

Circulating Mobile Apps in Greater China: Examining the Cross-Regional Degree in App Markets

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This article examines the use of mobile apps and the model of cross-regional communication in the app markets of Greater China and explores the influence of policy, capital, and culture on the mobile app consumption. The cross-regional degree (CRD) of mobile apps is used to measure the circulation of apps in different markets and to identify mobile apps and app producers capable of achieving cross-regional commercial success and of gaining market recognition in Greater China. The final samples include 1,124 mobile apps that ranked among the top 500 in at least two markets. The apps were coded according to market platform, firm age, price, producer listing status, producer location, app genre, and CRD. The consumption of apps in these markets is significantly influenced by policies, company capital, and local cultural tastes. Moreover, mainland China is isolated from other Greater China regions in terms of the app market. Compared with app producers in Hong Kong, Macau, and Taiwan, app producers in mainland China should consider more marketing strategies targeting audiences in other regions.

Keywords: mobile app, policy, capital, Greater China, cross-regional degree, regional cultural taste

“The celestial empire,” “the civilization of five thousand years,” and “blood is thicker than water”²—these terms and idioms imply that a Chinese-centered doctrine is deeply rooted in traditional Chinese culture, which ties the people, the family, the country, and even the nation together as the “imperial sword.” The term “Greater China” became popular in the early 1990s and is widely accepted academically and internationally as the name for Chinese communities and territories, including Hong

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² In Chinese, these idioms are written as “天朝上國,” “五千年文明,” and “血濃於水.” The emphasis is on the importance of kinship, cultural legacy, and ethnocentrism in Chinese history.

Kong, Taiwan, Macau, and mainland China (Harding, 1993; Shambaugh, 1993). Unlike several common phrases the Chinese use to symbolize "Chinese-ness," such as "the Chinese people," "the Heir of Loong,"³ and "the State of Etiquette," the term "Greater China" conveys at least two connotations. First, it indicates the commonality among the four regions, recognized by the international community in the early 1990s. Although they are ruled by different parties and have distinct economic systems, the four regions share many similarities regarding languages (Li, 2006), culture (Weiming, 1996), and history (Shambaugh, 1993). In addition, recognition of ethnic identity is higher in Greater China than in other self-contained Chinese communities (e.g., Singapore). Scholars have paid substantial attention to the cultural flow among the Greater China regions, as expressed by the Chinese idiom "a strip of water."⁴ For example, Gold (1993) found that the invasion of popular culture from Hong Kong and Taiwan has, to a certain extent, stimulated economic reform in mainland China.

In fact, comparative studies within the scope of Greater China constitute an interdisciplinary subject with historical origins. Broadly speaking, cross-regional media research—from print media and electronic media to digital media—has far-reaching theoretical and practical significance. For instance, the comparative study of the organizational structures of news agencies across nation-states can effectively reveal the structural effects of political systems, economic policy, and journalistic professionalism on the processes of news production and reporting (Hallin & Mancini, 2004). In addition, comparisons of media consumption have been a main concern of scholars. Comparing website usage data from around the world, scholars have found that cultural proximity has a greater impact on the use of the Internet than language and geography (Taneja & Wu, 2014). Narrowly speaking, as a collection of special areas, Greater China has inspired or even opened new possibilities for all the above-mentioned types of global research in the communication field. Concentrating on the Greater China regions facilitates the examination of the effects of political systems, economic structures, and regional cultural tastes on aspects of media production, use, and consumption, after controlling for geographical distinctions, linguistic distance, and national cultural differences.

Research on the Greater China regions has always been a trending topic in Chinese communication studies and the general field of communication. This article reviews the existing literature about Greater China in terms of political, economic, and cultural aspects of communication, proposing CRD as a dependent variable for measuring media consumption in local and cross-regional markets. CRD refers to the extent to which media products are recognized, accepted, and adopted by two or more regional markets. The more regional markets in which a media product is adopted, the higher its CRD. Through empirical study, this research specifically aims to examine how political, economic, and cultural factors affect the CRD of mobile apps in Greater China. It also explores general patterns of cross-regional app consumption in the Greater China region as further analysis.

Literature Review

³ "Loong" refers to the dragon, portrayed in Chinese mythology.

⁴ "A Strip of Water," written as "一衣帶水" in Chinese characters, literally means "a river as wide as a belt," which implies that two separate areas are strongly connected regardless of the distance.

Predicting Cross-Regional Media Consumption: The Concept of Cross-Regional Degree

Cross-regional media consumption has long been an important research field, as it offers a unique perspective on the dynamics in cross-regional flows of media products (Fu & Govindaraju, 2010; Lee, 2008). Patterns of media product selection and reception in diasporic regions reflect how different societies react to shared media products in heterogeneous ways (Fu & Govindaraju, 2010). Mobile apps, as a kind of rising media product, are being shared by consumers from various regional markets. Hence, examining the extent to which such media products are accepted by cross-regional markets is critical.

In this research, we propose using the concept of CRD to discuss media product performance in local and cross-regional markets. By definition, the CRD indicates the extent to which media products are recognized, accepted, and adopted in multiple regional markets. The CRD is measured by the number of regional markets in which consumers are adopting a media product. A higher CRD means the media products have a better performance across diasporic regions. Figure 1 provides an example from the context of mobile app consumption: mobile app A has been downloaded frequently in market X, but mobile app B has been downloaded frequently in both market X and market Y; the CRD of B is therefore higher than that of A.

