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Factors influencing the pricing of applications in the Apple App Store: A developers' perspective

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Abstract

Many know how Apple Inc. owes its success in Mobile Commerce to the introduction of the new “App Store” business model. This new market is characterized by the opening to third party mobile apps, which are distributed to consumers through the App Store. This paper investigates factors that might influence the pricing of applications in the Apple Mobile Application Store.

By reviewing the existing literature on the issue and analyzing the strategic features characterizing the App Store, we detect three main factors that could influence prices for apps, that is the number of developed apps, the presence of two-sided network externalities and developer’s specialization.

An empirical analysis on data from 68,220 apps downloaded from the Italian App Store is used to test the hypotheses. Regression results support our hypotheses. We argue, that even if the research here presented can be considered as a started analysis to the pricing problem in such markets, this work may have important managerial implication for the thousands of developers that are competing in this emerging market.

1.Introduction: Mobile Commerce and the new application store model

There is not a unique definition of Mobile Commerce (or, as some scholars identify it, Mobile e-Commerce): it could be defined as the electronic commerce over mobile devices (Anckar and D’Incau, 2002) or alternatively as the product resulting from the interaction among business transactions, Internet applications and mobile communications (Grami and Schell 2004). Other definitions, such as the one in Muller-Veerse (1999), focus on enabling business transactions through wireless devices; on the other hand, Tarasewich et al. (2002) focus on the potential commercial transaction conducted through communications networks interfacing with wireless (or mobile) devices.

Regardless definitions, Mobile Commerce is still an emerging market, with very high growth potential, but also difficult to manage.

In the early 2000s the context was dominated by the Mobile Portal model, which became a common entry point to mobile Internet. Mobile portals have assumed several forms as a service provider portals, such as Vodafone’s Live portal, or alternatively being public pure play sites that provided some kind of managed access to resources using a yellow pages approach (Parsons 2007).

Mobile Portals were the foundation of the Mobile Commerce value chain: they represented the key business-to-consumer market makers on the mobile Internet (Barnes 2002) and they were mostly managed and strongly controlled by Mobile Network Operators (MNO). These last players created these business models in order to face the decline of voice services marginality and average revenue per user (MacKenzie 2000) by increasing the revenues coming from alternative non-voice services (Ghezzi, Rangone 2010).

Exploiting their main strategic asset, i.e. the Mobile Network infrastructure, the MNOs constructed a high-centralized model (Kuo and Yu 2006) that allowed them to increase or consolidate their market power (Palomaki 2004, Parsons 2007, CNET News 2001).

This relative stable context was dramatically shaken by the launch, in 2008, of the Apple App Store, that has introduced a new distribution paradigm in Mobile Commerce.

An Application Store is a web site, accessible from mobile devices, from which it is possible to download mobile software applications that run on the same mobile devices, increasing the utility that consumers associate them. The mobile applications are built by third software developers, which sell their products on the Application Store by using the last as distribution channel to reach market end users.

Ghezzi and Rangone (2010) have emphasized how Apple, deploying a strategy based on leveraging on strong assets like its brand reputation and its innovative iPhone device launch, has been able to shock the traditional context.

The real innovation of the Application Store distribution paradigm consists in the translation of traditional software libraries or e-marketplaces business models, in the Mobile context; learning from the business model characterizing NTT DoCoMo (Japan's leading mobile operator) environment (iMode model) and leveraging new smart phones features and capabilities, Apple Inc. was able to increase the spread of Mobile apps for its devices in order to obtain higher market power on the main devices market.

According to Hagiu (2007) we could classify this model as a two-sided platform that generates a mutual advantage mechanism: by means of third parties' apps, Apple can exploit indirect network externalities (Gandal 1995, Shapiro and Varian 1999, Baraldi 2004) that increase the value of its own devices (iPhone, iPod touch and iPad). In fact, the higher the number of apps in App Store, the higher is the potential functions of Apple's devices. On the other side, developers are interested to sell their apps through App Store, because it allows them to reach many consumers in a global wide market.

In the Apple's model, the revenue from paid applications are split 70/30: developers can retain 70% of the revenues from their applications, while Apple keeps the other 30%.

