

MOBILE APPS

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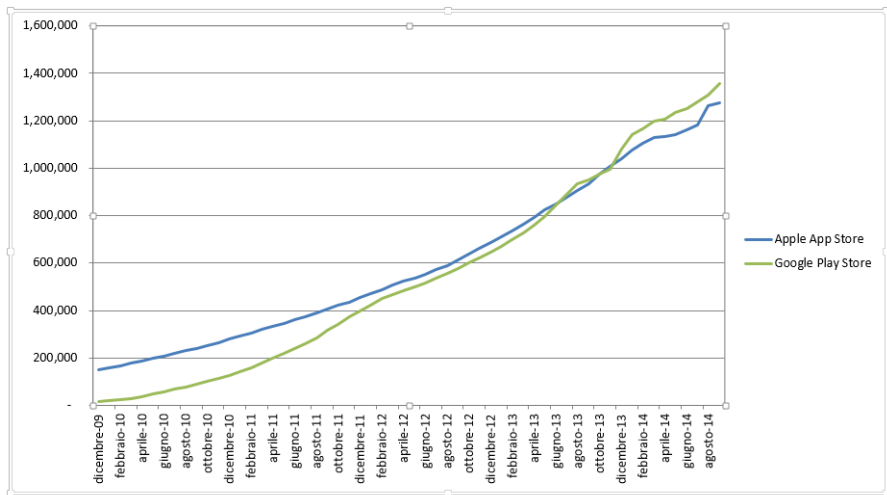
- ▶ Mobile applications (apps) together with their companions tablets and handsets are fast growing markets.
- ▶ The market for mobile applications has, after only a few years of existence, been honoured with the title “App Economy”.
- ▶ We are in a new technological era and need to understand the economic incentives and the challenges that users, developers and the Law are facing.
- ▶ This talk will focus on mobile applications (apps), as a whole, and on app update management, more specifically.

- ▶ A mobile application is a computer code written to be executed on smartphones, tablet computers and other mobile devices.
- ▶ Mobile applications were originally distributed in the late 90s as small games, ring tones, calculators, calendars, etc. Nowadays they are a dominant product in the economy.
- ▶ Looking inside a mobile application: <http://demos.telerik.com/kendo-ui/application/index>



- ▶ Apps are distributed via dedicated app stores.
- ▶ iTunes app store:
 - ▶ apps based on mobile operating system developed by Apple (iOS)
 - ▶ launched in July 2008
 - ▶ recently: about 1.7 billion monthly downloads, 1.6 million apps and 350,000 publishers in 155 countries.
- ▶ Google Play (GP) app store:
 - ▶ apps based on Android (open source developed by Google)
 - ▶ launched in November 2008
 - ▶ recently: about 6.2 billion monthly downloads, 1.8 million apps and 500,000 publishers in 101 countries.
- ▶ Other stores: BlackBerry World (about 130,000 apps), Windows Phone Store (about 340,000 apps) and Amazon Appstore (about 300,000 apps).

- ▶ iOS Apple devices:
 - ▶ iPhone 151 million sales
 - ▶ iPad 58 million sales.
- ▶ Android: more than 40 handset manufacturers and 20 tablet manufacturers (Samsung, HTC, Motorola, Sony, LG, Asus).
 - ▶ Android smartphones 775.7 million sales
 - ▶ Android tablets 121 million sales.
- ▶ In 2013 global Android sales were more than six times iOS sales.



