

The App Economy in the United States

A review of the mobile app market and its contribution to the
United States Economy

August 20, 2018

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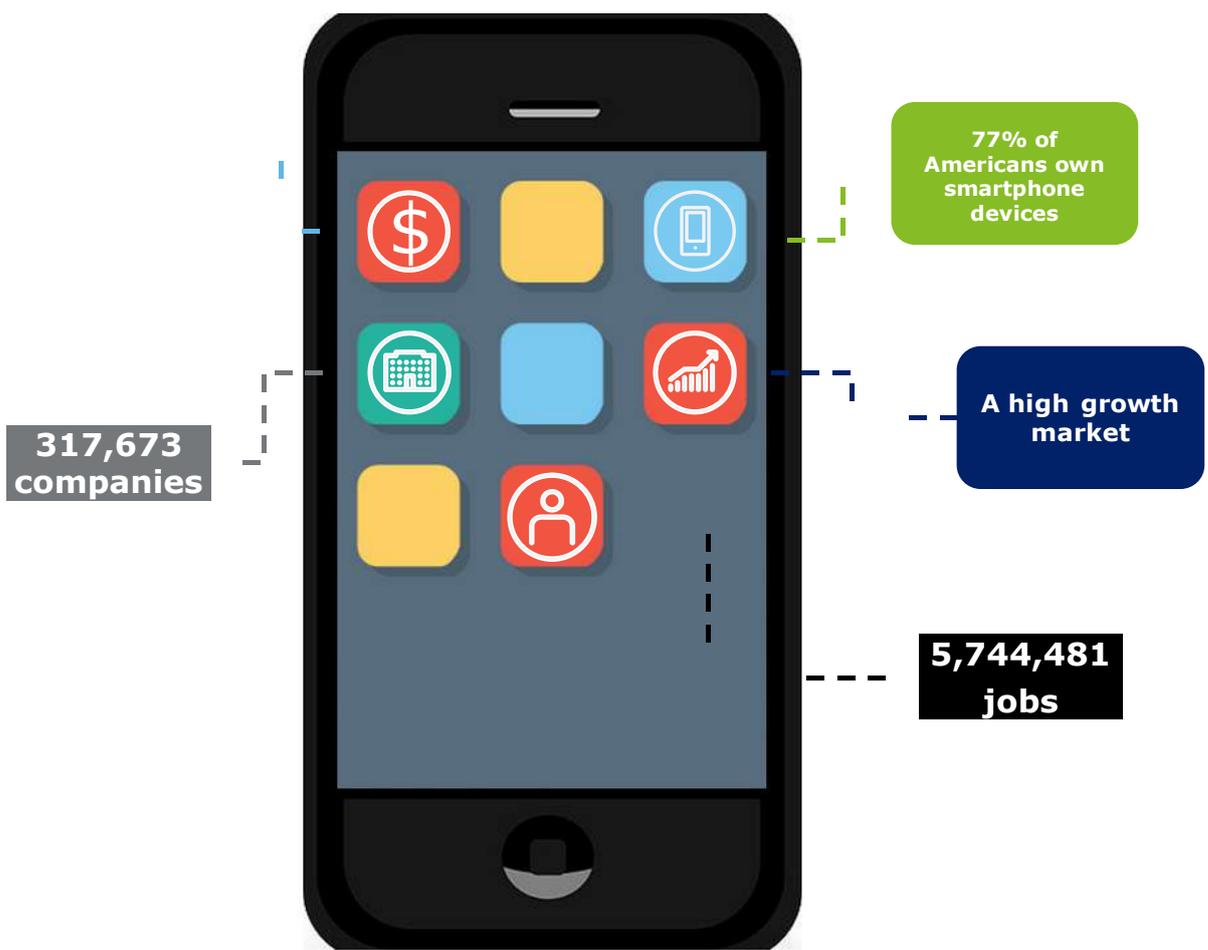
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Executive summary

1. The introduction of smartphones and their evolution in the past ten years reshaped the way people interact with their environment. The capabilities offered by mobile devices are dramatically improved by software applications – the apps - developed by third-party companies or individuals. These apps have transformed the national economy and people’s life, enabling disintermediation between buyers and developers, facilitating actions that were before difficult or setting up brand new industries. The purpose of this document is to focus on the reasons behind the success of app stores and the quantification of the national app economy.
2. Our research demonstrates the positive impact of app stores¹:
 - a. App stores **reduce transaction costs** for app developers and their users.
 - b. App stores **reduce entry barriers** for small developers and therefore **increase the level of competition**.
 - c. App stores increase consumer trust and security by creating a trustworthy platform for users and developers to interact.
3. App stores have **a positive impact on the value of smartphones** and on smartphone manufacturers’ innovation. The weight of this market constitutes a significant part of the whole national economy:
 - a. In 2018, the app economy represents **\$568.47 billion**, i.e. nearly 30 times the value of movie ticket sales in North America. It is broken down as follows:
 - i. **\$339.7 billion** in direct contributions from mobile-commerce, advertising revenue and paid downloads, subscriptions and in-app purchases.
 - ii. **\$228.77 billion** in indirect contributions through additional business and households consumption triggered by apps.
 - b. In 2018, **317,673 companies** are active in the mobile app market in the United States.
 - c. The mobile app market created **5,744,481 jobs**, including direct jobs and indirect jobs.
4. The Internet of Things (IoT), which includes a wide range of newly-connected devices ranging from household appliances to cars and buildings, will dramatically increase the importance of mobile apps in the near future as the touchpoint for both consumer and enterprise use of IoT products and services. The value created by mobile apps in the United States economy is expected to grow significantly in the years to come.

¹ App stores refer to all app platforms including Google Play store, Apple app store, Amazon app store, etc.

