

Is Digital Piracy an Enemy of the Mobile App Industry?

An Empirical Study on Piracy of Mobile Apps

Research-in-Progress

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Abstract

This research revisits the issue of software piracy in the emerging mobile apps market and seeks to empirically examine the controversial impact of piracy on the market performance of the legitimate apps. In particular, the study attempts to empirically examine how the presence (or absence) of free app affects the extent of piracy, and consequently, the adoption of the paid apps in the mobile app market, and whether such relationships are moderated by the varying degrees of network effects in these mobile apps. A set of hypotheses will be empirically tested using a panel dataset collected from both legitimate and pirated mobile app markets over a four-month period. Based on the findings, the study will attempt to offer insights to app developers and market designers on how to create mechanisms to curb piracy, stem the resulting losses, and foster a healthy growth of the mobile app market.

Keywords

Digital piracy, mobile apps, sampling effect, network externalities, network effect, word-of-mouth

Introduction

Since Apple Inc. launched “App Store” in 2008, the mobile app market¹ has been growing exponentially; with the number of mobile app downloads increased from 1 billion in 2008 (MarketsandMarkets 2013) to 36 billion in 2012 (ITBizcharts 2012). The global revenue in the market also has soared from \$4.2 billion in 2009 to \$29.5 billion in 2013, and is forecast to reach \$76.5 billion in 2017 (Gartner 2013).

Amid the dramatic market growth, the mobile app market has been plagued with piracy. Although piracy rate, which stands for the portion of pirated apps (i.e., illegally cracked and distributed paid apps) among the total number of app installed in smartphones or tablet PCs, differs by apps, the rate in general ranges from 60% to 90% (Amitay 2011; Hyman 2009; info security 2012; Kharif 2012; Rose 2012). Protection Technology Research (2012) claimed that when the number of downloads of an app reached 100,000, only about 10% was actually paid; the remaining 90% was pirated apps, suggesting 90% piracy rate. This is significantly higher than 57%, which is the overall piracy rate of traditional software (Business Software Alliance 2012). Not surprisingly, such a pervasive mobile app piracy has caused a substantial financial loss on the industry. According to the market research firm 24/7 Wall Street (2010), Apple App Store lost over \$450 million to piracy between July 2008 and December 2009, which accounts for roughly 15% of Apple’s total revenue from app sales during the same period.

Despite the seemingly intuitive cannibalization from pirated apps, there have been some counter arguments that mobile app piracy may actually increase the market performance of the legitimate apps. For example, Daniel Amitay, a mobile app developer, reported that the sales of one of his apps actually

¹ Mobile apps refer to software programs that can be installed on portable digital devices such as smartphones and tablets.

increased as the number of downloads of its pirated app increased, claiming that for every 15 pirated apps, an extra sale of the legitimate app was added (Amitay 2011). Similarly, Miguel Sanchez-Grice, the creator of the “iCombat” app, showed that although the piracy rate for the app was 82.9% and the number of downloads from Apple App Store was 1,089 during the first seven days, the piracy rate dropped to 57.4% while the number of downloads from Apple App Store increased to 11,388 in the first 30 days (Schramm 2009). He argued that the sales increase was due to the word-of-mouth advertising effect generated by the pirated app users on potential consumers of the legal app. Mikael Hed, CEO of Rovio and the creator of Angry Birds, also argued that app piracy may increase the popularity of the apps and the size of the fan-base in the long run (iMore 2012).

Given that the impact of piracy is a controversial issue in the mobile app market as well as in various digital markets, as shown in both popular trade press and academic literature (Chellappa and Shivendu 2005; Conner 1995; Givon et al. 1995; Peitz and Waelbroeck 2006; Salganik et al. 2006), and that there have been very few studies that empirically quantify the effect of piracy, this research seeks to fill this gap by investigating the effect of the pirated version of mobile apps on the market performance of their paid/legitimate version. In particular, the study attempts to empirically examine how the widely adopted free sampling strategy in the mobile app market affects the piracy rate and, consequently, the sales of the paid apps in the mobile app market; and whether such relationships are moderated by varying degrees of network effects in these mobile apps, as measured by their degree of integration with popular online social networks such as Facebook and Twitter. Based on our findings, we attempt to offer insights to app developers and market designers on how to create mechanisms to suppress piracy, stem the resulting losses, and foster a healthy growth of the mobile app market.