TOP CATEGORIES

IOS - PRIORI DATA REPORT (FEB 2014)

	# of Apps		Downloads		D/Apps
Games	170,523	Games	938,375,352	Games	5,502.9
Education	113,024	Entertainment	116,358,580	Networking	2,981.5
Lifestyle	95,365	Lifestyle	80,306,414	Weather	2,981.2
Entertainment	87,207	Utilities	67,436,374	Photography	2,084.0
Utilities	59,839	Photography	61,302,194	Business	1,876.2
Books	57,293	Networking	61,220,052	Entertainment	1,334.3
Travel	55,104	Music	48,022,967	Music	1,265.8
Music	37,938	Books	45,450,688	Productivity	1,234.9
Sports	32,481	Education	39,718,742	Utilities	1,127.0
Productivity	31,227	Productivity	38,561,703	Fitness	855.8
% of whole mkt	74.3%		89%		

- ▶ Top 10 countries in terms of monthly downloads (Feb 2014)

iOS		Google Play	
China	578,325,676	USA	1,111,679,877
USA	364,766,979	South Korea	521,096,827
Japan	200,017,673	Brasil	348,227,677
UK	68,901,785	Russia	280,357,174
Russia	58,490,125	Spain	279,533,512
South Korea	42,266,075	Japan	245,200,826
France	41,537,016	France	222,063,954
Germany	40,890,975	Germany	212,217,730
Canada	39,048,140	Turkey	187,914,927
Italy	31,130,600	Italy	176,203,809

- ▶ How do developers profit from Apps?
 - ▶ paid apps
 - ▶ apps with in-app purchases (freemium)
 - ▶ apps with in-app advertising (the most popular strategy)
 - ▶ corporate apps are apps that provide services which are complementary to paid services/products (e.g. app for mobile banking, app of airlines companies, etc).

- ▶ According to Priori DATA Report (Feb 2014)
 - ▶ free apps: iOS 65%; GP 83%.
 - ▶ paid apps: iOS 35%; GP 17%.
 - ▶ apps with in-app purchases/freemium: iOS 12%; GP 5.4%.
 - ▶ users pay for additional functionalities (e.g. subscription to newspapers, bonus game levels).
 - ▶ Average price of paid apps:
 - ▶ iOS: 3.18\$ (iPhone); 4.44\$ (iPad); GP: 3.06\$.
- ▶ For Android apps, developer fees can range from free up to matching the Apple App Store fee of \$99/year. Google Play has a one-time fee of \$25.
- ▶ Both stores adopt the 30-70 (store-developer) rule for paid apps.

HOW DO TOP CATEGORIES MONETIZE?

IOS - PRIORI DATA REPORT (FEB 2014)

	Free	Free+IAP	Paid	Paid+IAP
Games	53%	28%	14%	3%
Entertainment	66%	18%	15%	1%
Lifestyle	78%	11%	9%	1%
Utilities	62%	11%	25%	2%
Photography	52%	19%	26%	3%
Networking	73%	16%	9%	1%
Music	62%	13%	23%	3%
Books	55%	20%	23%	2%
Education	56%	19%	24%	1%
Productivity	51%	14%	32%	3%

- ▶ Need to estimate the combined effect of partial CLV (customer lifetime value) and eCPM (effective cost per mille).
- ▶ After solving a complicated formula from 100,000 downloads one can expect to make \$9,220 in ad revenue (about \$0.09 per download).

UPDATES MANAGEMENT IN MOBILE APPLICATIONS: iTUNES VS GOOGLE PLAY

Stefano Comino Fabio M. Manenti Franco Mariuzzo

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- ▶ Publishers compete for user's attention:
 - ▶ million of apps available
 - ▶ majority of users install very few apps (< 20).

VISIBILITY: A WHERE IS WALLY TYPE OF ISSUE?



- ▶ Stores use ranking lists and user reviews to help the matching user-app:
 - ▶ Bestseller status of the top-ranked apps is a very important determinant of consumer willingness to pay.
 - ▶ Only the very top-rank positions matter.
- ▶ Rating of the first reviewers can be fundamental for an app's success.

- ▶ **Main focus of our research:** investigate the possible role of app updates to stimulate growth and understand the determinants of updates.

A lot of app developers will see a large spike in downloads right at launch, and shortly after see these numbers slowly dwindle. The question I get asked in this situation is, “How do I continue growth?” The answer is simple, but the execution takes patience, practice, and a plan.