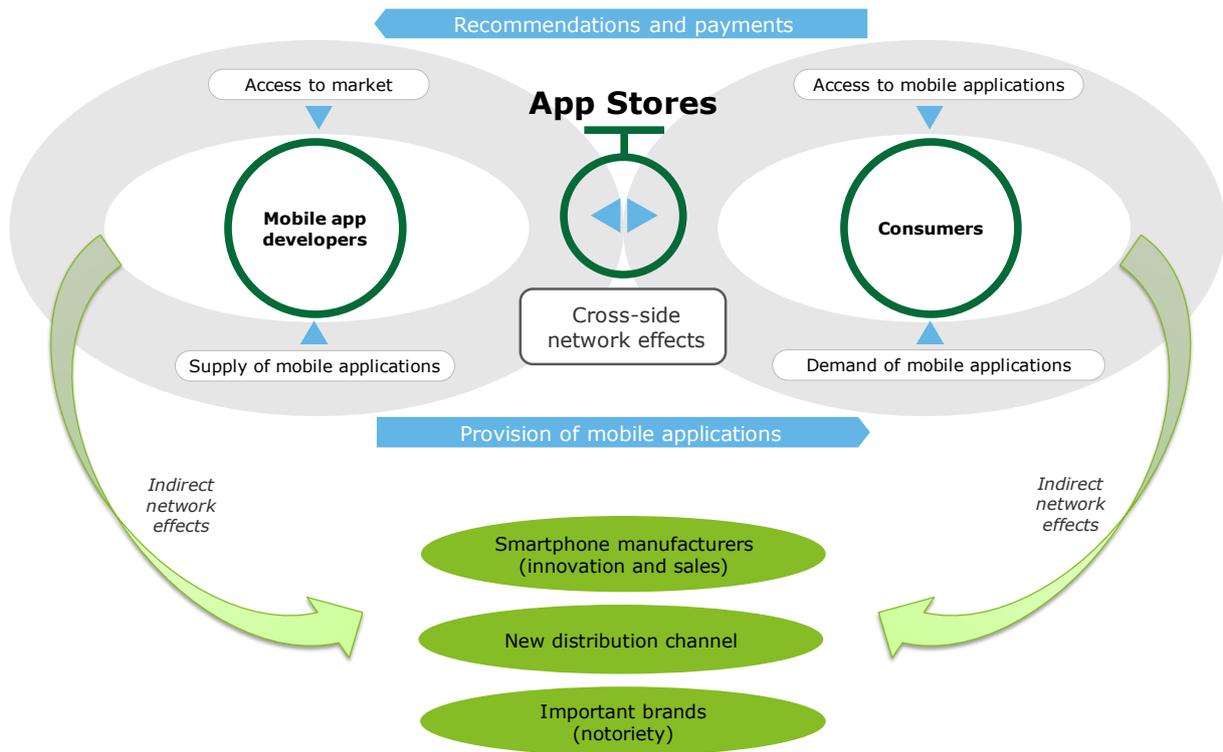


1 Mobile app platforms and the “economy of platforms”

1.1 Mobile app markets are typified by a specific market structure

5. In the information and communication technology (ICT) sector, app stores have a central position in exploring and accessing digital services. Apps act as an intermediary between app buyers and developers. These markets are typified by the presence of cross-side network effects: the economic utility that a user receives for her participation on the platform depends on a number of actors on the other side of the market.
6. The mobile app market brings together app developers and smartphone users:
 - a. **For mobile app developers:** App stores represent a tremendously efficient distribution channel. It is easier for a small developer to access a wide potential market with limited marketing and advertising expenditure. Without centralized platforms, the direct distribution of services is likely to lead to a very fragmented, costly, and non-user-friendly environment. Without app stores, developers would have to promote their app via a dedicated internet website. A multitude of websites would make looking for an app time consuming for users and more costly for small developers who would have to invest massively in marketing to get their product known.
 - b. **For mobile app users:** Mobile apps extend smartphone functionality, which in turn increases the value for the smartphone owner. In addition, thanks to platforms, end users have one single place to shop (*a one-stop-shop*) with widespread access to easy-to-use apps; the same dynamic further leads to reduced costs in reaching end users, incurring greater competition and reduced prices.

Figure 1. The mobile app market



Source: Microeconomix analysis

- Economists studied the specificity of the mobile app markets² and showed numerous benefits arising from the emergence of platforms.

1.2 Recognized positive effects of app stores

1.2.1 App platforms generate important benefits for app developers

8. App stores create trust capital for developers.

App stores create a relationship of trust between users and developers. Developers' success hinges on the building and maintenance of end user trust. The app stores draw up contracts with each developer and verify all new app updates before they are released. This is advantageous for users because of the consistent approval process behind the submission of each app. The general public's brand recognition for Apple or Google reflects the trust that users place in their respective app stores.³

App stores enable app rating, and their scores are an indicator of the service quality. The economic literature about this reputation effect demonstrates that there is a correlation between the viability of apps and their scores on app stores.⁴ This system has the advantage of rewarding the apps that respond better to the expectations of end users and heightens competition amongst developers. An app rated as "excellent" will be more successful.

² Heitkoetter et al. (2012), Holzer et al. (2011), Parker and Van Alsyne (2000), Rochet and Tirole (2004, 2006).

³ Cuadrado et al. (2012), Hyrynsalmi et al. (2014), Yun et al. (2017), Lee et al. (2014), Roma et al. (2012).

⁴ Lee et al. (2014).

App stores also moderate reviews and inappropriate content. This is an important role because consumers trust that negative reviews will not be deleted by the app developer, while still preventing inappropriate content from being published.

The recommendation system algorithms on app stores target apps that best meet end users' expectations. As a result, profits will be higher which creates an incentive for all apps to perform well and innovate.⁵

9. Strikingly, the economic literature finds that **app stores reduce transaction costs⁶ for developers.**

App stores provide a variety of ready-to-use "support" services for developers such as:

- ubiquity in user interface/user experience features,
- a secure platform to promote their products,
- storage systems for hosting apps and managing downloads,
- a billing service,
- a payment management system (micropayments) which makes it easy for mobile app developers to recover sales revenue.

Each developer avoids the creation and management of these services when using a centralized platform. **Marketing and operational costs are therefore much lower due to app stores.**

App stores provide their services to app developers through a standard contract. This harmonized and unified legal framework effectively **reduces** transaction costs by **reducing negotiation costs** (i.e. this framework prevents a proliferation of contracts).⁷

App stores provide ready-to-use interfaces for advertising and reduce transaction costs for developers.⁸ Advertising departments of app stores are used by developers who want to embed advertisements on their app. This service groups the different tasks such as negotiation of contracts, management of the technology and payments, etc., together into one interface which reduces the marketing effort and transaction costs for an app developer.

A whole range of tasks required to market a mobile app is thus handled by app stores. **All these services contribute to reducing time to market for developers.**⁹

App stores **facilitate developers' – and especially small business developers' – entrance into markets.**¹⁰ The platforms effectively enable fast and inexpensive access to the market for countless smartphone users around the world. Due to app stores' low barriers to entry, even smallest businesses have access to 2 billion smartphone users globally.¹¹ Facilitating market entrance of innovative small businesses greatly augments the sustainability of this dynamic ecosystem.

⁵ Zhan et al. (2017).

⁶ Transaction costs were defined by the economist Ronald Coase "When one wants to carry out a market transaction, it is necessary to discover who it is that one wishes to deal with, to give them certain necessary information and set the conditions of the contract, to conduct negotiations that result in a bargain, to draw up the contract, to put in place control structures to make sure that the terms of the contract are being observed by both parties, etc."

⁷ Amit and Zott (2001).

⁸ ITU (2016).

⁹ Cuadrado et al. (2012).

¹⁰ Roma et al. (2012), Pon (2015), OECD (2013), Ershov (2018).

¹¹ <http://mobilemarketingmagazine.com/24bn-smartphone-users-in-2017-says-emarketer>

10. App stores reduce apps' production costs.

Mobile platforms benefit from economies of scale and efficiency gains. App stores can spread their costs over an extended client base and thus reduce the costs for all developers.¹²

Moreover, app stores give developers access to high-quality programming tools in exchange for nominal annual fees.¹³ This eliminates the need for developers to invest in software programming (more expensive than annual fees) and, therefore, **reduces mobile app development costs.**

11. App stores enable developers to choose their payment modalities.

App stores offer developers freedom in their business models. Developers are free to choose how their apps are remunerated. Today there are seven leading business models. They are presented below.¹⁴

¹² Rob Frieden (2017).

¹³ Cuadrado et al. (2012).

¹⁴ Tang (2016).

Table 1. Presentation of the different business models available for mobile app developers

Business model	How it works	Examples of mobile apps
Distribution channel (Sale of goods and services)	Goods purchased in the mobile app are sent directly to users. Apps make the shopping experience frictionless and enable provision of new services.	Amazon eBay Uber/Lyft grubHub
Paid downloads (Paid)	Payment is made at the moment of download (with access to all the app features).	Grand Theft Auto – San Andreas FaceTune Terraria
In-app purchase	Apps are offered free of charge. Users can pay for additional services or add-ons in the app (this business model is found on gaming applications. For example, additional lives can be purchased during a game.)	CandyCrush Clash of Clans
Freemium (derivative of in-app purchase)	The app is downloaded for free on app stores, but users do not have access to all the app features. They are encouraged to pay for advanced features.	Monster Strike TomTom Shazam
Paidmium (derivative of in-app purchase)	Users must pay to download the app. They can also make purchases in the app (add-ons, etc.).	Minecraft - Pocket Edition Minecraft - Story Mode Ghost Blows Out the Light 3D
Subscription	The user must pay a monthly subscription to be able to use the app.	Spotify Coyotte
In-App Advertising	The app is generally free, but it displays advertising banners or video clips when it is used.	Rolly Vortex Helix Jump

Source: Microeconomix analysis

1.2.2 Economic theory highlights various benefits introduced by app platforms for consumers

12. App stores reduce transaction and research costs.

Platforms reduce the cost and time spent by users to search for an application.¹⁵ The possibility for users to quickly discover new services and apps is a significant advantage offered by platforms. Using app stores is simple and straightforward as users do not need any technical knowledge to install and use apps available.