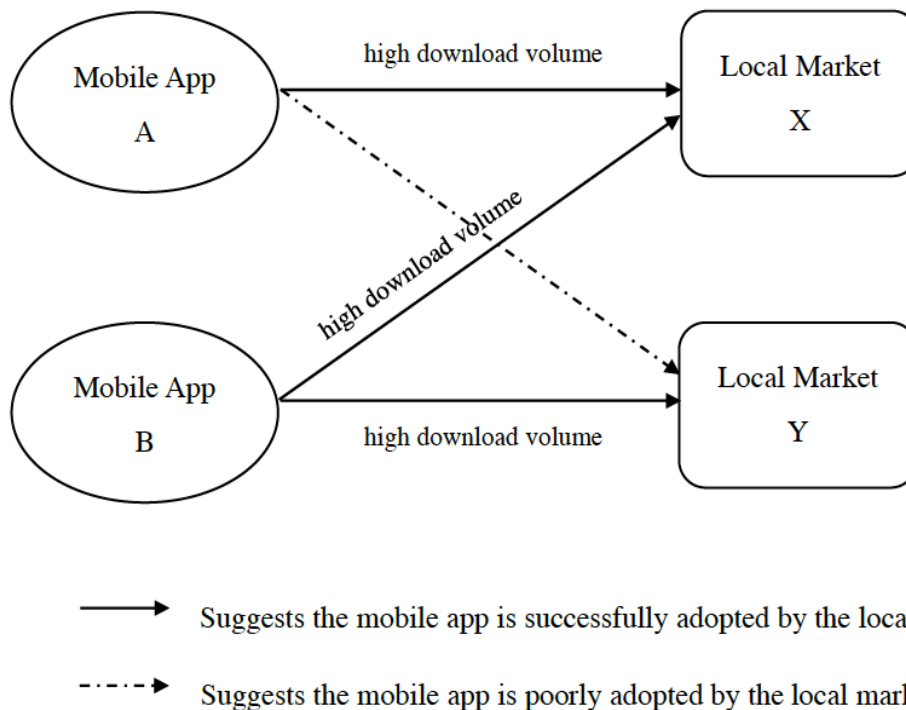


Figure 1. Cross-regional degree of a mobile application.

In studying the overseas consumption of media products, previous research has mainly focused on the impact of cultural discount on the cross-regional performance. For instance, several studies have reviewed the box office of Hollywood films in various countries to examine the cultural influence on foreign market performance (Craig, Greene, & Douglas, 2005; Fu & Govindaraju, 2010; Lee, 2006, 2008). From the perspective of cultural discount, the appeal of media products decreases in a nondomestic market because of the differences in cultural background between producer and consumer (Hoskins & Mirus, 1988; Lee, 2008). Reducing the cultural discount of media products is a primary goal of the producers (Lee, 2006).

The success of certain media products in the domestic market does not necessarily mean they will be recognized by consumers in other markets (Fu & Govindaraju, 2010; Lee, 2006, 2008). To further explore this phenomenon, previous literature has proposed the concept of "cross-culture predictability" (Lee, 2006, 2008) to measure the extent to which a particular media product's performance in one culture can predict its performance in another culture. A higher level of cross-culture predictability indicates a lower cultural discount (Lee, 2006, 2008).

However, the existing literature concerning cultural discount and cross-culture predictability has mainly compared media content performance in domestic and nondomestic markets from the cultural perspective. Although culture plays a significant role in shaping the performance of media content across markets, political and economic factors should not be overlooked. Therefore, this research proposes a more comprehensive approach to understanding media content performance in local and cross-regional markets from the perspectives of culture, politics, and economy. We postulate that these three factors significantly affect the CRD of a mobile app. App consumption provides a fascinating context for studying the CRD of media products. As compared with other media products, mobile apps offer more functions and reflect the diverse purposes of consumers (Goggin, 2011).

Culture and Cross-Regional Degree

Cultural difference is considered a barrier to the cross-regional flow of media content (e.g., Fu & Govindaraju, 2010; Lee, 2006, 2008). Scholars have conventionally viewed Greater China as regions with highly proximate cultures (Cheung & Chow, 1999; Tai & Tam, 1997). Yang (2003a) has argued that mainland China, Taiwan, and Hong Kong are all within the Chinese cultural sphere. This public sphere is shared not only in the offline world, but also in the online world (Yang, 2003a, 2003b). However, regional media consumption is different from historical and national cultural heritage, and it places more stress on the unique cultural preferences resulting from geographical isolation. For example, the mainland costume TV drama series *Langya Bang (Nirvana in Fire)* is regarded as a masterpiece by mainland audiences, but it set a low record viewing among Hong Kong audiences when screened during prime time ("*Lang Ya Bang*," 2016).

In a similar vein, in studies of the Hong Kong and mainland film industries, scholars have also observed that Hong Kong and mainland audiences differ dramatically in their viewing preferences and expectations. A successful film in Hong Kong often fails on the mainland, and vice versa (Yin & He, 2008). In this context, regional media consumption reflects the differentiation of a specific region from other regions through its unique consumption patterns and choices. For example, the literature has indicated that media content with less cultural specificity is less likely to suffer from cultural discount (Lee, 2006, 2008).