Literature Review

Impact of digital piracy on mobile app sales

Many previous studies investigated how piracy affects the sales of digital goods such as software, movie, eBook, and other digital products characterized with intellectual property. Despite the general consensus on the detrimental impact of piracy on the healthy growth of the digital goods market, there has been conflicting findings on the long term effect of piracy on the legitimate digital products. Early researchers have focused on estimating the immediate cannibalization effect on the sales of the legal copies. For example, in the music industry where piracy has been pervasive, researchers have empirically shown that piracy caused 6.6% of legal music CD sales loss from 1994 to 1998 (Hui and Png 2003). Therefore, researchers have generally called for strict restriction on pirated copies to switch users of illegal copies to those of legal ones (Novos and Waldman 1984) and increase the demand for legal copies (Johnson 1985).

However, some recent studies have argued that the impact of piracy can be more profound than the first order effect identified in the prior studies, and under certain circumstances piracy may benefit producers. For example, some studies have analytically shown that sampling effect resulted from piracy can reduce the uncertainty in the purchase decision making process (Chellappa and Shivendu 2005; Hui et al. 2008; Peitz and Waelbroeck 2003) and increase perceived quality of legal copies, which in turn, may increase the willingness to pay for the legal copies (Conner and Rumelt 1991). In particular, such a positive sampling effect can be more significant when a large portion of customers have low willingness to pay for legitimate copies and would have otherwise bypassed the product (King and Lampe 2003). Moreover, piracy can be profitable to legal producers due to the resulted word-of-mouth advertising effect. Such an effect is stronger when product diversity in the market is substantially high because pirated copies can enhance the product presence of their legal copies and lead to more sales of legal copies (Peitz and Waelbroeck 2006). This effect has been empirically demonstrated in the spreadsheets and word processing software markets in the United Kingdom, where piracy was found to account for 80% of new software purchase from January 1990 to August 1992 (Givon et al. 1995), as well as in the international software market, where efforts to reduce piracy have negatively impacted the profits of the software industry from 1996 to 2002 (Gu and Mahajan 2005).

With regard to the impact of piracy in the mobile app market, several studies have indicated that the mobile app market is characterized with low willingness to pay and high product diversity, and both are conducive to leveraging the sampling effect resulted from piracy. For example, although the levels of consumers' willingness to pay for apps are slightly different across platforms such as iOS, Android, and BlackBerry, the overall level of the willingness is lower than that in other digital industries. Specifically, only 16% of Android platform users showed their willingness to pay for

mobile apps despite the relatively low cost (Mplayit 2010). This number is substantially lower than that of consumers in digital music market (33%) (Whitney 2010) and security software market (55%) (Lilly 2013). In terms of product diversity, the mobile app market also leads the other markets with Apple App Store and Google Play, the two largest mobile app stores, each offered more than 1,000,000 apps (Lessin and Ante 2013). As discussed earlier, such characteristics may contribute to an ecosystem where the positive impact of piracy outweighs its negative impact.

In addition to the above factors, the piracy phenomenon in the mobile app market differs from that in other digital goods markets in that the pirated mobile apps are not perfect substitutes for the legitimate mobile apps. First, updating from app developers is not possible with pirated apps. Since timely updates to fix bugs, improve reliability and add new features are critical for a good user experience, developers tend to frequently update their apps² (iPhoneDevSDK 2009). However, pirated app users do not have access to such additional services. Second, a large portion of pirated apps are technically incomplete and unstable³. Due to such inherent inferiority, pirated apps can only serve as a sample of legitimate app, rather than a perfect substitute.

Given the above discussion, if users enjoy the functionality provided by the pirated app, it is likely that some of them will be induced to purchase the legitimate mobile app. Hence we propose the following hypothesis:

H1: The number of downloads of the paid version of a mobile app is positively associated with the number of downloads of its pirated version.