App stores offer users a single platform where users can download any apps compatible with their smartphone's operating system. This phenomenon of "one-stop shopping"¹⁶ enables the reduction of research and transaction costs. App stores offer users a single and secure interface for all their purchases on the platform.

App stores review and validate apps accessible through their platforms to preserve users' trust. Apps downloaded by users thus exhibit higher functionality and pose less risk to their device.

13. App stores promote a variety of high quality and innovative mobile apps.

App stores produce strong network effects conducive to the development of a rich and dynamic ecosystem of developers and apps.¹⁷ The distinguishing feature of cross-side network effects is the fact that the utility of an agent on one side of the market depends on the number of participants on the other side of the market. In the case of app stores, the utility of developers increases with the number of users and vice versa.

In addition, **the large number of apps available on app stores pushes developers to continuously innovate to attract new users.**¹⁸ As the pace of innovations and new developments are high, developers must be able to offer mobile apps that meet users' new expectations.¹⁹

Platforms have made innovative services available to users. Without which, these app services would not have existed. Uber, Tinder, TooGoodToGo and other geolocation apps would not exist without the development of mobile app platforms. These services require a geolocation system to operate and need to instantly reach a critical mass of users. App stores with 2 billion users offer developers means to create these new services.

Although a significant percentage of mobile apps do not generate revenue directly, **they provide an additional distribution channel and can give existing services a broader customer base.** When companies such as Amazon or eBay developed their own app, they increased sales of these e-commerce giants. For example, when the mobile eBay app was launched in 2009, it generated \$600m in sales.²⁰ More recently, start-ups have created businesses whose model is primarily based on mobile app sales. OfferUp, which was founded in 2011, is now the largest peer-to-peer commerce marketplace. The company managed to generate more transactions in five years than what eBay North America generated in its first 10 years on the market.²¹ The

¹⁵ Ershov (2018), Cachon et al. (2008).

¹⁶ For Censors, app stores Offer One-stop Shopping (2017).

¹⁷ Cuadrado et al. (2012).

¹⁸ Cuadrado et al. (2012).

¹⁹ McIlroy et al. (2016).

²⁰ eBay Inc. Annual Report 2009.

(http://files.shareholder.com/downloads/eBay/923940436x0x361552/b45137ee-aa41-4c2c-94ca-d72d5b0844be/eBay_77655_BANNERLESS.pdf).

²¹ <https://www.forbes.com/sites/zackfriedman/2017/01/09/meet-two-young-entrepreneurs-who-raised-221-million-to-disrupt-craigslist/#5b451f1e40d5>

mobile market has expanded to allow for new innovative business models that are predominately based on sales and activity via apps.

1.3 App stores have an impact far beyond the platforms' direct users

1.3.1 App stores generate indirect network effects

14. **App stores have a positive impact on smartphone manufacturers.** By increasing the number of apps available to users, the value of the smartphone increases for users. This higher value, in turn, increases sales of smartphones.²²
15. Mobile app performance increases rapidly with the addition of new features.²³ Smartphone manufacturers must, therefore, follow this trend by investing in research and development to offer their customers more efficient smartphones. **Mobile apps thus encourage smartphone manufacturers to innovate.**²⁴
16. **Mobile apps are a new communication channel for companies.**²⁵ They enable companies to reach users who are less exposed to traditional communication channels such as television, radio, newspapers, or magazines, as well as desktop computer browsers. This means that apps cannot be substituted by other channels of distribution for this category of consumers.²⁶

1.3.2 The platforms have been proactive in addressing challenges

17. Mobile platforms manage users' and developers' personal information. They also manage financial transactions like payment for apps, in-app purchases, or payment of revenue to developers, and other sensitive data. The fact that sensitive information is increasingly digitized and stored in the cloud naturally raises concerns about unappropriated use or exposure by unauthorized entities due to increased attack vectors. To prevent this risk, **app stores invest heavily in cyber security.**²⁷
18. Moreover, centralizing personal data on online platforms could pose a problem with regard to the pricing structure of applications. As platforms have access to users' full purchase history, they could have a precise idea about users' willingness to pay and therefore offer services at the highest possible price. This fear is unfounded to the extent that **app stores do not set the prices of apps, this decision being the sole prerogative of developers.**²⁸ Since developers do not have access to the consumer's other app purchases or behavior, they cannot leverage that information to drive pricing decisions.

²² Holzer et al. (2011).

²³ According to a study by SensorTower, the size of mobile apps has continued to increase in recent years. Over the period 2013-2017, the size of the 10 most used applications on iPhones (Facebook, Uber, Gmail, Snapchat, Spotify, Messenger, Google Maps, YouTube, Instagram and Netflix) increased by 1,000% (<https://sensortower.com/blog/ios-app-size-growth>).

²⁴ Cuadrado et al. (2012).

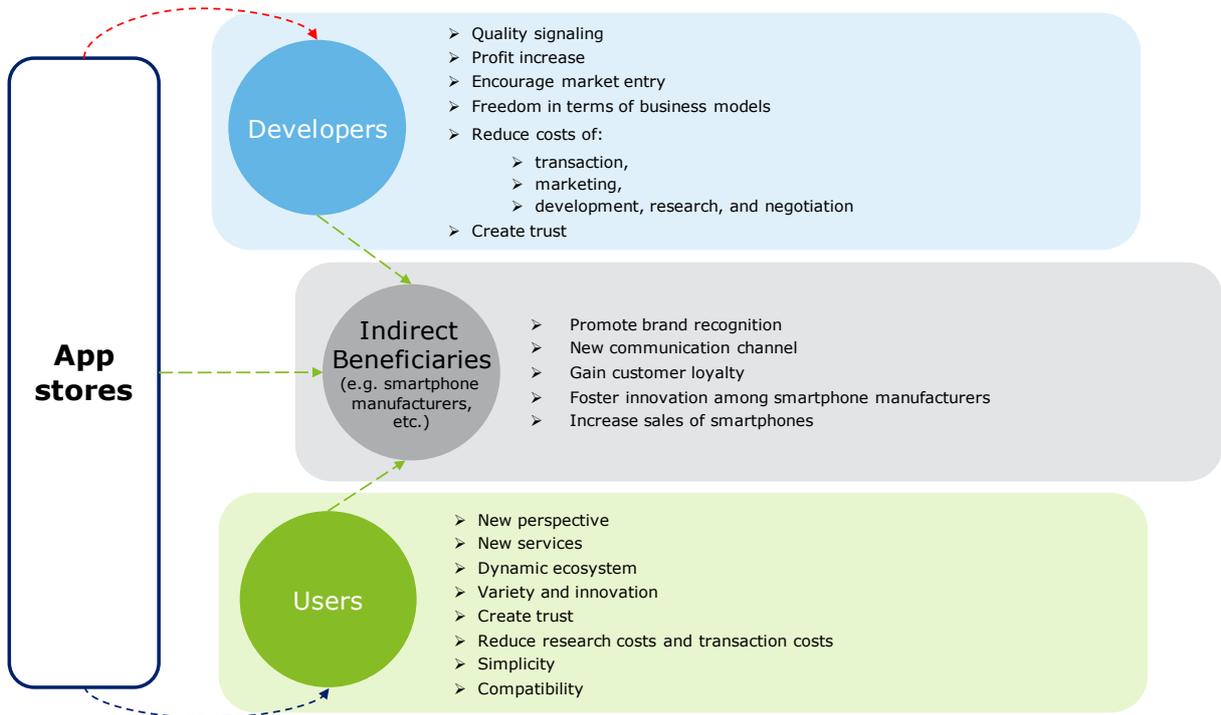
²⁵ <https://www.thewebconsulting.com/media/item/703-9-raisons-pour-lesquelles-votre-societe-a-besoin-d-une-application-mobile>

²⁶ Avin Cheikho (2015).