With the rapid development of mobile technology, mobile apps are encouraging a new form of media consumption (Böhmer, Hecht, Schöning, Krüger, & Bauer, 2011; Pentina, Zhang, Bata, & Chen, 2016). Culture also has a significant impact on shaping peoples' mobile app consumption in terms of both perceptions and adoption (Pentina et al., 2016). However, compared with mass media consumption, mobile app consumption is more sensitive to various genres and infrastructural logics.

Existing mobile app usage studies have not reached an agreement on the categorization of app genres. This research categorizes mobile apps into four genres: (1) entertainment apps, such as those providing games, music, sports information, movies, and television dramas; (2) communication and information media apps, such as those providing news, books, social networking, and instant communication; (3) noncommercial tool apps, such as apps providing tools related to education, health, lifestyle, medicine, travel, and weather; and (4) commercial tool apps, such as those providing tools related to finance, business, productivity, and e-commerce. Table 1 provides a summary of the categories and exemplary apps.

Table 1. Summary of App Categorization and Exemplary Apps.

Category	Exemplary Apps
Entertainment apps	QQ music, Candy Crush, Pokémon Go, Mermaid Grows Up, Dailymotion
Communication and information media apps	UC Web, Yahoo News, Sina Weibo, WeChat, WooTalk
Noncommercial tools apps	Coursera, Chrome Remote, Baidu Map, Wallpapers HD, Runtastic
Commercial tools apps	Taobao, Foodgulu, Bank of China, Tencent Stock, Alipay

Under this categorization, certain app genres, such as commercial tools and noncommercial tools, exhibit less cultural specificity. The evaluation of these apps mainly depends on their objective technical performance. In contrast, other app genres with greater cultural specificity, such as communication and information media apps, can hardly gain cross-regional recognition from users with different cultural backgrounds.

Moreover, compared with other app genres, communication and information-media apps are likelier to feature a CRD constrained by regional censorship policies (e.g., the content censorship on Weibo and WeChat), while the CRDs of entertainment apps are constrained by copyright issues (e.g., certain television dramas available on the IQIYI app could only be viewed by users in mainland China and were not accessible to users in Hong Kong, Macau, or Taiwan). Based on the above argument, this article offers the following hypothesis:

H1: The app genre affects an app's CRD within Greater China.

***The Political Economy Approach in Greater China:
Policy versus Market Comparisons***

Lessig (1998) defined four types of power that regulate and control Internet use: law, market, architecture, and social norms. The government influences the market by passing laws that regulate the Internet, and market developments can also lead to the modification of policy, in turn affecting people's use of the Internet. Based on an analysis of the Asian business of Phoenix TV, which falls under Rupert Murdoch's media monarchy, Curtin (2005) has argued that government control and capitalized markets have a significant impact on television coverage at the local infrastructure level. In line with Lessig (1998), this study recognizes two policy implications affecting local media content consumption: policy as a restriction and policy as an incubator.

On one hand, political powers intervene and control the media market through policy making. As an illustration, in an examination of Star TV, whose business activities span the pan-Asian area, Chan (1994) maintained that government policy management is an important factor for unilateral privileges. Such political restrictions are also observable in the Greater China mobile app market. The most well-known case of policy regulation is the censorship of Google's operations in mainland China. One year after the Chinese government blocked YouTube (owned by Google), Google announced a handover of all its Chinese business to Hong Kong, resulting in the total unavailability of its services in mainland China (Branigan, 2010). Such state-level regulation in Greater China is a major factor affecting the development of different app markets. In fact, the impact of a region's political environment and facilitating conditions substantially influences the adoption of mobile media products and other digital services today (Lu, Liu, Yu, & Wang, 2008).

On the other hand, local government policies may encourage innovation, protect local industries, and serve as incubators for media content consumption. For instance, Wu and Taneja (2016) investigated cross-regional Internet usage and found that friendly state policies can facilitate regional content production and benefit the vivacious domestic market. They argued that the robust Internet industry and affirmative state interventions in China have significantly contributed to the vibrant local content catering to regional needs, basing their conclusions on an analysis of global participation in online communication. Likewise, countries such as Russia and Japan feature vast local Internet markets and have implemented protective policies to encourage domestic innovation and to protect local industries fulfilling the content needs of regional consumers. However, in Greater China, and particularly in the mainland China market, policy as a restriction may overtake policy as an incubator.

Two magnates in the global mobile app market, iTunes and Google Play, receive significantly different treatment in mainland China. China has become the second-largest iTunes market based on the sales profits of apps, replacing Japan (Perez, 2016). Although Google's number of downloads is 1.5 times that of Apple's globally, Apple's profits from mobile apps far exceed those of Google. Google consequently must admit that mainland China is a highly significant market, and recent reports have claimed that Google plans to reenter China (CIW Team, 2016). Google's tumultuous experiences in mainland China indicate that technology is not borderless and that it is influenced by policy and the market. Changes in policy will bring risks related to media entry, and profits will drive the media to self-adaptation (Rosenberg, 2016). As a consequence of Google's retreat, users on the mainland cannot (at least stably) access the Google app platform and must employ an unofficial Android

platform made by a domestic third party.⁵ Based on the influence of regional policy on media consumption, this article proposes a second hypothesis:

H2: Compared with mobile apps released via Google Play, apps released via Apple iTunes have a higher CRD within Greater China.