Impact of social networking in pirated mobile app on the diffusion of legal mobile app

Recent years have witnessed the rapid growth of social network-based mobile apps (Forbes 2013). Typical examples include apps for social network communications such as Facebook and Twitter. The motivation for social network-based apps is that users can track and engage in online social activities and extend their network to new users, even those whom they do not know in their real life (Ellison 2007; Kwon and Wen 2010). As the total number of users increases, the perceived utility of social network-based app will increase due to the direct network externalities (Clements 2004; Farrell and Saloner 1985; Katz and Shapiro 1985).

Another type of social network-based apps is social gaming apps that support networking services with other users on the apps. Well-known examples include Farmville, Candy Crush Saga, and Clash of Clans. Similar to those of social network communication apps, the users of social gaming apps can track the latest status updates of other users and actively cooperate or compete with other users to accomplish tasks or missions in the games (Riis 2011). As a result, social gaming apps also exhibit direct network externalities.

Direct network externalities provide social network-based apps with an advantage in their diffusion over non-social network-based apps. Users of Candy Crush Saga, for example, can send invitation messages to their friends to encourage them to join the game and share their status, which is a more effective way to promote the awareness of the app than general marketing. When an invited friend joins the game, the user who initiated the invitation will receive a reward (e.g., Heart, a life for playing the game in Candy Crush Saga), potentially motivating them to invite more friends. Such a positive feedback loop often leads to faster diffusion and broader adoption of a mobile app.

Previous studies have illustrated the positive impact of direct network externalities on the diffusion of digital products in various markets such as peer-to-peer file sharing service (Strahilevitz 2003), internet instant messaging service (Wang et al. 2004), and mobile network service (Birke and Swann 2006). In the presence of network externalities, a product becomes more attractive as the total number of users increases (Conner 1995) and such attractiveness often translates into a price premium (Salganik et al. 2006). Moreover, this outcome occurs regardless of the legitimacy of the product (Gayer and Shy 2006), which means that the adoption of pirated products can also contribute to the increase of the overall install base (Takeyama 1994) and the size of the potential market (Xie and Sirbu 1995), and consequently, an accelerated diffusion of its legal version (Givon et al. 1995). In fact, in the context of mobile apps, pirated product users are likely to be heavy users (Gopal and Sanders 1998) and contribute more to the diffusion of the legal product.

² Some developers and marketers of apps showed that frequent app update is positively associated with higher ranks and sales.

³ At appaddict.org, one of the most popular pirated app websites, there are numerous complaints on damaged and malfunction pirated apps (e.g., <https://www.appaddict.org/forum/index.php?app=core&module=search&do=search&fromMainBar=1>).

Based on the above discussion, we expect a social network-based mobile app will benefit more from a higher number of pirated app downloads than does a non-social network-based mobile app, which leads to the following hypothesis:

H2: The positive impact of the number of downloads of the pirated version of a mobile app on the number of downloads of its paid version is more significant for social network-based apps than non-social network-based apps.

Impact of free sampling strategy on app piracy

Free sampling strategy has been widely used in the digital industry and has been found to be associated with various benefits, such as price premium, image of market standard (Gallaugher and Wang 2002), accelerated diffusion of new software (Jiang and Sarkar 2009), increased user base (Bawa and Shoemaker 2004), and improved consumer mindshare (Gallaugher and Wang 2002; Kim and Morris 2007). Furthermore, this strategy is perceived to suppress piracy as it helps to reduce consumers’ uncertainty about the digital products, which is positively associated with the behavioral intention to pirate them (Cheng et al. 1997; Higgins et al. 2005; Hill 2007; Sherizen 1995; Shore et al. 2001).

Due to the distinct market environment of mobile apps, which is far more competitive with greater product diversity, app developers have extensively employed the sampling strategy; 80 to 84% of apps are free versions (Flurry 2013). Consequently, if a free version of an app is not offered, its paid version is less likely to attain awareness and interest of the potential consumer group (Anderson 2009). Besides, the free version of a mobile app may suppress piracy on its paid version. Although it has some inherent shortcomings such as limited features, in-app advertisements, and limited contents, the free version provides opportunities for potential consumers to explore primary features of its paid version (Kincaid 2009). In addition, because a free version with in-app advertisement, offers almost same functionalities as its paid version except for the advertisement, potential consumers who would search for the pirated version would less likely do it when a mobile app has a free version.