²⁷ "Cybersecurity has been a part of Apple's DNA for a long time, and embedded into all of its products" Steve Morgan, Founder and Editor-in-Chief of Cybersecurity Ventures (Cybersecurity Q1 2018: Trends and takeaways (<https://investingnews.com/daily/tech-investing/cybersecurity-investing/cybersecurity-update-q1-2018-review/>))

²⁸ OCDE (2013).

Figure 2. Diagram of benefits generated by app stores



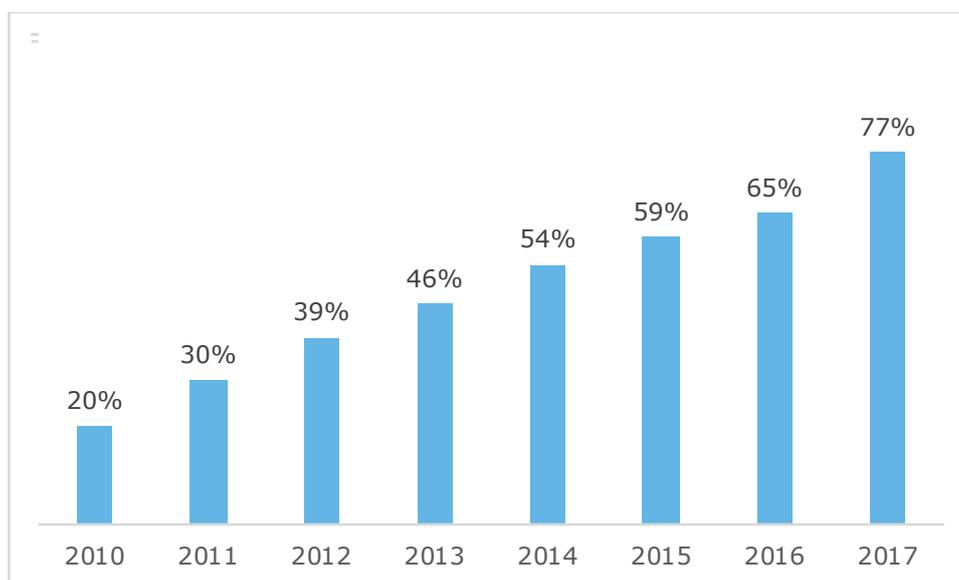
Source: Microeconomix analysis

2 The economic weight of the mobile app market in the United States

2.1 Presentation of the mobile app market in the United States

19. The United States (U.S.) has seen a rapid growth in the number of smartphone devices. In 2017, 3 out of 4 people²⁹ in the United States had a smartphone, according to the Pew Research Center, while only 30% of the population had one in 2011.

Figure 3. Percentage of people with a smartphone in the United States



Source: Statista DMO (2016), eMarketer (2016), Pew Research Center (2017)

20. The development of mobile apps grew alongside this high market penetration for smartphones. Google Play and Apple's App Store offer today more than 6 million mobile apps to their users.
21. **American smartphone owners spend more than 150 minutes³⁰ on average on their mobile apps every day.** This figure has increased by 25% since 2015.
22. U.S. mobile apps are well represented in the top 500 most downloaded apps (in the U.S.).
23. A study of the ranking of U.S. mobile app developers on Google Play and Apple's App Store shows that on average 50% of the downloaded apps are free.
24. More than two-thirds of the top 200 U.S. apps are available both in Google Play Store and Apple's App Store. The app economy provides a low friction environment allowing app developers to produce software programs and apps that are compatible on several platforms. As app developers can provide apps for competing app stores, they are not dependent on Apple or Google.

²⁹ <http://www.pewinternet.org/fact-sheet/mobile/>

³⁰ App Annie 2017 Retrospective.

Figure 4. Share of top 200 downloaded apps available on both Google Play Store and Apple's App Store (as of 23 July 2018)



Source: App Annie (2018), Microeconomix analysis

25. In 2018, 1,443,966³¹ companies are active in the mobile app industry worldwide. Considering that the United States accounts for 22% of the worldwide app developer community,³² there are 317,673 companies active in the mobile app industry in the United States.
26. The number of businesses involved in the app economy in the United States has been increasing since 2010. The number of companies in the sector has increased by 5.1% on average each year between 2010 and 2015.
27. The analysis presented in the previous section of the different business models offered to developers to monetize their services³³ enabled us to identify five direct sources of revenues among the seven business models. Our analysis of the app economy's weight in the United States will seek to quantify these five sources of revenue:
- Developers can generate revenue by **charging for the download of their app**.
 - Developers can opt for **in-app purchases**. In this case, developers provide their app for free to increase the number of users.
 - Developers can also be compensated by offering a subscription for the use of their application. This is the case with several newspaper apps, such as the Economist, where consumers pay a subscription fee to access to articles.
 - Developers can be paid by **displaying advertisements in their app**. This payment method is possible for both free and paid apps.
 - Developers can **develop a mobile app to open a new distribution channel for consumer goods**. For example, the Amazon app allows placing orders directly without using a PC. To get a large clientele, developers provide their app for free in app stores.

³¹ The number of companies includes app developers in the Google Play Store and the Apple Store (App Annie, 2018).

³² Caribou Digital (2016).

³³ Paid downloads, In-App purchases including Freemium and Paidmium, subscriptions, In-App Advertising, and the sale of goods and services.

Table 2. Presentation of the 5 direct revenue sources for mobile app developers

	Revenue generated on app stores			Advertising agencies	Online sales platforms
	Paid download	In-app purchases	Subscriptions	Mobile advertising	Distribution channel
Mobile applications	a Revenue generated by the sale of apps on app stores	b In-app purchases (including Freemium and Paidmium)	c Revenue generated by subscriptions	d Revenue generated by mobile advertising	e mobile-commerce ³⁴

Source: Microeconomix analysis

28. App Annie³⁵ has become the global industry standard for app analytics and app data. The company now has more than 900 customers all over the world,³⁶ more than 900,000 regular users and more than a million connected apps on its platforms.

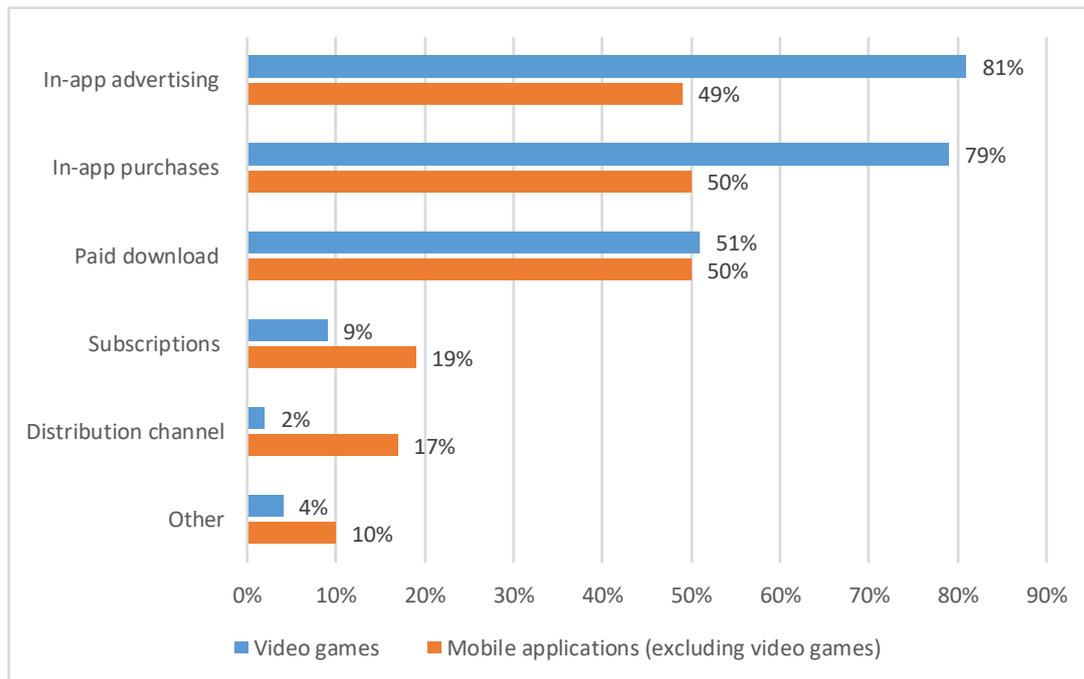
29. Video games are the main source of revenue for developers in app stores. Statistics provided by App Annie show that developers choose to monetize their video games by using in-app purchases and advertising in 80% of cases. For the remaining mobile apps, the choice of developers is less marked. They choose for the most part "paid downloads," "advertising," and "in-app purchases."