In addition to policy, capital also has an effect on media use and consumption; this influence, however, can hardly be detected by users in, for example, the film industry (Yin & He, 2008). Since the 1990s, capital from Hong Kong has taken advantage of the mainland film industry's resources for film shooting. However, recently, Hong Kong films have had to rely on the large market of mainland China (Yin & He, 2008). It is therefore evident that capital is crucial in terms of media consumption. As a result of globalization, large capital and interest groups have emerged in the media industry, and the media content used worldwide is more subject to the influence of the globally fused consumption discourse (Boyle, 1992). Mobile apps are exactly this kind of product. Their technical properties, design features, and virtual use environment make them accessible to users around the world at a low cost. The present research delineates three capital characteristics of mobile apps: firm age, download price, and listing status. These three characteristics could all affect the consumption of mobile apps in Greater China.

Previous research has indicated that innovation is essential to mobile app development, as producers of mobile apps need to keep pace with frequent changes and face various challenges such as fragmentation within and across platforms, app monitoring, and testing (Joorabchi, Mesbah, & Kruchten, 2013). Firm age has a significant impact on the innovation capacity of the firm. In many industries, firms with a longer history presented a lower probability of innovation, while firms with a shorter history showed a higher probability of innovation (Balasubramanian & Lee, 2008; Coad, Segarra, & Teruel, 2016; Huergo & Jaumandreu, 2004). Given the fast-changing environment of mobile app production, younger firms with higher innovation capacity will have an advantage in adapting to the cross-regional markets.

Generally speaking, producers of mobile apps share common characteristics: a short history and a small scale. These traits are consequences of the Silicon Valley-style entrepreneurial boom initiated by the high-technology industry in neoliberal societies (Marwick, 2013). Compared with companies with long traditions, these young entrepreneurial producers are more capable of meeting the various demands of users from different regions in an innovative way. Older companies, in contrast, confined by their internal complexities, often cannot take the initiative in the fast-changing mobile app market. Therefore, the following hypothesis regarding capital and CRD is proposed:

H3a: Mobile apps produced by companies with a shorter firm age have a higher level of CRD within the Greater China area.

⁵ Google Play was officially banned in mainland China when the data collection was finished. Users from mainland China must use a virtual private network (VPN) for Google Play. The report can be retrieved from <https://www.globalwebindex.com/reports/vpn-usage-around-the-world>

Different regions diverge in preferences regarding advertisements. To generate profits by targeting specific groups, advertisements have different orientations within Greater China's regions (Tse, Belk, & Zhou, 1989). As the current major profit model for mobile apps, advertisements can be inserted in apps in several ways (Leppaniemi & Karjaluoto, 2005). For example, Google and Apple have both developed proprietary advertisement plugins—Admob and iAds, respectively—to provide diversified and individualized advertising revenue models for app producers. Since they do not generate profits when downloaded, free mobile apps have to strengthen the effect of advertisements. Thus, the producers of free mobile apps unsurprisingly care more about the consumption characteristics of regional users and place more region-oriented advertisements than paid app producers. Paid apps, however, emphasize the content itself and minimize the regional orientation to gain recognition from users in more regional markets. Hence, this article suggests the following hypothesis:

H3b: Paid mobile apps have a higher level of CRD within Greater China than free apps.

Lastly, whether a company is listed also reflects its capital composition. Listed companies have access to a broader audience, and in the capital market, they must broaden their profitable areas to ensure the bureaucratic function. For example, Tencent.com, a monopolistic Internet-based mainland company, has globally extended its business scope by expanding its mobile app production in absolute terms as well as the number of categories. This article therefore argues that listed companies are likelier to expand their coverage in the capital market than nonlisted companies and proposes the following hypothesis:

H3c: Mobile apps produced by listed companies have a higher level of CRD within Greater China than nonlisted companies.

Data and Method

Data

Sampling. The data were collected from App Annie, a commercial organization that specializes in the statistical analysis of mobile app download data. App Annie's business scope covers several mobile app platforms, such as Apple iTunes, Google Play, and Amazon, and its data consist of mobile app rankings in more than 155 countries and regions. Based on apps' cumulative download times, App Annie provides registered users with a list of the top 500 free and paid apps (1,000 in total) for each country or region, along with app information such as names, rankings in a certain country or region, price status (free or paid), and producers. Since this study focused on Greater China, we used only the app lists for mainland China, Hong Kong, Macau, and Taiwan. To underscore the focus and to avoid excessive complexity, this study examined data from two platforms: Apple iTunes and Google Play. The data collection occurred in March 2016. As reported by comScore (2015), Apple and Google have dominated the global mobile app markets. This study's data were therefore largely representative of model app consumption patterns in Greater China. The dataset ultimately included information about 8,000 mobile apps: (500 free apps + 500 paid apps) × (2 platforms) × (4 regions) = 8,000 apps.