The above discussion leads us to the following hypothesis:

H3: When a mobile app has a free version, the number of downloads of its pirated version is less than that of the mobile app without free version.

In order to better illustrate the relationships among the various hypotheses proposed in this section, we provide an integrated view of our research framework in Figure 1.

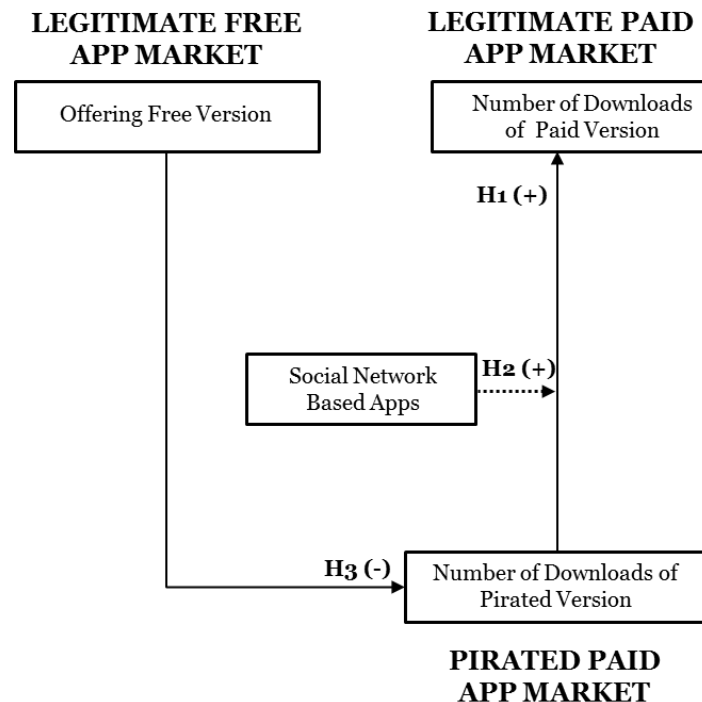


Figure 1. Research Model

Data Collection

In our research, we focus on the app market of South Korea for three important reasons. First, Korea's app market allows for an apples-to-apples comparison. Unlike legal online app stores which make available country-specific market data, world's popular mobile app piracy websites (e.g., iphonecake.com, appaddict.org, and appcake.net) do not identify users by country⁴. Hence, we cannot compare the number of downloads of pirated apps at those websites with that of legal apps in a single country. However, due to the language barrier, visitors to Korean websites are predominantly South Korean⁵. Second, South Korea is the second largest Android app market in the world, and accounts for over 20% of total revenue of the Google Play market (AppAnnie 2013). Therefore, the findings from our research have significant practical values to app developers and market designers. Third, software piracy in South Korea is more rampant than in the other two top Android app markets, Japan and the United States. The app piracy rate in South Korea is 43%, while in Japan and the United States they are 23% and 20%, respectively (Business Software Alliance 2013). Therefore, we expect to observe more vigorous interaction between pirated and legal app markets than in the other two countries.

Among the different mobile app marketplaces, we focused on the ranking lists of Google Play, which has been suffering from a higher app piracy rate than any other platforms or app stores. In the ranking lists of South Korea's Google Play, we collected data of the Top Free and Top Paid categories, which are the most relevant to our research questions. The variables collected at this website include app name, rank, price (for paid apps only), overall review rating, rating count (number of reviews), number of reviews for each rating category (from 1 star to 5 stars), update date of new version, file size, minimum version of Android OS required, and content rating (level of maturity).

For the pirated app market data, we collected data from appzzang.com, which is the most popular pirated app website in South Korea⁶. The variables collected from this website include app name, posting date of pirated app, number of page views (number of clicks on a pirated app post), and number of downloads for a pirated app.

Because the ranking lists on googleplay.com and appzzang.com are updated on a daily basis, we have been collecting daily data from both websites using automatic software agents since December 12, 2013. Below are the descriptive statistics (Table 1) and correlation matrix (Table 2) based on the data collected from December 12, 2013 to February 11, 2014. The data collection will continue through June 2014 to construct a six-month panel data set, which will allow us to conduct analysis on our hypotheses and present the results in August for AMCIS 2014.