³⁴ Mobile-commerce includes all commercial transactions carried out on mobile devices such as smartphones. The transactions can be carried out in mobile environments, but also at home.

³⁵ App Annie provides the most reliable data and insights on the market - downloads, revenue, usage and demographic data, marketing - on more than 6 million apps to support businesses in their mobile strategies. More than 50% of the revenue from app stores are generated by all of App Annie's customers and more than 1,000,000 professionals use the App Annie platform every day, making it the essential industry standard in the global app economy. The company's HQ is in San Francisco, it employs 450 employees and has 15 offices all over the world, 3 of which are in North America. App Annie has raised 157 million USD from investors such as e.Ventures, Greenspring Associates, Greycroft Partners, IDG Capital Partners, Institutional Venture Partners and Sequoia Capital.

³⁶ Including Google, Amazon, Alibaba, Visa, Coca-Cola, Samsung.

Figure 5. Share of app developers per direct business model categories (global, 2017)



Source: App Annie via Statista (2017)

2.2 The app economy creates value in the United States

30. The study of the economic value of the app economy in the United States is divided into two parts:

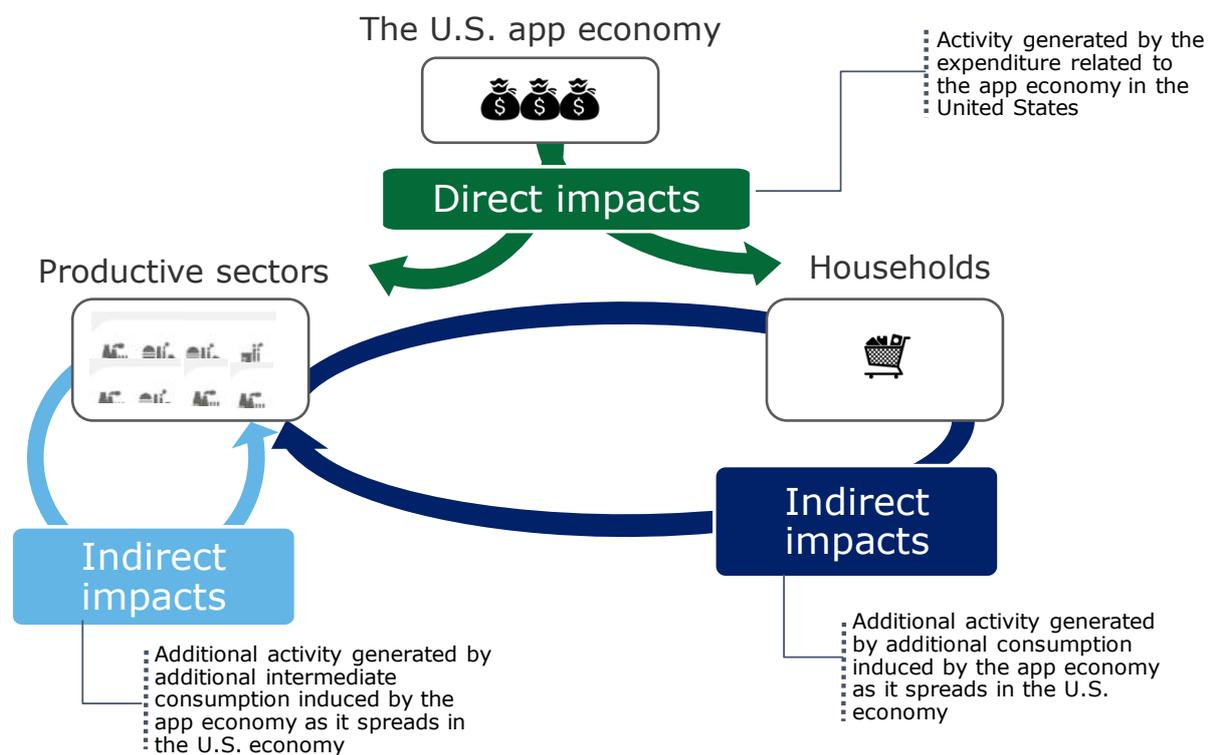
- a. Direct economic impact: this includes the total direct revenues earned by the companies in the sector. This direct impact is calculated by evaluating the five revenue sources identified in the study.
- b. Further, as the different sectors of the economy are interdependent, the app economy generates wealth beyond the companies in the app developing industry. We quantify these indirect impacts, which consist of "impacts on other productive sectors" and "impacts of households."
 - i. The impact of the app economy on the productive sectors in the United States is the result of all the intermediate production cycles in the provision of goods and services to businesses involved in the app economy in the country (i.e. additional activities generated by intermediate consumption induced by the app economy as it spreads in the United States economy).
 - ii. The impact of households is the result of expenses incurred by employees (in the form of consumers' purchases) and businesses (that respond to that additional demand) which have benefited either directly or indirectly from the initial revenues of the app economy in the United States.

31. The indirect impacts of the app economy in the United States are calculated using an economic model based on interdependencies between sectors known as an *Input-Output* analysis.³⁷

2.2.1 Total economic impact of the mobile app market in the United States

32. The total economic impact of the mobile app market in the United States is divided into direct and indirect contributions. The following diagram summarizes the economic impact of the mobile app market in the United States.

Figure 6. Economic impact of app stores



Source: Microeconomix analysis

33. The total impact of the app economy in the United States is estimated at \$568.47 billion.

Table 3. Impact of the app economy in the United States (2018)

	Details	Revenue
Direct contribution	<ul style="list-style-type: none"> \$18.7 bn in revenue generated on app stores \$114.4 bn from in-app advertising \$206.5 bn from sales made on mobile apps 	\$339.7 bn

³⁷ This analysis is based on Input-Output tables (IOT) of the American National Accounting System. The Input-Output tables give an overview of trade in goods and services within the economy. To manufacture a product (output), each sector consumes a certain quantity of products from other sectors (input). This type of inter-sector consumption is known as intermediate consumption. The IOT is used to establish the relationships between all the different sectors of the U.S. economy. It is therefore possible to determine the impact of a shock in a given sector of activity on the entire U.S. economy.

Indirect impact	<ul style="list-style-type: none"> • \$ 79.22 bn from impacts on the productive sector • \$ 149.56 bn from impact on households 	\$ 228.77 bn
Total economic impact		\$ 568.47 bn