Database 1. We first detected the overlapping apps in the four regions and arrived at 1,943 distinctive apps in Apple iTunes and 1,827 distinctive apps in Google Play. This was the first database to be analyzed. Each entry in this database contained basic information on a particular app, including its name, its producer, its price

status (free or paid), and the regions in which it was listed in the top 500.⁶ We also constructed a list of apps based on cross-regional rankings: If an app ranked among the top 500 in more than one region, it was included. This new list thus excluded those apps that were among the top 500 in only one region and retained only those that ranked among the top 500 in two or more regional markets. After the selection, the new database contained 537 Apple apps and 587 Google apps in total. This was the second database adopted in this study.

Database 2. This article detailed the further information searches and content analyses performed on the second database. We obtained information about the app producers from multiple online portals, searching for the location of each app's headquarters, founding year, parent company, listing status, listing country, and business type. As mentioned, there were 1,124 list entries (537 Apple apps + 587 Google apps). The cross-regional mobile app database, however, contained each app's name, category, price status, platform (whether Apple or Google), founding year, parent company, listing status, listing country, and business type, along with the regions where it ranked in the top 500, its producer, and that producer's location.

This content analysis was conducted by two research assistants who analyzed all the data independently and compared their results. The Cohen Kappa coefficient for consistency reliability between the two coders was .58. The criterion for the Cohen Kappa coefficient was between .41 and .60 (Landis & Koch, 1977), and thus, the reliability of the current content analysis was acceptable. In addition, after data recoding, one author calculated the average correlation coefficient between the coding of the two research assistants for the same variable ($r = .93$), and the value demonstrated that the consistency between them was quite high. We also reached an agreement after full discussion on the data that were inconsistent.

Operationalization

CRD. To measure the CRD, we needed to first count how many top 500 lists an app appeared on. For this study, a first attempt to ascertain the potential explanatory power of structural factors (policy, capital, and culture) on cross-regional mobile media acceptance, we coded each app according to the number of top 500 rankings in the Greater China area. Therefore, the CRD measured the extent to which an app circulated within Greater China on a scale from 2 to 4. A code of "2" suggested that the app was listed in the top 500 in two Greater China regions; "3" indicated that the app was listed in the top 500 in three regions; and "4" denoted a ranking in all regions. As indicated in Figure 1, an app with a higher CRD was likelier to succeed in Greater China app markets, which implies more users and cumulative downloads across the local regions.

Policy: app platform. Apps released on Google Play were coded as "0," and apps released on Apple iTunes were coded as "1." Because of divergent regional policies, mobile app markets had different access mechanisms and market share compositions. For example, as a result of mainland China's blocking of Google, many users have to use the third-party Android app platform. This suggests that Google's share of the mainland market was, to a large extent, affected by the local policy.

⁶ Excluding data that appear only in one region, there are 11 possibilities for the markets in which an app can appear: two regions (six possible combinations), three regions (six possible combinations), or all four regions (one combination).

Capital: firm age, app price, and listed company. Three items were extracted to measure the capital elements implied in the app database: the producer's establishment year, the price of the app, and the app producer's listing status.

- a. Firm age:** The recoded variable of firm age was obtained from the production company's founding year (2016 minus the founding year).
- b. App price:** Free apps were coded as "0," while paid apps were coded as "1." A code of "2" indicated that the app had both paid and free versions released online. This variable reflected the profitability of an app, as free apps could mainly profit from advertising revenue, paid apps could profit from payment by users, and apps with both paid and free versions could profit from both mechanisms.
- c. Listing status:** Unlisted producers were coded as "0" (62.7%, $n = 2,365$), while listed producers were coded as "1" (37.3%, $n = 1,405$). The higher the value, the likelier the producer is to adopt a global strategy. The stock markets of the listed app producers were further coded into three categories for descriptive purposes: (1) listed in the stock markets in the Greater China area (39.7%, $n = 558$); (2) listed in Asia, except for Greater China (13.3%, $n = 187$); and (3) listed outside Asia (47.0%, $n = 660$). Of the producers, 55.9% ($n = 785$) were listed in the same stock markets as their headquarters, and 44.1% ($n = 620$) were listed overseas. Regarding overseas-listed producers, 49.4% ($n = 306$) were headquartered in mainland China, 22.4% ($n = 148$) were headquartered in Hong Kong, and the remainder were headquartered in Macau and other overseas districts.

Regional cultural taste: app genre. This study recategorized mobile apps into four genres: entertainment, communication and information media, noncommercial tools, and commercial tools, accordingly coded as four dummy variables. Corresponding to the categories of apps released on the market, the entertainment apps included apps related to entertainment, games, music, and sports. The communication and information media genre included books, communication, news, video, and social networking. The noncommercial tools genre comprised education, health, lifestyle, medicine, navigation, personalization, reference, tools, travel, utilities, and weather. Lastly, the commercial tools genre consisted of apps related to finance, business, food and drink, productivity, shopping, and e-commerce.

Locations of the app producers' headquarters. The geographical locations of the app producers' headquarters were also coded into categories: (1) general regions of mainland China, including Chengdu, Chongqing, Fuzhou, Hangzhou, Hefei, Nanjing, Ningbo, Sichuan, Suzhou, and Xiamen;⁷ (2) the most developed areas of mainland China, including Beijing, Shanghai, Guangzhou, and Shenzhen; (3) the nonmainland Greater China area, including Hong Kong, Macau, and Taiwan; (4) Asian regions other than Greater China; and (5) North America and Europe.