Such business model is quite common in video games industry (Rochet e Tirole, 2002) and, as matter of fact, it was introduced by Sony with the PlayStation; indeed, in that case, Sony was interested to encourage the development of many compatible games, in order to increase the real value of the platform. Many scholars have analyzed this market, emphasizing as in video games console platforms the consumers are the subsidized side (Rochet e Tirole, 2002, Evans e Schmalense, 2007), in order to exploit inter-market externalities.

Anyway, for our scope, the most important issue is the consideration that App Store gives a great opportunity to the apps developers, which could reach consumers in a global market, without managing distribution context. According to Gartner forecast (Gartner 2010) consumers are expected to spend \$ 6.2 billion at mobile application stores in 2010, and the worldwide downloads to overpass 21.6 billion by 2013, generating more than \$ 29 billion in revenue.

Furthermore we need to highlight how the great success achieved by App Store has caused the imitation by Apple's competitors, which have launched other similar Application Portal, such as Ovi Store by Nokia, Samsung Apps and the Android Market.

This imitation strategy, if on one side can increase the business opportunities for developers, on the other side might increase the development costs for the same; the spread of Application Stores generates several interesting strategic issues for mobile apps developers.

2. Research motivation: application store model and the pricing of the apps

During the last two years, the attention of scholars to Application Store business model is significantly increased, but no scientific papers have produced, so far, an empirical analysis investigating the principal drivers influencing the pricing of apps in this kind of market.

Some scholars have explored the current trends under a developers' perspective (Holzer & Ondrus 2010); others have focused their attention on the dramatic change of the strategic environment and market's structure brought by the Application Store model (Ghezzi, Rangone 2010).

Our focus is indeed on investing price strategies in this market and specifically to understand *what factors influence the price of mobile applications and, consequently, how developers can obtain high prices in the Application Store business model.*

The issue is very interesting, not only to evaluate the profitability of the mobile applications market, but also to make a comparison with the previous MNO's Portals model.

Buellingen and Woerter (2004) have noticed as, in MNO Portals, the application developers had a particular demanding role: their products enabled mobile portal provider to increase customer satisfaction, nevertheless they were not able to increase their importance in Mobile Commerce Value Chain.

Then, a very interesting question is whether the new Application Store model increases the business opportunity for mobile content developers. In this sense, it might be very enlightening to investigate pricing strategies and factors influencing prices in such business models.

Indeed, the "pricing of the apps" is a very interesting problem for a developer, because today Application Stores are populated by thousands of apps, many of which are free. Nevertheless, many developers sell their apps with prices consistently higher than the average price.

Since today Apple App Store is the more famous and the more used Application Store, we focus our study on this market.

The Apple App Store can be regarded as a free entering digital market with high level of competition. Barrier to entry are relatively low for this market and the result is that we have located, at least in the Italian Apple Store, 24,316 of developer and 68,220 of Apps. Once a developer has developed an application, their marginal costs are zero, since the product can be downloaded by users a zero cost for the developer. Actually, this is a very common feature for digital goods and it has a remarkable influence on pricing; Shapiro and Varian (1999) argue how providers of digital goods can create turnover by selling large quantity of products at relatively low prices. They also emphasize the strategic role of third-degree price discrimination, i.e. setting different prices for certain customer groups or product features.

In a very interesting music-online customer survey, Bauxmann et al. (2005) have distinguished between four categories of songs (Current Hits, Older Title, Rarities and Newcomer) demonstrating as the willingness to pay of the consumer is different for each of these. In particular, most of the survey's participant would not to pay more than \$ 0.99 for digital music, with the only exception for the Rarities. So the authors suggest setting lower prices in order to maximize the profit through higher number of downloads per song (Bauxmann et al.2005, 2007).

Shiller and Waldfoegel (2009) have argued as, for digital music, third degree price discrimination based on available observable criteria does not raise revenue significantly.

Actually, price discrimination is not very practiced in on line music and multimedia stores; the same Apple, with its iTunes store, exploit its bargaining power to set uniform and indiscriminate price (\$0.99 per song, \$1.99 per TV series episode, \$9.99 and \$14.99 per movie downloaded).