In order to continue growth you need to provide constant value, which means everything from creating new game characters to designing a more intuitive user interface to a million things in between. But, this also means updating your app! That said, I always encourage my students to update their apps and keep iterating to get feedback, which helps boost downloads. Letting your apps collect dust is the same as letting them fail, and with the recent release of iOS 7, there is no better time than the present to update your app.

Chad Mureta “<http://blog.appannie.com/updating-your-app-chad-mureta/>”

THE ROLE OF UPDATES

- ▶ The release of a new version is an opportunity to communicate with customers and reach out to others.
- ▶ Stores have “what’s new” sections.
- ▶ Updates offer a way to keep users engaged via comments/reviews on dedicated blogs, social networks...
- ▶ Updates may modify the quality of the app and show the commitment of the developer to the project.
- ▶ Updates affect the “buzz” surrounding the app.
 - ▶ buzz is an amplification mechanism for the good or for the bad (increases the variance of visibility).

Bresnahan et al. (*NBER*, 2014)

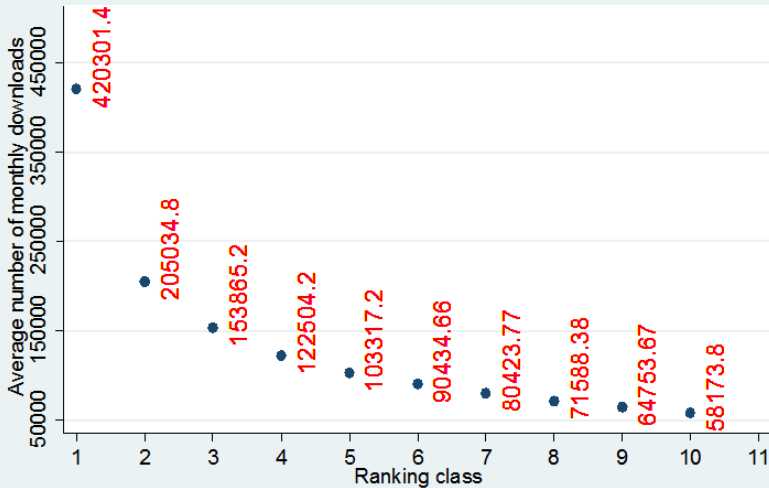
Ghose and Han (*Management Science*, 2014)

Yin et al. (*American Economic Review*, 2014)

Carare (*International Economic Review*, 2012)

- ▶ Data from Priori DATA:
 - ▶ iOS and GP.
 - ▶ top 1,000 apps in terms of downloads (account for roughly 60% of total downloads).
 - ▶ countries: FRA, GER, ITA, SPA and UK.
 - ▶ montly data, from Sept 2013 to Feb 2014.
 - ▶ Information about: downloads, price, rating, category, age, number of versions, monetization strategy.
 - ▶ Priori computes downloads by combining publicly available information with Priori proprietary metrics. Only first-time installations are counted as downloads in our data.
- ▶ iOS dataset enriched with info from AppAnnie:
 - ▶ size, major updates, compatibility, alternative classification (corporate apps, network apps, 'pure' apps).

DI top 100 apps - Germany iOS by ranking class



Ranking classes: apps grouped ten by ten

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- ▶ We analyze the strategy of releasing frequent updates by exploiting the differences across iTunes and GP:
 - (1) iTunes, app store centralized and monitored by Apple:
 - ▶ Centralized quality review.
 - ▶ Each app must comply with Apple's prescriptions.
 - ▶ Examiners check apps submitted by developers.
 - ▶ Updates can be submitted every 2 weeks.

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 - ▶ Updates can be submitted every 2 weeks.
 - (2) Google Play:
 - ▶ No centralized quality review.
 - ▶ Updates can be published instantaneously by developers with a "simple click of the mouse".
 - ▶ GP often criticized for the poor quality of the apps.