⁷ These categories were extracted based on the obtained data on app producers' geographical locations, which means that regions or districts that do not appear in the second dataset were excluded.

Analysis and Results

Predicting the Cross-Regional Degree of Mobile Apps in Greater China

We conducted multiple linear regressions to test the hypotheses. This article argues that policy (app platform), capital (firm age, app price, and producer listing status), and regional cultural taste (app genre) could affect the CRDs of mobile apps. As shown in Table 2, all hypotheses were supported. App platform ($\beta = .09, p < .001$), firm age ($\beta = -.08, p < .001$), price ($\beta = .15, p < .001$), producer listing status ($\beta = .16, p < .001$), and app genre were all significant variables for predicting an app's CRD.

Table 2 indicates that apps released via Apple iTunes had higher CRDs than apps released via Google Play. Paid apps produced by listed companies with a shorter history and a global strategy, such as high-tech startups, exhibited higher CRDs. Finally, apps belonging to more practical genres with less cultural specificity, such as entertainment apps ($\beta = .05, p < .05$) and noncommercial tools apps ($\beta = .09, p < .05$), were likelier to be adopted and circulated across the local app markets.

This research also compared the influence of CRD among regions. In terms of policy, the results revealed that, for mobile apps produced in mainland China, apps released via Apple iTunes had higher CRDs than Google Play apps ($\beta = .23, p < .001$), while for mobile apps produced in Hong Kong, Macau, Taiwan ($\beta = -.11, p < .001$), and regions outside Greater China ($\beta = -.10, p < .001$), the opposite was observed. In terms of capital, firm age had a negative impact on the CRD of apps produced in Hong Kong, Macau, Taiwan ($\beta = -.17, p < .001$), and regions outside Greater China ($\beta = -.07, p < .01$) but had no significant impact for apps produced in mainland China ($\beta = .01, p > .05$). App price had a positive impact on the CRD of apps produced in Hong Kong, Macau, Taiwan ($\beta = .10, p < .01$), and regions outside Greater China ($\beta = .12, p < .001$) but had no significant impact for apps developed in mainland China ($\beta = -.01, p > .05$). As for the cultural dimension, for apps produced in mainland China, apps belonging to the communication and information media genre had the highest CRD ($\beta = .14, p < .001$); for mobile apps produced in Hong Kong, Macau, Taiwan ($\beta = .28, p < .001$), and regions outside Greater China ($\beta = .13, p < .001$), entertainment apps had the highest CRD.

Table 2. Predicting App's Cross-Regional Degree.

Model 1 All sample	Model 2 Mainland China	Model 3 Hong Kong, Macau, Taiwan	Model 4 Outside Greater China regions
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Policy				
App platform	.09***	.23***	-.11***	-.10***
ΔR^2	.01***	.05***	.01***	.01***
Capital				
Firm age	-.08***	.01	-.17***	-.07**
Price	.15***	-.01	.10**	.12***
Listed	.16***	.12***	.01	.24***
ΔR^2	.02***	.02***	.04***	.05***
App genre				
Communication and information media	.03	.14***	-.14***	.02
Entertainment	.05*	-.10**	.28***	.13***
Noncommercial tools	.09*	.07*	.26***	.11***
Commercial tools	-.03	.09*	-.26***	-.03
ΔR^2	.01***	.03***	.09***	.01***
Total adjusted R^2	.04***	.09***	.13***	.07***

Note. Entries are standardized regression coefficients. Missing values are replaced by means. Regression are separately run according to app producers' headquarters. Model 1 includes all samples; model 2 includes apps that were produced in mainland China; model 3 includes apps that were produced in Hong Kong, Macau, and Taiwan; and model 4 includes apps that were produced outside the Greater China regions.

* $p < .05$; ** $p < .01$; *** $p < .001$.

Further Analysis: Description of App Usage in Greater China Regions

To further explore the ecology of mobile app production and consumption in these four regional app markets, this research conducted a series of further analyses. These included descriptive analyses on the number of producers, cross-regional producers, and cross-regional mobile apps on Apple iTunes and Google Play.

As revealed in Table 3, in the iOS market, producers have developed nearly identical numbers of free and paid apps in the four Greater China regions (the ratio of free-to-paid apps was close to 1). However, the Google Play market yielded several differences. Hong Kong and Taiwan had approximately four times as many app producers as the mainland and Macau. Unsurprisingly, producers of Android apps had to face much more intensive competition in Hong Kong's and Taiwan's app markets.

Table 3. Number of App Producers that Publish Applications on Top 500 Rankings in the Greater China Regions.

	Apple iTunes	Google Play
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	Free	Paid	Total	Free	Paid	Total
Mainland	261	262	523	96	94	190
Hong Kong	274	265	539	396	395	791
Macau	250	251	501	103	95	198
Taiwan	267	254	521	352	351	703

Table 4 illustrates the number of cross-regional producers that released top 500 apps in two of the four Greater China regions.

Table 4. Number of Cross-Regional App Producers among the Greater China Regions.