Apple's point, concerning price discrimination, is that having a unified, easy-to-use interface, as well as a very simple pricing scheme, is critical to attracting consumers to the iTunes store (Hagiu 2007).

Apple wants to reach the same objective with App Store, in order to increase the sales of its devices, but some particular features related to the software market and the development risk issues, make the pricing in this market quite different than in digital music one.

Referring to the same framework introduced by Hagiu (2007), we associate App Store to a pure two-sided platform of digital apps, because, differently than iTunes, the price of the apps is chosen by developers. The different pricing policy adopted by Apple in this case, is probably due to the need of encourage the development of applications that can increase the value of the platform and, at last, the value of the Cupertino's devices.

Apple allows the developer to be the residual claimant of the revenues derived from the app and extract some royalty payments in order to deal with its own incentives to expand the user market for devices. In this way, apps developers internalize the benefits assured by investments in higher quality and/or lesser costs and, simultaneously, Apple can focus on the main market.

Anyway, the most important issue we want emphasize is how pricing policy is deeply different between digital music goods and mobile apps, and this raises the interest on the issue.

So, what are the determinants for making price decision in this market? Are there some significant factors influencing the price of apps? We have conjointly analyzed the App Store interface and several literature references in order to formulate some hypotheses.

The organization of this paper is as it follows: next section provides a literature review aims at formulating some hypotheses about pricing in this market. Section 4 reports about the data used to perform the econometric analysis. Section 5 then describes the regression model and the results of the analysis. Finally, conclusions are discussed in Section 6.

3. Theoretical background and hypotheses formulation

By analyzing the existing literature and the strategic aspects of App Store, we have detected three main factors that might be used by developers in order to obtain higher prices. These factors are, in order, the **degree of the developer's proliferation**, the **degree of developer's specialization** and the app's **thematic category**.

As we have emphasized in the introduction, Mobile Commerce literature is poor of empirical pricing analysis and there are not previous econometric models investigating factors influencing the price of mobile apps.

Then we analyzed several literature branches that we think can be reasonable associated to the above three factors, interpreting them in a Mobile Commerce perspective.

3.1 The degree of the developer's proliferation

By analyzing the application store business model we assume that product proliferation is a winning strategy in such market. This is due to the visibility rules common applied in such a market. Indeed, every time a user opens a descriptive page about a given application, all the apps built by the same developer are showed. So the higher the number of apps, the higher the probability that one generic

user can download one developer's app. Furthermore, since App Store advertises last applications release, the more apps are released the higher is the probability a developer gets a download.

Brand or product proliferation strategy has been widely analyzed, especially in Food Industries, and several scholars have demonstrated as a high number of products might allow to increase market prices; Putsis (1997) finds that an increase in the number of brands, increases the ability of national brand manufacturers to raise price. In addition, it is recognized as a broad product lines can deter entry (Schmalensee 1978, Brander and Eaton 1984, Bonanno 1987) thereby allowing an incumbent to raise its market prices (Benson 1990, Levy and Reitzes 1993, Putsis 1997).

Then, it is reasonable to hypothesize how such a strategy might be winning one also in mobile software industry, where the market is growing (Gartner 2010) and where the distribution is delegate to big new portals like App Store, which counts thousands of apps.

Consequently we have hypothesized a relation between the developer's proliferation degree and the apps prices, that is:

H1: The higher the developer's concentration degree, the higher the price of developer's apps.

3.2 The degree of developer's specialization

Daniels and al. defines the degree of specialization as the degree to which player should focus efforts in terms of the width of product lines, the target segments, and the geographical market served (Daniels et al. 2009). In a recent survey on the videogame industry, Langlotz et al. (2008), highlights how the degree of specialization is an important competitive strategy in such an industry. For example, they highlight how Nintendo console incorporates a low specialization in hardware and a high specialization on the software side. However, in the application store market, developers can rely only on software specialization to improve their competitive position and setting higher prices. Also, in this industry, specialization is related with reputation, since the more a developer is specialized on a given thematic area the higher its reputation in developing goods product. The idea

that reputation can be very important in order to set higher prices, also in electronic commerce, has been confirmed in a very interesting work by Melnik and Alm (2002). In their work, the authors demonstrate how seller reputation is an important driver for setting higher prices in on-line auctions such as e-Bay. Furthermore, Banerjee and Duflo (2000) have highlighted how reputation, in software industry, allows to raise contracts value.