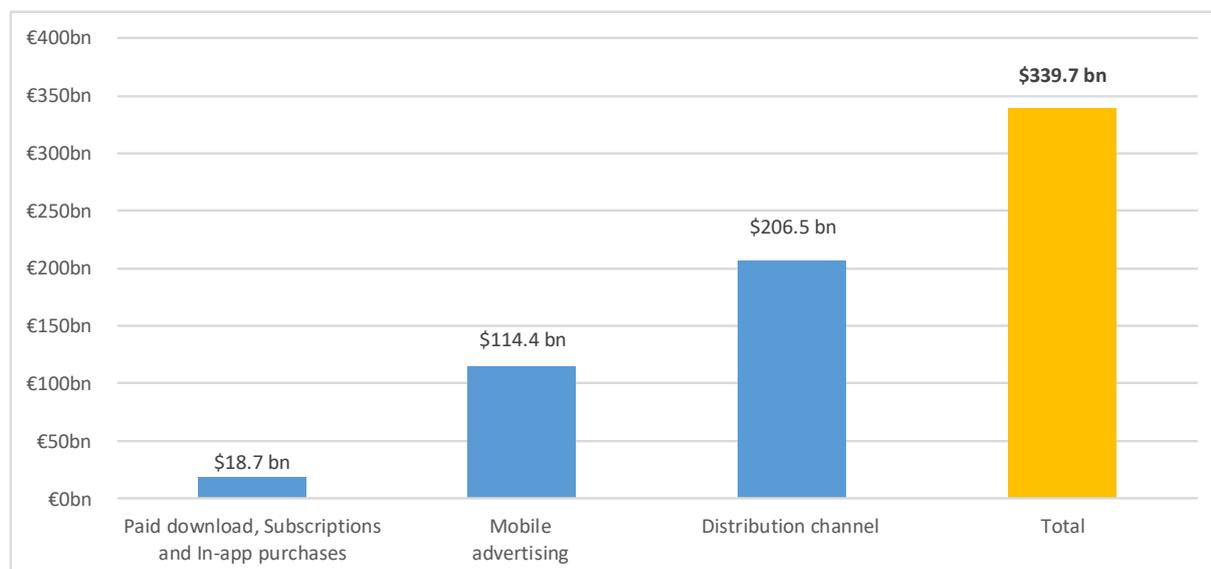
Source: Microeconomix analysis

The total economic impact of the mobile app market represents \$568.47 billion in revenue for U.S. economy, of which \$206.5 billion comes from sales via mobile apps.

2.2.2 Direct economic impact of the mobile app market in the United States

34. The total direct economic impact of the app economy in the United States in 2018 represents \$339.6 billion in revenue, including \$18.7 billion in revenue generated on app stores, \$114.4 billion from in-app advertising and \$206.5 billion from sales on mobile apps. With regard to sales on mobile apps, it should be noted that part of these sales existed already in other distribution channels.³⁸

Figure 7. Breakdown of the direct economic impact of the mobile app market in the United States (in 2018)



Source: Microeconomix analysis

The app economy, taking into account online sales generated on mobile apps, represents 1.8 percentage point³⁹ of GDP⁴⁰ for the U.S. economy.

³⁸ The impact on the US economy is reduced given that for sales on mobile apps (206.5 billion USD) substitution effect between channels has not been taken into account. To date, there are no studies that isolated precisely this effect.

³⁹ 1.8% = 339.7 (direct impact of the app economy) / 19,390 (United States GDP 2017, in billion USD)

⁴⁰ Gross Domestic Product

The app economy represents nearly 30 times the value of movie ticket sales in the United States.⁴¹ Without “sales on mobile apps,” the app economy generates \$133.2 billion in revenue which is still more than the film industry.

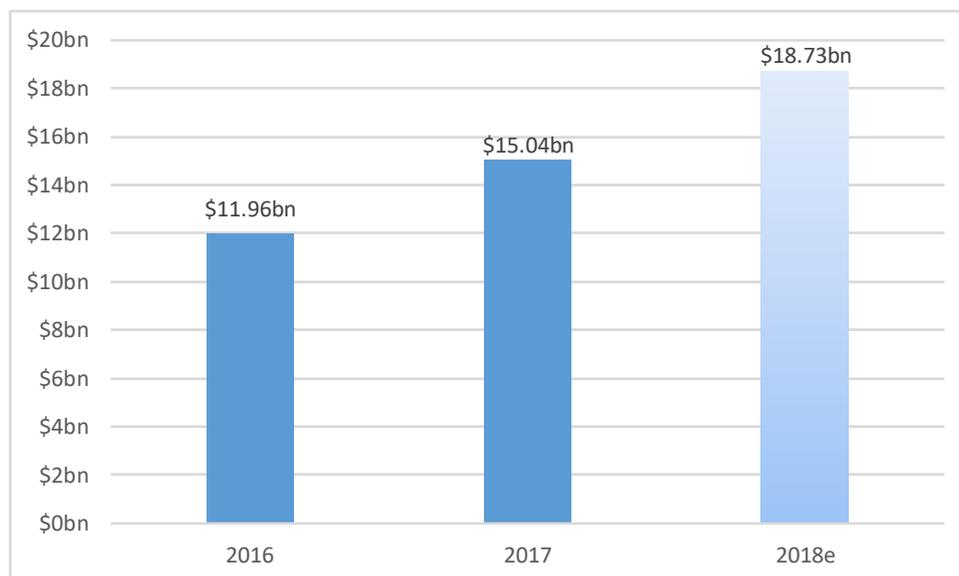
35. The direct economic impact of mobile apps in the United States is estimated from the five revenue sources previously identified in the study. In the sections below, the revenues directly generated by mobile apps on app stores (which correspond to an “access fee”), the revenue generated by in-app advertising, and the revenue generated from online sales made on mobile apps are detailed.

Revenue generated directly on app stores⁴²

36. The App Annie study on the U.S. market carried out at the beginning of the second half of 2017 shows that mobile app developers received \$15.4 billion from the two main app stores, Apple’s App Store and Google Play Store. The revenue measured by App Annie includes total spending on app stores: monthly subscriptions,⁴³ buying apps, and in-app purchases.

37. Consumer spending on mobile apps is expected to increase by 22% per year globally in the period 2017-2022 according to App Annie.⁴⁴ At the national level, the United States market is expected to grow by 14.6% per year in the period 2017-2022. Mobile app developers should, therefore, receive \$18.73 billion in revenue this year (2018).

Figure 8. Revenue from mobile apps (excluding advertising revenue and mobile-commerce) in the United States on Apple’s App Store and Google Play Store



Source: App Annie (2018), Microeconomix analysis

⁴¹ According to figures from the Box Office Mojo (via Statista), box office revenues in North America (United States and Canada) were \$11.07bn in 2017.

⁴² This revenue comes from downloads, subscriptions and in-app purchases.

⁴³ For example, on a music streaming app.

⁴⁴ App Annie report, App economy forecast: \$6 trillion in value creation, 2017.

In 2018, \$18.73⁴⁵ billion flows from consumers to developers through app stores in the United States.

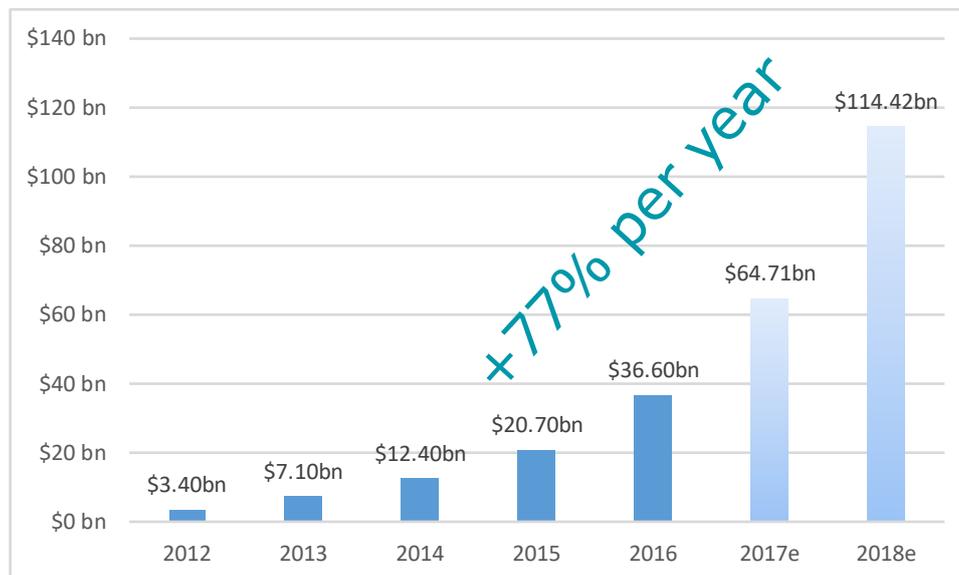
Revenue generated by in-app advertising

38. According to a report by the Interactive Advertising Bureau (IAB), mobile ad revenues represented \$36.6⁴⁶ billion in the United States in 2016. This figure includes in-app advertising and advertisements on browsers and search engines. This report indicates a growth rate of +77% between 2015 and 2016. By applying this growth rate for 2017 and 2018, we estimate that mobile ad revenues will grow to \$114 billion in 2018.

