is supported. Similarly, if Hypothesis 3 is validated, the estimated coefficient of *MODBetweenExceptSD* is less negative than that of *MODWithin*. Finally, the estimated effect of *MODSameDeveloper* is less negative than any other net effects of membership overlap density if Hypothesis 4 is supported.

Results and Discussion

Because Equations 9-11 are not nested within one another, we compared the models by using AIC instead of likelihood-ratio tests (Burnham and Anderson 2002). Each equation's AIC estimate suggests that Equation 11 exhibits the best fit among the four models. For this reason, we focused on the results derived from this equation⁵. Tables 2 and 3 represent the estimation results derived on the basis of Equation 11 for usage and membership growth, respectively. The estimated value of ψ^2 significantly differs from 0 at the 0.05 level in both Tables 2 and 3, suggesting that the heterogeneity emanating from the membership overlap between observations of the same MSA varies from MSA to MSA. A likelihood-ratio test also confirms that this random effect offers significant improvements over a linear regression model with fixed effects only ($p \approx 0.0000$).

Table 2. Estimation Results for Equation 11 (Usage Growth)

MSA Category	Variable	Parameter	Coefficient	Standard Errors
SNS App	<i>MODWithin</i>	$\beta_1 + \beta_{11}$	0.0080191	0.0485256
	<i>MODBetweenExceptSD</i>	$\beta_2 + \beta_{21}$	-0.2380226***	0.0850917
Messaging App	<i>MODWithin</i>	β_1	-0.5095638***	0.1292711
	<i>MODBetweenExceptSD</i>	β_2	-0.0292924	0.0920775
	<i>MODSameDeveloper</i>	β_3	0.1376198**	0.0580215
	<i>SNS</i>	β_4	-0.3917627	0.29923
	<i>MembershipSize</i>	β_5	-0.3064321***	0.0303392
	<i>Holiday</i>	β_6	-0.0752366***	0.0184544
	<i>Constant</i>	β_0	2.429989***	0.2926857
	Random-effects parameters	ψ^2	0.2261604	0.1117934
		σ_ϵ^2	0.2207531	0.0058004

Number of obs = 2928, Number of groups = 16, Group variable: MSA_id,
 Log restricted-likelihood = -1995.9489, Wald chi2(7) = 139.96, Prob > chi2 = 0.0000,
 LR test vs. linear regression: chibar2(01) = 42.36, Prob >= chibar2 = 0.0000.

Significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

As displayed in Table 2, for SNS apps, membership overlap density with SNS apps (i.e., *MODWithin*) has no significant effect on usage growth. However, membership overlap density with messaging apps that are

⁵ Refer to the results of Equations 9 and 10 in Appendix A (Appendices are available upon request).

created by different developers (i.e. *MODBetweenExceptSD*) poses a significant negative impact on the usage growth of SNS apps. Therefore, Hypothesis 2 is supported. Contrastingly, for messaging apps, membership overlap density between messaging apps and SNS apps that are created by different developers (i.e., *MODBetweenExceptSD*) has no significant impact on usage growth, but membership overlap density with messaging apps (i.e., *MODWithin*) exerts a significant negative impact on usage growth. Consequently, Hypothesis 3 is supported. This validation strongly supports the presence of asymmetric competition between SNS and messaging apps. To wit, SNS apps compete against messaging apps and messaging apps compete against their peer messaging apps for users' time resources. Under these circumstances, competition among MSAs can be interpreted as being more favorable to messaging apps. Additionally, membership overlap density between the MSAs of a single developer exerts a statistically significant and positive effect on usage growth. This finding suggests that the MSAs created by a single developer hold a synergistic relationship. Therefore, Hypothesis 4 is supported. Hypothesis 1, however, is only partially supported. These are interesting results because we adopted a rather stringent definition of synergistic relationships. The findings specifically indicate that the usage of a focal MSA increases as more users of the focal MSA spend time on another MSA created by the same developer that produced the focal MSA. The results are not a reflection of growth in the sum of usage over both MSAs; rather, they suggest that usage over both the MSAs grows in conjunction.