Following the above reasoning the can hypothesize a relation between the degree of specialization of a developer and the possibility to set higher prices; so we express this relation through the following hypothesis:

H2: The higher the developer's specialization degree, the higher the price of developer's apps.

3.3 The apps' thematic category

The third hypothesis is about the presence of thematic categories showing network externalities more than others. Actually we argue that the pricing of some categories of apps could be influenced by Two-Sided Network effects; the presence of these externalities means that a firm could decide to give away free products on a specific market with the purpose to obtain higher profits on another, correlated, market (Rochet and Tirole 2002, Parker and Van Alstyne, 2005). We have noticed such kind of behavior in some App Store thematic categories, such as Social Networking, Games, News and Lifestyle. In fact apps belonging to these categories are characterized by the presence of in-app advertising or free trial lite versions, which are two cases cited by Parker and Van Alstyne (2005).

Indeed, it is quite known how many firms give away new-limited version but charge for a professional version. In some App Store categories this strategy is frequent, especially in Games category. The focal point of this approach is that the lite version encourages experimentation and purchase of the complete version. This is probably because, also for famous games titles, there is the need to prove the product in a new technology platform, such as Apple's devices.

On the other hand, in case of free apps with alternative revenue sources there is the exploitation of externalities between consumers and advertisers (Parker and Van Alstyne, 2005); indeed, the higher is the number of consumers, the higher is the advertisers' willingness to pay. This is a quite common phenomenon, traditionally analyzed in News and Media industry (Kaiser and Wright 2005, Ferrando et al. 2003), in which the inter-market network externalities cause a price competition on consumers market, in order to obtain higher profits on the advertising market. We really think this approach is very used also in App Store, especially for "Social Networking", "Lifestyle" and "News" apps.

So for categories enjoying "two side network externalities", that is Games, Social Network, Entertainment, Lifestyle and New, we hypothesize the following hypothesis:

H3: The price of apps falling in "two side network externality" categories is lower than in other categories.

4. The dataset

The data used test our hypotheses consist of records collected by means of "Browse Feature" in the Italian App Store. They refer to all existing apps to July 2010 and they account for 68,220 records containing information about name of the app, name of the developer, thematic category and price of the app. We have arranged these data in a database, in order to obtain some useful queries that enabled our analysis. In order to test our hypothesis we have developed proper measure of the degree of developers' proliferation and specialization, while for hypothesis three we have used the 20 thematic categories in the App Store.

4.1 A measure for the degree of developers' proliferation

There are 24,316 developers in our dataset; in order to measure the developers' proliferation we have ranked the developers on the base of the number of apps present in the dataset. In particular,

we have divided developers into three classes, A, B, C, on the base of a Pareto analysis performed on the number of apps developed by each developer.

So, by indicating with DP the degree of developers' proliferation, it can assume the following values:

- A; it means Class A developers, i.e. is the set of developers that, all together, collects the 70% of total apps.
- B; it means Class B developers, i.e. is the set of developers that, all together, collects another 20% of total apps.
- C; Class C developers, i.e. is the set of developers that, all together, collects the remaining 10% of total apps.

Therefore, we have assumed these classes being a proxy of the degree of proliferation of developers.

The Pareto Analysis has showed that 6,885, i.e. about the 28% of the total, collects the 70% of the apps present in the dataset.

4.2 A measure for the degree of developers' specialization

We have measured the degree of developers' specialization with the concentration of the apps in each of 20 thematic categories in App Store.

In order to do that we have standardized the number of apps each developer has produced in each category. By doing this we have obtained a standardized distribution for each thematic categories, that is a distribution with mean equal to 0 and standard deviation equal to 1.

Then we have used the following classification for each developer j and category i :

- *The developer j is not specialized in the i -th category* if the standardized number of apps produced by j in the category i is less than 1 (i.e. lower than the standard deviation).