39. According to the advertising platform Smaato, 87%⁴⁷ of mobile ad spending comes from in-app advertising. By applying this percentage to IAB's figure, mobile app developers should receive **\$99.5 billion in advertising revenue** from in-app advertising in their apps in 2018.

Advertising agencies will pay more than \$99 billion in advertising revenue to U.S. app developers in 2018.

Figure 9. Mobile ad revenue in the United States



Source: IAB (2016), Microeconomix analysis

Revenue generated by mobile-commerce

40. Some mobile apps are not intended to directly generate revenue for their developers. But they do open new distribution channels for companies. In fact, mobile apps enable their users to change their consumption habits. Purchases formerly made via traditional distribution channels

⁴⁵ Estimated value

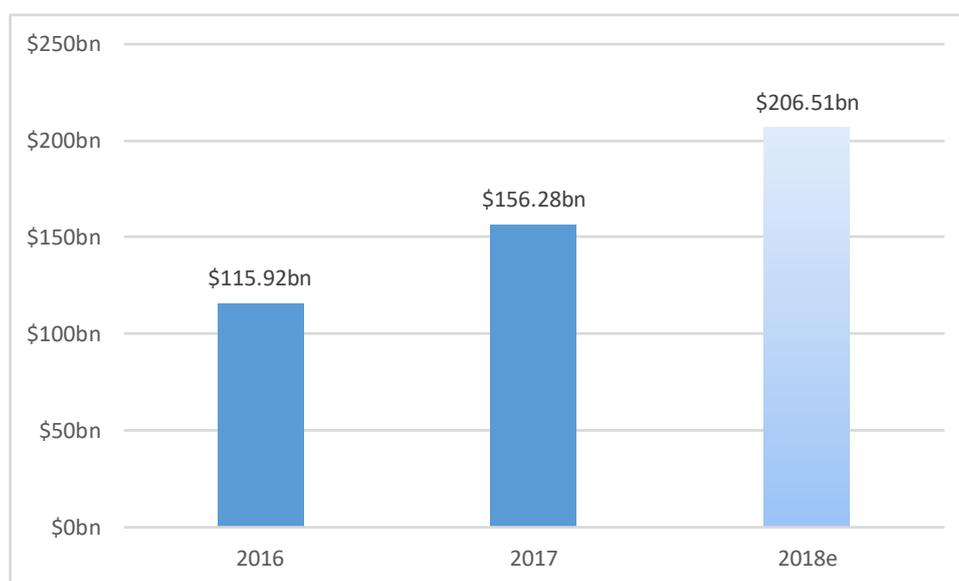
⁴⁶ <https://www.iab.com/wp-content/uploads/2016/04/HY-2017-IAB-Internet-Advertising-Revenue-webinar-IAB-portion.pdf>. Page 8.

⁴⁷ <https://blog.smaato.com/mobile-in-app-advertising-trends-q4-2017>

(shops, hypermarkets, commercial websites etc.) can be easily made on a digital device. In addition, mobile apps can generate new sales.⁴⁸

41. A number of apps, including prominent examples such as eBay or Amazon, generate sales through mobile apps.⁴⁹
42. According to data published by eMarketer, online sales made on mobiles represented more than \$156 billion in the United States in 2017. This value is estimated to increase to \$206.51 billion in 2018. According to App Annie's estimates,⁵⁰ total mobile-commerce spend per user is expected to increase by 228% in the period 2016-2021.

Figure 10. Changes in United States mobile retail e-commerce sales



Source: eMarketer via Statista (2017), Microeconomix analysis

In 2018, sales via mobile apps in the United States should represent \$206.51 billion.

2.2.3 Indirect economic impact of the mobile app market in the United States

43. Indirect impacts are estimated from the Input-Output framework. The Input-Output model enables us to assess the additional value introduced by the app economy in the other sectors of the U.S. economy (beyond the companies specialized in the sector). We consider the total value (in terms of revenue) of the app economy and estimate the spillovers on the rest of the economy. We decided to take a conservative approach when modeling the indirect impacts by only taking into account revenue generated on app stores and in-app advertising, i.e. a total of \$133.15 billion. With no statistics available about the proportion of mobile commerce generated by mobile apps alone, we decided not to consider revenues from mobile commerce.⁵¹

⁴⁸ These are the sales that would not have existed without a mobile app.

⁴⁹ It should be noted that there is a substitution effect between the different sales channels (shops, commercial websites, mobile apps). This means that some of the sales made on mobile apps replace sales on the other distribution channels. The 206.51 billion USD forecast do not take this effect into account, so this amount may be overestimated (The amount of sales that would not have existed without mobile apps is less than 206.51 billion USD).

⁵⁰ <https://www.appannie.com/en/insights/market-data/app-economy-forecast-6-trillion-market-making/>

⁵¹ i.e. accounting for substitutions with other sales channels.

44. The Input-Output framework is a powerful tool to assess the impact of an industry or a project on other sectors in an economy. The general idea is to measure how a sector is integrated into the economy and how the companies in that sector interact within the supply chain. Our model is based on the U.S. Input-Output tables. These tables capture the interdependencies between different sectors of the U.S. economy.
45. Our model was calibrated on data provided by World Input Output Database (WIOD). It produced Input-Output tables for the United States in 2014 and data on employment in Socio Economic Accounts (SEA).
46. In our model, we inject a positive shock of \$133.15 billion, representing revenue generated by app stores and in-app advertising, as part of "Computer programming, consultancy and related activities and information service activities."⁵²
47. From our economic model, mobile apps generate nearly \$228.77 billion of revenue in the U.S. economy above and beyond mobile app developers. The additional business for companies in the United States generated by the intermediate consumption of mobile app developers represents \$79.22 billion. The additional consumption by households brought by the app economy in the United States represents nearly \$150 billion.⁵³ The following table summarizes the impacts of the app economy in the U.S. economy in terms of indirect effects.

Table 4. Breakdown of the impact of mobile apps beyond app developers

Impacts	Amount of revenue generated in the U.S. economy
Impacts on the productive sectors (generated by intermediate consumption by app developers)	\$79.22 bn
Impacts of households (resulting from consumer spending by people employed in mobile app development companies)	\$149.56 bn
Total indirect contribution	\$228.77 bn

Source: Microeconomix analysis

48. In Appendix 1, we show the breakdown of these indirect effects on all sectors of the economy identified by the World Input Output Database.

The impact of the app economy on the rest of the U.S. economy (beyond the companies specialized in the sector) represents more than \$228 billion in revenue.

⁵² Identified by the World Input Output Database, this classification includes the activities involving computer programming and video game publishing used in our study.

⁵³ To compute the relation between compensation of employees and spending, we assume that 30% of the compensation of employees goes to taxes and 5% of households' disposable incomes go to savings. These assumptions are backed by data from the OECD.

2.3 The app economy and job creation in the United States

49. The impact of mobile apps on the U.S. economy can also be measured by the number of jobs it generates in the United States. In 2018, the app economy represents 5,744,481 direct, indirect, and induced jobs in the United States.
50. The app economy generates three different types of jobs:
- a. **Direct jobs:**
 - i. Essential roles (mobile app specialists): positions occupied by qualified employees, including mobile app development, maintenance, and support.
 - ii. Support roles: jobs consisting of management teams, human resources, marketing, sales, etc., within companies employing mobile app developers.
 - b. **Indirect jobs:** jobs created by the suppliers to the core app economy firms, including positions in security, catering and cleaning services, and office utility supply.⁵⁴
 - c. **Induced jobs:** jobs supported by the spending of those directly employed at the app firms. Covers mainly service related jobs such as restaurants, grocery stores, transport, and finance.⁵⁵
51. To quantify the number of direct jobs created by the app economy in the United States, we have used the public data from the United States Bureau of Labor Statistics.
52. The codes⁵⁶ of occupations in the app industry give us the number of direct jobs created by the app economy in the United States. Using the average annual growth rate over the period 2012-2017, we extrapolated the figures for 2018.
53. We estimated that the U.S. app economy creates 1,436,120 direct jobs in 2018.
54. To estimate the number of indirect and induced jobs, we made the assumption that each of the direct jobs generates four additional jobs in the U.S. economy (indirect and induced jobs). The multiplier is the one used in the economic literature in the high-tech sector (around 5).⁵⁷
55. The U.S. app economy creates 4,308,361 indirect and induced jobs in 2018.