Table 3. Estimation Results for Equation 11 (Membership Growth)

MSA Category	Variable	Parameter	Coefficient	Standard Errors
SNS App	<i>MODWithin</i>	$\beta_1 + \beta_{11}$	-0.0075903	0.027199
	<i>MODBetweenExceptSD</i>	$\beta_2 + \beta_{21}$	-0.1198225**	0.0476772
Messaging App	<i>MODWithin</i>	β_1	-0.088829	0.0735515
	<i>MODBetweenExceptSD</i>	β_2	0.105751**	0.0512194
	<i>MODSameDeveloper</i>	β_3	0.1190788***	0.0344133
	<i>SNS</i>	β_4	-0.1261751	0.5964856
	<i>MembershipSize</i>	β_5	-0.6331674***	0.0189065
	<i>Holiday</i>	β_6	-0.1043875***	0.010208
	<i>Constant</i>	β_0	4.468927***	0.4602821
	Random-effects	ψ^2	1.359892	0.523613
	Parameters	σ_ϵ^2	0.0675377	0.001772

Number of obs = 2928, Number of groups = 16, Group variable: MSA_id,
 Log restricted-likelihood = -287.94124, Wald chi2(7) = 1286.88, Prob > chi2 = 0.0000,
 LR test vs. linear regression: chibar2(01) = 791.37, Prob >= chibar2 = 0.0000.

Significance levels: *p<0.1, **p<0.05, ***p<0.01

Under membership growth as the dependent variable, asymmetric competition is even more pronounced. Table 3 shows that, for SNS apps, the results are similar to those derived for usage growth, thereby lending support to Hypothesis 2. The findings demonstrate that SNS apps compete against messaging apps for both users (i.e., membership) and time spent (i.e., usage). Nevertheless, the membership growth of messaging apps is not significantly affected by membership overlap with messaging apps. To the contrary, it is positively influenced by membership overlap with SNS apps, thus supporting Hypothesis 3. This suggests that as messaging apps are shared with more users of SNS apps, the membership growth of the former increases. Additionally, membership overlap density between the MSAs of a single developer has a significantly positive effect on membership growth. Thus, Hypothesis 4 is supported. This support, however, does not extend to Hypothesis 1, which is only partially substantiated. In other words, the membership growth of messaging apps is not negatively affected by any form of membership overlap density. As noted earlier, competition in the context of MSAs is much more favorable to messaging apps.

The estimated effects of membership size on both usage and membership growth are significantly negative, suggesting that an MSA's ability to grow is hindered as MSAs expand. Moreover, the negative coefficients of *Holiday* for both dependent variables confirm that users prefer to engage in outdoor activities on weekends and holidays.

The results reveal that SNS apps do not compete with one another but compete against messaging apps for users and their social time resource. Conversely, messaging apps compete with one another but not against SNS apps for each user's social time budget. Such diverse forms of organizations (i.e., specialist and generalist), as we discern from the principle of isomorphism, correspond to the diversity of their environments; in equilibrium, only one organizational form can optimally adapt to the demands of a given environment (Hawley 1968). In fact, GlobalWebIndex indicates that the second most popular behavior on Facebook is one-to-one communication⁶, even though Facebook is not a messaging apps specializing in such type of interaction. Our results may therefore have been advanced by the fact that messaging apps adapt to the demands of their environments better than do SNS apps. That is, the demands of one-to-one communication exceed those of one-to-many or one-to-few communication in stable MSA environments. Users' privacy concerns with SNS and stronger ties among users on messaging apps than on SNS apps may partially explain the higher demand and eventually more favorable competition for messaging apps.

Robustness Check

As pointed out earlier, we additionally ran the conservative fixed effects model to guarantee the reliability of our estimates and found that the results remain largely unchanged (see Appendix B). This constancy reflects that our results are robust to alternative model specifications. The growth rates of usage and membership also tend to be time-sensitive. As a demonstration of such sensitivity, growth rates can systematically vary over time or change day by day, without such variations being underlain by a certain time trend. To address this issue, we conducted robustness checks by separately incorporating (1) time trend variables and (2) time fixed effects. The main results are robust against both specifications. In addition, no significant time trend in both growth rates was found (see Appendix C), and the null hypothesis that the coefficients of all the days are jointly equal to zero cannot be rejected (see Appendix D). We conclude that no significant time effect is exerted on the growth rates in our sample period.

A user's usage intensity (i.e., heavy or light) may also affect MSAs' performance. We conducted additional robustness validations by incorporating the extent of users' consumption intensity. Specifically, when we calculated $\#SharedMember_{ijt}$ in Equation (1), we assigned higher weights to heavy users of MSA i and lower weights to light users of MSA i . Weight assignment to each user of MSA i was then calculated based on the standardized value of his (her) MSA i consumption. As displayed in Tables 4 and 5, we find that the results remain more or less unchanged. The consistent empirical regularities, despite the weight adjustment, reinforce the robustness of our findings. The results suggest that membership overlap effectively captures the competitive dynamics between MSAs even when we take users' consumption characteristics into account.