- *The developer j is weakly specialized in the i-th category* if the standardized number of apps produced by *j* in the category *i* is between 1 and 3 (i.e. less the three time the standard deviation).
- *The developer j is strongly specialized in the i-th category* if the standardized number of apps produced by *j* in the category *i* is greater than 3 (i.e. more than three time the standard deviation).

Then, by indicating with DS the degree of developer specialization, it can assume the following values:

- S; it stands for *strongly specialized* developer, that is a developer showing at least one strong specialization in any thematic category, according to the previous classification.
- W; it stands for *weakly specialized* developer, that is a developer showing at least one weak specialization in any thematic category, according to the previous classification
- N; it stands for *not specialized* developer, that is a developer showing no specialization.

5. The Econometric analysis

5.1 The model

In order to test the above hypotheses we have used a Generalized Linear Model (GZLM) as reported in expression (1), in which all the variables are dummy assuming value “0” if the factor level is false, and “1” if it is true.

$$\begin{aligned}
Price_i = & \alpha + \beta_1(A_i) + \beta_2(B_i) + \beta_3(C_i) + \gamma_1(S_i) + \gamma_2(W_i) + \gamma_3(N_i) + \delta_1(Business_i) + \\
& \delta_2(Finance_i) + \delta_3(Photography_i) + \\
& \delta_4(Games_i) + \delta_5(Entertainment_i) + \delta_6(Education_i) + \delta_7(Books_i) + \delta_8(Medical_i) + \\
& \delta_9(Weather_i) + \delta_{10}(Lifestyle_i) + \delta_{11}(Music_i) + \delta_{12}(Navigation_i) + \delta_{13}(News_i) + \\
& \delta_{14}(Productivity_i) + \delta_{15}(Reference) + \delta_{16}(Healthcare\&Fitness) + \\
& \delta_{17}(SocialNetworking_i) + \delta_{18}(Sports_i) + \delta_{19}(Utilities_i) + \delta_{20}(Travel_i) + \varepsilon_i \quad (1)
\end{aligned}$$

Since there are many free of charge apps, we have used a Tweedie regression model, that is a particular kind of GZLM, resulting very appropriate when the dependent variable has many 0 values, and the overall distribution has a positive skew (Garson, Gilchrist and Drinkwater 2000).

So, in our model, the dependent variable is $Price_i$, i.e. a metric variable which represents the price of the i -th app, while the independents variable are DP assuming value A and B, DS assuming values S and W and the 20 thematic categories in App Store.

4.2 Results

Table 1 reports statistics about the price of apps in the Italian App Store. As the reader can notice, the average price is quite low as expected, since 27,942 apps are free. However, is quite surprising that the price range is quite large, since the maximum price is 719.99€ and it is related to a video surveillance app.

Table 1: Dependent variable statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Price	68,220	.00	719.99	1.59	6.51

The regression model appraisal has been conducted through the omnibus test and the test of model effect.

As reported in Table 2, the likelihood ratio in the "omnibus test" table is a function of the difference in likelihood values between the chosen model and the model with the intercept only (the null model). Since the likelihood ratio is significant, we conclude that the coefficients in the model are different from 0 and the model can be accepted.

Instead, the "tests of model effects" table reports Wald chi-square tests for the null hypothesis that none of the parameter estimates (b coefficients) for a predictor are different from 0 (a finding of significance means that at least one of the parameter estimates is significant). As showed in Table 3 (where the column Df stands for Degree of freedom for the Wald test) all variables in our model

result statistically significant. Finally, Table 4 reports the parameter estimates (significance: * $<.10$ and ** $<.05$).