	Apple iTunes			Google Play		
	Free	Paid	Total	Free	Paid	Total
Mainland * Hong Kong	26	28	54	10	30	40
Mainland * Macau	29	32	61	19	16	35
Mainland * Taiwan	19	21	40	22	18	40
Hong Kong * Macau	60	54	114	3	46	49
Hong Kong * Taiwan	42	51	93	92	97	189
Macau * Taiwan	42	43	85	17	20	37

Producers that released an app that appeared in two regional markets at the same time are included in the counts. Generally speaking, the number of producers that produced apps circulated across Hong Kong, Taiwan, and Macau far exceeded the number of producers whose apps were circulated between mainland and any one of the other three regions. In the iOS market, Hong Kong and Macau shared the most producers that released recognizable cross-regional apps ($n = 114$), while mainland China and Taiwan shared the fewest cross-regional producers ($n = 40$). In the Android market, Hong Kong and Taiwan shared the greatest number of cross-regional producers ($n = 189$), while mainland China and Macau shared the fewest ($n = 35$).

Table 5 compares the cross-regional apps in detail. Regarding iOS apps that had two top 500 rankings across regional markets, Hong Kong and Macau shared the most ($n = 114$), while China and Taiwan shared the fewest ($n = 27$). As for iOS apps that had three top 500 rankings, Hong Kong, Macau, and Taiwan shared the most ($n = 73$), while mainland China, Hong Kong, and Taiwan shared the fewest ($n = 17$). Lastly, only 21 apps were listed in the top rankings of all four regional markets. As for the Android market, Hong Kong and Taiwan shared the most apps in the top 500 rankings ($n = 384$), while the mainland and Taiwan only shared seven top-ranking apps. The other regions also shared very few overlapping apps compared with the figure seen for Hong Kong and Taiwan.

Table 5. Number of Cross-Regional Apps among the Greater China Regions.

Cross-Regional Class	Apple iTunes	Google Play
Binary cross-regional		
Mainland * Hong Kong	38	23
Mainland * Macau	53	21
Mainland * Taiwan	27	7
Hong Kong * Macau	114	41
Hong Kong * Taiwan	84	384
Macau * Taiwan	61	5
<i>Total</i>	<i>377</i>	<i>481</i>
Triple cross-regional		
Mainland * Hong Kong * Macau	28	35
Mainland * Hong Kong * Taiwan	17	14
Mainland * Macau * Taiwan	21	9
Hong Kong * Macau * Taiwan	73	28
<i>Total</i>	<i>139</i>	<i>86</i>
Tetrad cross-regional		
Mainland * Hong Kong * Macau * Taiwan	21	20
<i>Total</i>	<i>21</i>	<i>20</i>
Total number of cross-regional apps	537	587

N = 1124.

In summary, among the Greater China regions, Hong Kong and Taiwan had the most exchange regarding their app markets, followed by Hong Kong and Macau. Mainland China, in contrast, had very little exchange with the other three regions in terms of mobile apps.

In addition, we conducted ANOVA test and Scheffé post hoc analyses to explore whether app producers located in various geographical locations differed in their ability to circulate their products in the four markets. As Table 6 demonstrates, there was a significant difference between groups (different geographical locations of the producer's headquarters) in terms of the CRD ($F = 7.10, p < .001$).

Table 6. One-Way ANOVA Test and Scheffé Post Hoc Analyses between the Headquarters of App Producers and Cross-Regional Degrees of Apps.

Headquarters	Headquarters	M.D.
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General Mainland	Developed Mainland	.11
	Greater China area	.31**
	Asia	.25
	North America and Europe	.11
Developed Mainland	Greater China area	.20**
	Asia	.14
	North America and Europe	-.01
Greater China area	Asia	-.06
	North America and Europe	-.20**
Asia	North America and Europe	-.14
F value		7.10***

Note. "General Mainland" refers to those general mainland districts from the database, including Anhui, Chengdu, Chongqing, Fuzhou, Hangzhou, Hefei, Nanjing, Ningbo, Sichuan, Suzhou, and Xiamen. "Developed Mainland" includes Beijing, Shanghai, Guangzhou, and Shenzhen, which are the most developed districts in Mainland China. "Greater China area" excludes the mainland and keep the other three regions (Hong Kong, Taiwan, and Macau). "Asia" excludes the four regions of the Greater China. N = 1124. * $p < .05$; ** $p < .01$; *** $< .001$.

The CRDs of mobile apps produced by companies located in the other three Greater China regions were significantly higher than those of apps produced by companies located in the mainland, including the most developed mainland districts ($M.D. = .20, p < .01$) and other general mainland districts ($M.D. = .31, p < .01$). Moreover, the results demonstrated that the CRDs of mobile apps made by producers located in North America and Europe were significantly higher than those of apps developed by companies in Hong Kong, Taiwan, and Macau ($M.D. = -.20, p < .01$).

Concluding Discussion

This study has focused on cross-regional media consumption in Greater China. It proposes a dependent variable, CRD, which could be widely adopted to examine the impact of cultural and political factors on media information exchange among different geographically isolated regions. Under such a conceptualization, comparisons of more than two subjects become more feasible than is the case with classic comparative analyses in the field of comparative studies (Landman, 2000). This dependent variable could potentially be used to identify differences among nations and regions all over the world as long as data are available.