TABLE: Summary statistics from the five countries

	N.	Google Play mean	std. dev.	N.	iTunes mean	std. dev.
	Full sample					
	Priori data					
free	15,985	0.999	0.033	14,675	0.917	0.276
price (if free=0)	17	2.447	1.148	1,219	2.760	2.916
in-app purchase	15,985	0.297	0.457	14,675	0.562	0.496
local	15,985	0.371	0.483	14,675	0.349	0.477
user rating	15,985	4.077	0.449	14,675	4.067	0.651
user rating count	15,985	80,320	375,114	14,675	47,645	174,580
age (in months)	15,985	15.036	13.993	14,675	19.227	15.868
age version (in months)	15,985	1.836	3.100	14,675	2.290	3.781
number versions	15,985	33.430	78.487	14,675	10.044	9.860
update version*	7,991	0.542	0.498	8,469	0.453	0.498
apps same developer	15,985	7.182	17.343	14,675	8.925	18.089
number countries	15,985	1.877	1.395	14,675	2.027	1.490
monthly downloads	15,985	249,837	1,244,139	14,675	58,243	166,898
growth downloads*	8,225	0.476	5.335	8,591	0.115	1.808
	App Annie data					
age major version (in months)				13,645	10.523	9.913
number major versions				13,773	2.050	2.005
update major version				8,113	0.037	0.188
size				13,771	64.088	149.987

*Updates and growth are in first differences and hence have less observations

The key features of the model are:

- i)* downloads depend both on the intrinsic quality q of the software and on the buzz b surrounding it (i.e. reviews, comments in dedicated blogs, etc.). b is a random variable
- ii)* demand (downloads) is right skewed
- iii)* the release of an updated version stimulates the buzz around the app.

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Consider a developer that has already published two apps and aims at maximizing downloads

- $v(u) = q(u) + b(u)$, is the visibility of the focal app, $u = \{0, 1\}$
- we assume that there exists a threshold level τ for visibility s.t.:

$$\begin{aligned} \text{if } v \geq \tau & \quad \text{downloads are } \bar{D} = \bar{d} + \rho\bar{d}, \\ \text{if } v < \tau & \quad \text{downloads are } \underline{D} = \underline{d} + \rho\underline{d}, \end{aligned}$$

where $\bar{d} > \underline{d} \geq 0$ are the downloads of the focal app while $\rho\bar{d}$ and $\rho\underline{d}$ measure the impact of downloads of this app on the other app of the developer ($\rho > 0$: apps are complements).

THE BUZZ

- ▶ can be positive or negative: bloggers, journalists, but also regular users might positively or negatively welcome the new version of the software
- ▶ it increases with the release of a new version of the app
- ▶ the augmented buzz may improve or worsen app visibility; formally, an update makes app visibility more uncertain.

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The current version of the focal app:

- has visibility $v(0) = q(0) + b(0)$;
- $b(0)$ is the realization of a random variable, uniformly distributed over the segment $(B - \eta, B + \eta)$

The updated version of the focal app:

- has visibility $v(1) = q(1) + b(1)$;
- $b(1)$ is the realization of a random variable, uniformly distributed over the segment $(B - \gamma\eta, B + \gamma\eta)$, $\gamma \geq 1$.

The developer compares expected downloads when $u = 0$ and when $u = 1$:

Proposition 1: *The developer releases a new version of the focal application when the increase in total expected downloads is higher than the cost of developing the update, ϕ ; formally, $u = 1$ when:*

$$(\bar{D} - \underline{D})[(\tau - q(0) - B)(\gamma - 1) + \Delta] \geq 2\gamma\eta\phi. \quad (1)$$

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Release the update when the expected visibility of the current version of the focal app ($q(0) + B$) is small relative to the threshold level τ .