⁶ <http://www.globalwebindex.net/blog/facebook-active-users-show-why-messenger-will-work>

Table 4. Estimation Results for Usage Growth with Weight by Users' Consumption

MSA Category	Variable	Parameter	Coefficient	Standard Errors
SNS App	<i>MODWithin</i>	$\beta_1 + \beta_{11}$	0.0108281	0.0485851
	<i>MODBetweenExceptSD</i>	$\beta_2 + \beta_{21}$	-0.2329683***	0.0852784
Messaging App	<i>MODWithin</i>	β_1	-0.5084894***	0.1296384
	<i>MODBetweenExceptSD</i>	β_2	-0.0259086	0.0921052
	<i>MODSameDeveloper</i>	β_3	0.4303347*	0.2237309
	<i>SNS</i>	β_4	-0.4057304	0.306219
	<i>MembershipSize</i>	β_5	-0.310162***	0.0305739
	<i>Holiday</i>	β_6	-0.0755792***	0.0184577
	<i>Constant</i>	β_0	2.14203***	0.2899284
	Random-effects parameters	ψ^2	0.2424781	0.1164953
		σ_ϵ^2	0.2208217	0.0058005

Number of obs = 2928, Number of groups = 16, Group variable: MSA_id,
 Log restricted-likelihood = -1995.5248, Wald chi2(7) = 139.01, Prob > chi2 = 0.0000,
 LR test vs. linear regression: chibar2(01) = 40.88, Prob >= chibar2 = 0.0000.

Significance levels: *p<0.1, **p<0.05, ***p<0.01

Table 5. Estimation Results for Membership Growth with Weight by Users' Consumption

MSA Category	Variable	Parameter	Coefficient	Standard Errors
SNS App	<i>MODWithin</i>	$\beta_1 + \beta_{11}$	-0.0066433	0.0272182
	<i>MODBetweenExceptSD</i>	$\beta_2 + \beta_{21}$	-0.1184742**	0.0477136
Messaging App	<i>MODWithin</i>	β_1	-0.0871348	0.0737193
	<i>MODBetweenExceptSD</i>	β_2	0.1073989**	0.0513209
	<i>MODSameDeveloper</i>	β_3	0.3913346***	0.1467191
	<i>SNS</i>	β_4	-0.130443	0.5970764
	<i>MembershipSize</i>	β_5	-0.6333323***	0.0189349
	<i>Holiday</i>	β_6	-0.1047123***	0.010217
	<i>Constant</i>	β_0	4.199935***	0.4604743
	Random-effects parameters	ψ^2	1.362213	0.5248189
		σ_ϵ^2	0.0676498	0.0017752

Number of obs = 2928, Number of groups = 16, Group variable: MSA_id,
 Log restricted-likelihood = -288.91365, Wald chi2(7) = 1279.91, Prob > chi2 = 0.0000,
 LR test vs. linear regression: chibar2(01) = 787.88, Prob >= chibar2 = 0.0000.

Significance levels: *p<0.1, **p<0.05, ***p<0.01

Implications

Implications for Research

Although organizational ecology theory has been extensively applied in diverse contexts to investigate various competitive properties, to the best of our knowledge, our study is among the first carried out in the context of mobile apps. The theoretical underpinnings drawn from the ecological paradigm enhances our understanding of the complicated nature of competition among MSAs. We uniquely classified membership overlap density on the basis of the salient characteristics of overlaps: (1) overlaps within or between categories and (2) overlaps within the same or across different MSA developers. The findings point to asymmetric competition between different MSA categories and synergistic effects between the MSAs of the single developer. These insights cannot be captured by a traditional measurement of membership overlap density. Thus, we suggest that clarifying membership overlap density in accordance with its characteristics can extend our grasp of the complex nature of competition in the emerging MSA industry.