The previous literature concerning cultural discount and cross-culture predictability has mainly studied the cross-regional consumption of media products from the cultural perspective. Thanks to this newly proposed concept, the data traffic undergirding mobile app markets has made it possible to uncover the distinct explanatory power of various factors (e.g., policy, capital, and cultural taste). For instance, comparing the app markets in Hong Kong and Macau revealed that although both are special administrative regions of the People's Republic of China, Hong Kong apparently has more producers that contribute to Great China app markets and that are more successful at circulating app products across regions. The

success of Hong Kong's app industry is probably because of the government's policies, which encourage a competitive environment aimed at nurturing small digital enterprises so they can thrive outside of the domestic market (Quibria, Ahmed, Tschang, & Reyes-Macasaquit, 2003). Comparatively speaking, Macau has a less-developed innovation industry than Hong Kong and Taiwan, although it keeps pace with mainland China in terms of politics. Thus, the differences in regional app markets echo the discussion of the internationalization processes of firms from newly industrialized economies at the macro level (Lau, 2003). The next sections articulate the key findings of the comparisons of the Greater China regions in terms of mobile app markets.

The Uneven Circulation of Mobile Apps in Greater China

Whether mobile apps produced in a certain region manage to rank in the top 500 in several cross-regional markets reflects the flow of mobile app circulation. Mobile media consumption is influenced by policy, the economy, and regional cultural tastes. Mobile apps from mainland China can hardly enter the markets of Hong Kong, Macau, and Taiwan, but apps from Hong Kong, Macau, and Taiwan can gain a degree of popularity among mainland users. This is most obvious in the Google app market, potentially because of the mainland's blocking of Google products.

Focusing on the mainland's mobile app market, this study's data reveal a potentially common rule: Mobile apps developed in mainland China rarely penetrate mainstream consumer groups in other Chinese communities, but mobile app producers in other Chinese regions must seriously consider the consumption demand of the substantial group of potential mainland users. Mobile apps made in other Chinese regions, and even other countries, will further intensify internal competition in the mainland mobile app market, carving up mainland app consumer groups. In contrast, mainland app producers need more support and must make greater efforts to compete cross-regionally and internationally. Today, the mobile app is becoming an indispensable part of the online cultural sphere; the current uneven circulation of mobile apps and the isolation of the regional market might obstruct the "Chinese cultural sphere" (Yang, 2003a, 2003b) to a certain extent. Improving the CRD of mobile apps is of great importance for not only app producers but also policy makers.

It cannot be denied that the different domestic market sizes of mainland China, Hong Kong, Macau, and Taiwan could influence producers' cross-regional strategies. For producers from Hong Kong, Macau, and Taiwan, improving the CRD is essential, as the mainland China market has vital economic significance. Despite the lack of economic demand from nondomestic markets, policy makers still must value mobile app exports in the regional "soft power competition" (Chua, 2012). For example, two giants of mainland app production, Tencent and Alibaba, have been committed to promoting their mobile payment apps (i.e., WeChat Pay and Ali Pay) in Hong Kong and Macau (Lao, 2018) and other overseas regions.

Empirical data also highlight mainland producers' ambition to improve the CRD of their products. For example, according to a report released by Cheetah Mobile, mainland Chinese companies have remarkably increased their commercial promotion in global app markets ("Cheetah Mobile Hosts," 2006). In fact, Chinese apps have penetrated more than 50 major countries and 51.7% of all Android phones feature a Chinese app. Likewise, more than 90% of the top 300 iTunes apps in mainland have launched overseas

versions in other countries. Furthermore, the descriptive results revealing where app producers choose to list their companies suggest that a high proportion of the app producers in our sample desire to extend their products to overseas markets.

Who Succeeds in Greater China Markets?

From an economic perspective, the capital operation of companies can significantly affect the CRD of apps. Young listed companies are likelier to succeed in Greater China compared with time-honored and/or nonlisted companies. This outcome could be due to the mobile app market's characteristics, which require producers to update their products quickly and efficiently and to instantly improve the user experience based on their audiences' feedback. Our discussion adopting an economic perspective challenges the claim made by studies of traditional news media, namely, that substantial capital is likelier to lead to cross-regional success and highlights the particularity of new media consumption.

Lastly, our study has found that apps with stronger regional cultural color face more challenges in spreading to other regions and gaining users' recognition. This finding is in line with the results of previous studies on television and Internet consumption. As scholars such as Chan (1994, 2005) and Curtin (2005) have argued, the Greater China market is a complex aggregate of regional markets affected by multiple factors. Policy, economy, culture, and regional consumption habits all play a role in this Greater China market.

This study faced limitations that should be addressed in the future. First, because of limitations regarding available types of data, not all facets of policy, capital, and regional cultural tastes in app markets could be included. We could therefore only test our hypotheses based on the available data and variances. However, we believe that despite the lack of complex and multiple dimensions of measurement, the available data still provide valuable empirical evidence of new media users' consumption habits, media choices, and preferences in different regions and countries. Second, since the mobile app market is an emerging market characterized by rapid updates and fierce competition, the validity of the data collected can only be guaranteed for a certain period. In one or two years, or even six months, the rankings of mobile apps will likely have changed considerably. Third, the CRD of mobile apps needs to be related to other global markets for further discussion and a precise definition, an area in which follow-up studies should engage in theoretical and empirical development. Finally, future research should aim to establish a reliable measure of domestic market size and weight that variable to explore app producers' orientations in terms of content production and marketing strategies.

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