- ⇒ when the developer expects a poor performance of their app, they might be induced to release an update in the hope of stimulating positive buzz around it and, via this channel, downloads.
- ⇒ this is a risky action: app visibility becomes more uncertain: *bet for resurrection action.*

Corollary 1: *The developer may decide to release an update even if it does not improve the intrinsic quality of the app.*

$$\begin{aligned}g_{jt} &= \phi_{11}g_{j,t-1} + \phi_{12}u_{jt} + h_{1t} + \mathbf{x}_{1jt}\boldsymbol{\beta}_1 + \alpha_{1j} + \varepsilon_{1jt} \\u_{jt} &= \phi_{21}g_{j,t-1} + \phi_{22}u_{j,t-1} + h_{2t} + \mathbf{x}_{2jt}\boldsymbol{\beta}_2 + \alpha_{2j} + \varepsilon_{2jt}, \quad t = 2, \dots, T.\end{aligned}\tag{2}$$

It is reasonable to assume that the developer forms expectations on the visibility of the current version of their app by looking at its past performance.

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From Proposition 1 we derive a set of testable hypotheses:

- ▶ **Hypothesis 1:** *Developers are more likely to release an update when they observe a worsening of the app performance.*
- ▶ **Hypothesis 2:** *The effect of the release of an update on downloads is stronger in iTunes than in Google Play.*
- ▶ **Hypothesis 3:** *Developers of applications with the in-app purchase option are more likely to update their apps.*
- ▶ **Hypothesis 4:** *Developers distributing more than one application are more (less) likely to release updates when apps are complements (substitutes).*

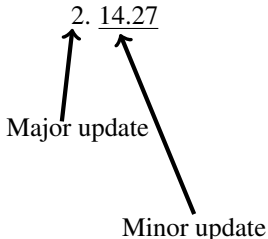
TABLE: First difference growth and update equations

	Growth equation (gdl_t)		Update equation (u_t)	
	iTunes	GP	iTunes	GP
	(1)	(2)	(3)	(4)
Lag growth (gdl_{t-1})	-0.026 ^a (0.008)	-0.009 ^a (0.001)	-0.042 ^a (0.015)	0.0004 0.0003
Update (u_t, u_{t-1})	0.362 ^a (0.059)	0.281 (0.186)	0.056 ^b (0.027)	0.219 ^a (0.037)
In-app	-0.462 (0.287)	-0.657 ^a (0.286)	0.698 ^a (0.089)	0.317 ^a (0.125)
Number of apps by developer	0.078 ^a (0.014)	0.031 ^b (0.014)	0.011 ^a (0.003)	-0.002 (0.002)
Observations	3,660	2,956	3,660	2,956

Superscripts a, b, c indicate parameters which are significant at 1%, 5% and 10%, respectively.

- ▶ There are two different forms of updates:
- ▶ Minor updates: high frequency updates that address bugs (e.g. crashing). Apple guidelines suggest to release these updates frequently.
- ▶ Major updates: low frequency updates aimed at distributing apps with new features and functionalities.

Example:



For iTunes apps we collected additional information about the type of updates by distinguishing between **major updates** and **minor updates**.

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Results largely confirm those obtained in the general estimation. On top of them:

- Major updates have stronger impact on downloads than minor ones.
- As regard the update equation is concerned: minor updates are most suited to be used strategically than major ones
 - ↪ minor updates can be developed more easily and as such can be used more effectively in reaction to poor app performance.

CONCLUSIONS

- ▶ We have found evidence that updates have a rational flavour as they are used by developers as a tool to increase the buzz surrounding their apps in an attempt to improve user engagement, and increase or maintain high app visibility.
- ▶ Our empirical analysis has shown that updates play a quite different role in stimulating downloads on iTunes and Google Play stores. On iTunes, updates trigger further growth in the number of downloads; by contrast, on Google Play their effect is not significant.

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EXTENSIONS

- ▶ We will combine the data on apps with those on tablets and estimate a two-sided market focusing on the role of quality.