In some of the existing literature about mobile apps, researchers measure the performance or demand of mobile apps with reference to the number of downloads for each mobile app (Ghose and Han 2014; Kim et al. 2015a; Lee and Raghu 2014; Liu et al. 2014). Notwithstanding the value of this approach, it can be severely biased because numerous mobile apps are never used more than once. To avoid potential problems from such bias, we used the actual amount of time spent by the 8,483 panel members on each MSA as basis in accurately measuring the performance of the apps. We also adopted a mixed-effect linear regression model rather than a choice model, whose utility is constrained by a strong assumption of single-homing. This assumption can cause significant bias in the context of MSAs for which multi-homing behavior is pervasive. In addition, our chosen model specification addresses possible violations of homoscedasticity caused by the multilevel structure of a panel dataset. Most articles on competition among MSAs rely on speculation or small-scale survey instruments (Hoehle and Venkatesh 2015). Our research deviates from this practice by elucidating the actual competition for users and their time efforts.

Implications for Practice and Antitrust Enforcement

Companies often compete without knowing who their competitors are and what competitive tensions favor their organizations. The findings suggest that contrary to conventional beliefs and the typical thrust of scholarship, competitors in the MSA context do not necessarily resemble one another. If MSAs take on the “wrong” competitors, they will suffer from significant physical and intangible costs. Figure 1 depicts a holistic view of the competitive dynamics between SNS and messaging apps. With respect to time usage, SNS apps compete not with their counterparts but with messaging apps. However, messaging apps compete against one another in a bid to dominate users’ time. In this regard, strategies should be tailored to MSAs in diverse categories. For instance, SNS app developers that directly compete with messaging app creators should provide users with additional feature that are at par with those of messaging apps. (e.g., private chatting or a more exclusive social mechanism). One such example of social and private forums is *Facebook Groups*. By contrast, messaging app developers do not necessarily need to offer more public socialization mechanisms, which are the main strengths of SNS apps. Instead, messaging app developers should strive to gain an advantage over competing messaging apps. As the rivalry among messaging apps intensifies, they must attract users providing supplementary features and functionalities, such as games, stickers, and payment systems.

Moreover, the competition strategies devised for MSAs must be amended in a manner that complements not only their categories but also their specific goals (e.g., membership or usage). In the case of smaller-scale messaging apps, for which initial attempts to expand active users have been unsuccessful, developers should consider shared access to SNS app users by adding features that enable connection between messaging and SNS apps. This approach is beneficial because membership overlap with SNS apps positively influences the membership growth of messaging apps. Alternatively, if the aim for messaging apps is to secure substantial usage, developers should focus on users who simultaneously patronize their apps and other messaging programs. The rationale for this scheme is that membership overlap with messaging apps negatively affect the usage growth of messaging apps. To wit, developers should provide additional features intended to “lock in” usage and make dual, simultaneous access to

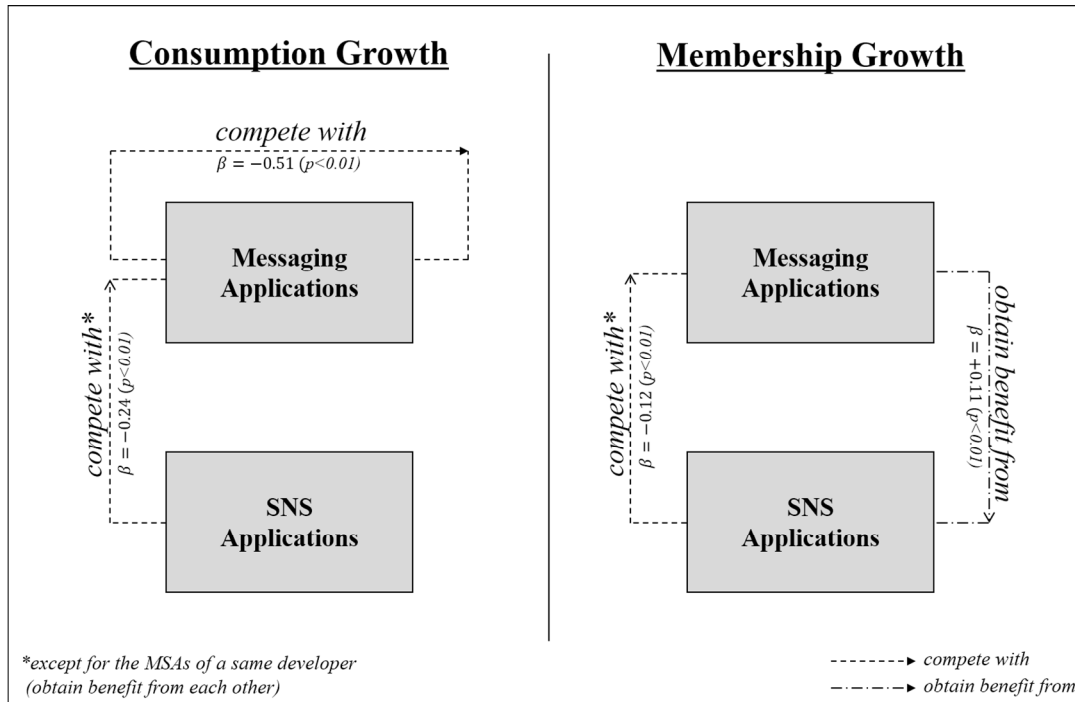
competing messaging programs difficult or unnecessarily. This goal can be achieved by increasing switching costs or offering loyalty-reinforcing incentives.