Table 2: Omnibus test result

Likelihood Ratio Chi-Square	Degree of freedom	Sig.
29896.529	23	0.000

Table 3: Test of model effects

Source	Wald Chi-Square	Df	Sig.
Intercept	44141.213	1	.000
DP	49.381	2	.000
DS	602.444	2	.000
Thematic Categories	16157.911	19	.000

Table 4: Parameter Estimates

Parameter	B	Std. Error	Sig.
Intercept	1.610	.0194	.000
DP = C	-.092	.0151	.000**
DP = B	-.011	.0129	.402
DP = A	0	.	.
DS = N	-.362	.0165	.000**
DS = W	-.243	.0112	.000**
DS = S	0	.	.
Category = Business	1.049	.0440	.000**
Category = Finance	.892	.0526	.000**
Category = Photography	.008	.0304	.793
Category = Games	-.614	.0217	.000**
Category = Entertainment	-.768	.0217	.000**
Category = Education	.202	.0311	.000**
Category = Books	.064	.0286	.025*
Category = Medical	4.127	.0792	.000**
Category = Weather	-.524	.0438	.000**
Category = Lifestyle	-.585	.0250	.000**
Category = Music	-.039	.0265	.136
Category = Navigation	2.526	.0574	.000**
Category = News	-.850	.0247	.000**
Category = Productivity	.465	.0359	.000**
Category = Reference	1.107	.0557	.000**
Category = Healthcare & Fitness	.110	.0308	.000**
Category = Social Networking	-.727	.0265	.000**
Category = Sports	.145	.0301	.000**
Category = Utilities	-.364	.0237	.000**
Category = Travel	0	.	.

As clarified in Table 4, the last level of each category is automatically set to zero (reference level), so that the B value can be interpreted as the price variation when each category varies from the reference level.

The results obtained from the regression analysis are consistent with the hypotheses formulated.

Regarding hypothesis 1, H1, we can see how the lower is degree of proliferation (DP), the lower is the price, more precisely the results show how the price differential between Class A developers and Class C developers is equal to 0.092 €. Therefore, H1 is confirmed by our analysis.

Regarding hypothesis 2, H2, we notice how the lower is the degree of specialization, the lower are prices. In particular, when moving from strong specialized, S, to not-specialized, N, we get a price differential of 0.362€. So also H2 is full confirmed.

Finally, in order to verify hypothesis H3, we have ranked the 20 thematic categories according to their price respect the reference level (Travel); of course, this rank is obtained according to the result of the regression analysis (the B value in table 4).

As the reader can notice from the analysis of Table 5, the last categories in term of price are those we have hypothesized showing the two-side network externality effect. So even H3 is full confirmed.

5. Conclusions

This paper analyzes pricing strategies in the App Store market, trying to understand what are the main drivers that allow developers to set higher prices. According to the available literature on the issue and on the observation of behavior in such market, we have hypothesized that apps' price can depend on: degree of developers' product proliferation and specialization. Furthermore, price depends also from thematic categories of the apps, and specifically apps showing two-sided network externalities have lower price. In order to test our hypothesis we have collected data from 68,220 apps of the Italian Apple Store. The empirical analysis full supports our hypotheses.

Table 5: Price ranking of thematic categories

	B	Average price
Category = Medical	4.127	5.5014
Category = Navigation	2.526	3.8997
Category = References	1.107	2.4807
Category = Business	1.049	2.4234
Category = Finance	0.892	2.2662
Category = Productivity	0.465	1.8387
Category = Education	0.202	1.5755
Category = Sports	0.145	1.5185
Category = Healthcare&Fitness	0.11	1.4834
Category = Books	0.064	1.438
Category = Photography	0.008	1.3819
Category = Travel	0	1.3739
Category = Music	-0.039	1.3344
Category = Utilities	-0.364	1.0096
Category = Weather	-0.524	0.8498
Category = Lifestyle	-0.585	0.7891
Category = Games	-0.614	0.7595
Category = Social Networking	-0.727	0.6464
Category = Entertainment	-0.768	0.6054
Category = News	-0.85	0.5235

We think this research can provide a contribution to the mobile commerce value chain research stream and, particularly, it provides one of the first contributions regarding the Apple's Application Store model.

Also, from a managerial point of view, the result obtained in this research can represent useful guideline for the thousands of developers that are interested to this emerging market. Indeed, while Gartner forecast shows how it can be a very profitable market (Gartner 2010), it is to be said, according to Holzer and Ondrus (2010), that there are also many threats arising from several opposing technology trends. In this context we consider that this work can provide a good approach to better face this emerging market.

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