Variable	N	Mean	Std. Dev	Minimum	Maximum
daily pageview	6,480	1901	27,929	0	1,539,396
daily download	6,480	489.34	4,912	0	236,403
game	6,480	0.54	0.49	0	1
rank	6,480	181.71	138.92	1	540
price	6,480	3.84	3.55	0	19.99
rating	6,480	4.28	0.63	0	5
raters	6,480	19,078	41,151	0	364,072
free	6,480	0.53	0.49	0	1

Table 1. Descriptive Statistics

⁴ For example, the users of appaddict.org are from various countries such as India (9.90%), Germany (9.70%), France (9.00%), the United States (8.60%), and Thailand (5.80%, estimated in January 31, 2014 from thatweb.com, a website traffic analytics company).

⁵ For instance, 92.30% of the visitors of appzzang.com, the one of the data sources in our research, are from South Korea.

⁶ According to thatweb.com, a web traffic tracking website, appzzang.com is ranked at 4,300th among all the websites visited from South Korea. This is the higher rank than any other pirated app websites such as theappl.com (7,897th) and emple.net (8,978th) in South Korea.

	daily pageview	daily download	Game	rank	price	rating	raters	free
daily pageview	1	0.35756 <.01	0.02246 0.0706	-0.04508 <.01	0.0292 0.0187	0.00918 0.46	0.07416 <.01	-0.0234 0.0601
daily download	0.35756 <.01	1	0.05146 <.01	-0.05462 <.01	-0.0001 0.9935	-0.00162 0.8964	0.0375 <.01	-0.0334 <.01
game	0.02246 0.0706	0.05146 <.01	1	-0.00523 0.674	-0.0743 <.01	-0.16119 <.01	-0.0102 0.411	-0.4588 <.01
rank	-0.0451 <.01	-0.0546 <.01	-0.0052 0.674	1	0.05353 <.01	-0.05589 <.01	-0.3104 <.01	0.11121 <.01
price	0.0292 0.0187	-0.0001 0.9935	-0.0743 <.01	0.05353 <.01	1	0.04011 <.01	-0.0075 0.5485	-0.126 <.01
rating	0.00918 0.46	-0.0016 0.8964	-0.1612 <.01	-0.05589 <.01	0.04011 <.01	1	0.13272 <.01	0.19761 <.01
raters	0.07416 <.01	0.0375 <.01	-0.0102 0.411	-0.31044 <.01	-0.0075 0.5485	0.13272 <.01	1	0.03839 <.01
free	-0.0234 0.0601	-0.0334 <.01	-0.4588 <.01	0.11121 <.01	-0.126 <.01	0.19761 <.01	0.03839 <.01	1

Table 2. Correlation Matrix

Expected Contributions

Although this study is at its preliminary stage, it is expected to provide several theoretical contributions in the area of digital piracy. First, while several prior studies demonstrated contradicting claims on the impact of a pirated version on the market performance of its legal version, relatively few studies discussed this issue with empirical evidence (e.g., Givon et al. 1995; Gu and Mahajan 2005). This research will empirically explore the impact of piracy in the context of the increasingly popular mobile app market. Second, while there have been some attempts to investigate the interaction between free version and paid version of digital goods (e.g., Liu et al. 2012) or between pirated version and paid version of digital goods (e.g., Gu and Mahajan 2005), no prior literature has attempted to explain the dynamics among the three different forms of digital goods such as the free, paid, and pirated versions. This research will fill this gap by suggesting a more comprehensive theoretical framework that includes the interaction of these three forms. Third, this study will enrich the existing literature on word-of-mouth effect (H1), network effect (H2), sampling effect (H3) of a pirated version on its paid version.

This research also will offer valuable implications for the practitioners in the mobile app industry. The results of the study will shed light on how app piracy is associated with the market performance of legal apps and how they should respond against the piracy. For example, developers may want to integrate more social network features into their apps to leverage the positive impact of piracy (H2) and consider adopting a free sampling strategy if their primary goal is to reduce the extent of piracy (H3).

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