If managing users' multi-homing behaviors proves to be an enormous challenge, MSA providers are advised to launch or acquire other MSAs in different categories rather than concentrate efforts on their own MSAs. According to our results, membership overlap between the MSAs of a single developer has a significantly positive effect on both membership and usage growth. A line expansion strategy can therefore be an effective means of survival under fierce competition. This recommendation is well aligned with a recent statement that emphasizes the family of apps acquired by Facebook. Our results may also explain the current trend of mergers and acquisitions occurring in the MSA market.

If asymmetric competition between SNS and messaging apps is an inevitability in a stable environment (i.e., low environmental variability), messaging app providers should transform their products into platforms that deliver an array of services to enhance their profitability. The appeal of messaging apps is shadowed by the off-putting presence of revenue-generating advertisements. Certain messaging apps, such as WhatsApp, have thus far been able to keep their services simple and free of advertisements even as these programs are such ready avenues for advertisement compared with SNS apps. An effective alternative, therefore, is for developers to establish business models that differ from those underlying SNS apps to endure in long competitive journey. This direction accords with a recent move by Facebook and LINE to focus on the platform strategies of messaging apps. Asia-based messaging app companies, such as LINE, KakaoTalk, and WeChat, recently succeeded in earning revenue from video games, stickers, and official accounts for businesses and celebrities. These new features will function as new major sources of income and incentives for increased switching.

Our findings also present legal implications in terms of antitrust enforcement. The European Commission recently sanctioned the acquisition of WhatsApp by Facebook because of its evaluation that the two platforms are not close competitors. Our results suggest otherwise. Facebook and other SNSs aggressively compete with messaging apps, such as WhatsApp. The European Commission's approval of the acquisition may seriously harm competition especially that among SNS apps. Antitrust laws should be carefully enforced in a mobile environment, which can be characterized by straightforward competitive dynamics. Our approach can be easily extended to unearth further salient legal insight into competition in this emerging sector.

Figure 1. The Competitive Dynamics between SNS and Messaging Apps



Conclusion

Similar to love, competition can often be unrequited. In academic circles, the association among asymmetric competition, niche overlap, and organizational performance remains poorly understood. From the perspective of organizational ecology, this study sought to identify the nature and state of competition among MSAs that operate in two-sided social platforms. In so doing, we were able to assess the empirical regularities in competition patterns with help from data that comprise the exact daily consumption of 8,483 panel members over 21 MSAs for a six-month period. Although we remain of the view that the duration of six months is sufficient to observe users' app consumption behaviors, we acknowledge that the robustness and generalizability of the findings will be enhanced if longer periods are studied. The findings suggest that asymmetric rivalry illustrates the sophisticated nature of competition between SNS and messaging apps. Such unreciprocated competition means that messaging apps hold an advantage over their SNS counterparts. In addition, this asymmetric pattern is more pronounced for membership competition than for usage competition. Finally, membership overlap between the MSAs of a single developer has a synergistic, rather than destructive, effect on membership growth.

Competition is often inevitable and necessary in an environment where resources are in short supply and unevenly distributed. The mature MSA market and its ecosystem are currently moving through a period of disequilibrium, thereby prompting numerous acquisitions and takeovers. Speculating on how the asymmetric struggle will evolve and who will eventually win the battle for user resources is premature at this point. Dynamic phenomena are often resistant to conclusive interpretations; the end of symmetric competition can spell the dawn of asymmetric competition or vice versa. Delineating competition in mobile contexts is less a matter of securing an irrefutable foundation for the direction of rivalry than recognizing and adapting to what might be an inherent volatility; just as environments transform and mutate, so do patterns of competition.

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