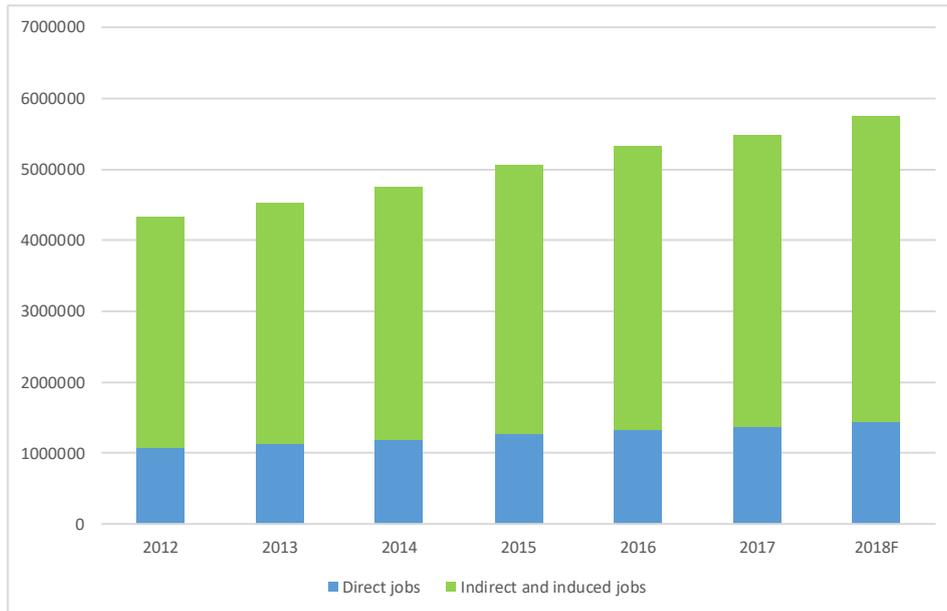
⁵⁴ Copenhagen Economics (July 2017). Jobs in Apps

⁵⁵ Copenhagen Economics (July 2017). Jobs in Apps

⁵⁶ Appendix 2 lists the occupation profiles included in this calculation.

⁵⁷ According to several studies, jobs in the high-tech sector generate 5 indirect and induced jobs in the economy (Advances in the Theory and Practice of Smart Specialization, Slavo Radosevic, Academic Press 2017).

Figure 11. Number of jobs created by the app economy in the United States (2018)



Source: United States Bureau of Labor Statistics (2018), Microeconomix analysis

In 2018, the app economy represents more than 5.74 million jobs in the United States or almost 4%⁵⁸ of the active population.

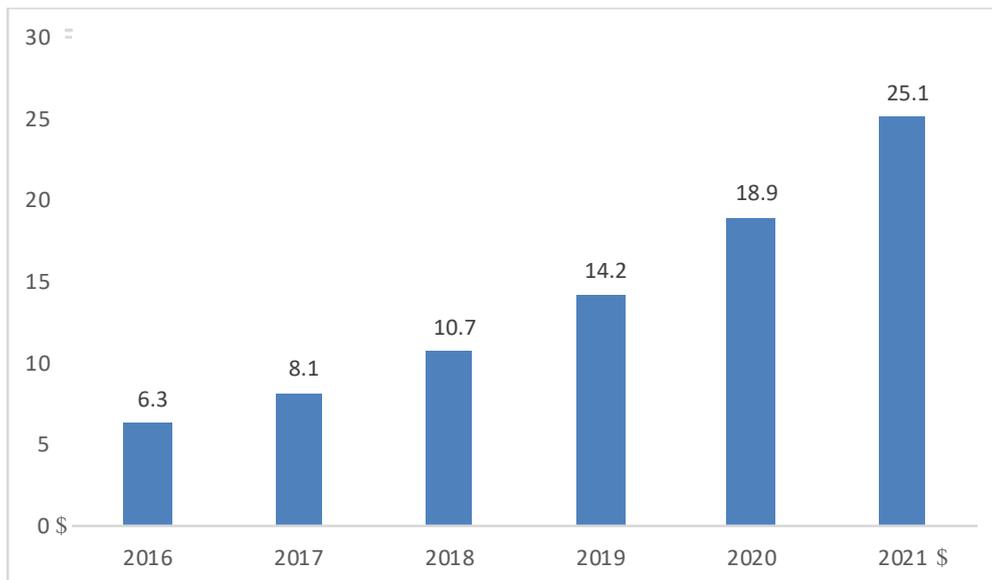
⁵⁸ According to the Federal Reserve Economic, the active population of the United States in 2018 represented 151.750 million people. 5.74 million jobs/151.75 million = 3.783%.

3 Mobile apps will shape the economy of tomorrow

3.1 The Internet of Things

56. A phenomenon encouraging the industry to increase the connectivity of things to the internet has emerged in recent years. It is a technological movement referred to as the *Internet of Things* (IoT).⁵⁹ Gartner⁶⁰ predicts that there will be more than **25 billion connected devices by 2021**. The IoT represents the idea that older consumer and enterprise devices that lack internet connectivity and sensors (“dumb” devices) will gain these capabilities (becoming “smart” devices), leading to a vast network of connected devices that collect and share data seamlessly to enable timely decisions that unlock new efficiencies.

Figure 12. Change in the number of connected devices globally (estimates)



Source: Gartner (2017)

57. The IoT includes a wide range of devices connected via mobile apps ranging from household appliances to cars, and even buildings, forming a concept known as *smart cities*.

⁵⁹ The Internet of Things is a network of connected physical objects with their own digital identifiers that can communicate with each other. This network creates a bridge between the physical world and the virtual world. In addition, the IoT also includes various machine components. For example, a jet engine in an aircraft, which is connected to the internet, can send performance data to a portable device to enable engineers to configure it or quickly detect any faults.

⁶⁰ Gartner is the world's leading IT research and consultancy firm. Gartner regularly publishes sector analysis of the IT market. Gartner advises more than 12 000 companies all over the world. The company employs more than 8 000 people in 85 countries. In 2016 Gartner generated 2.4 billion USD in revenue.

becomes more prevalent, mobile app development grows. In the near future, the IoT is expected to revolutionize users' habits.⁶¹

60. In one way or another, connected devices need an endpoint that collects, processes, and restores data. Currently, mobile apps are primarily used in the consumer context to listen to music, entertain users, and interact with their friends via social networks; and in the enterprise context to communicate within an organization (e.g., email, instant messaging, etc.). However, mobile apps will increasingly be used to interact with connected things.

61. Consequently, connected devices and mobile apps are linked because they provide both an analytics tool and a user interface for displaying processed data to end users.

62. The number of mobile apps that interact with connected things has increased considerably in recent years and greatly influences changes to the Internet of Things.

63. Below we list several examples of the benefits of connecting mobile apps to objects:

a. **Health services:** The health services sector is an important economic sector in the United States, and it is expected to face growing demand as the population ages. Health spending represents \$3.53⁶² trillion (18.2%⁶³ of GDP) in the United States, which is more than the GDP of France. According to mHealth,⁶⁴ there are 325,000 health apps available globally.⁶⁵ The U.S. market is one of the most attractive countries for digital health solutions (vast population, large market size, level of health care spending). Connected things and mobile apps can have an impact on individuals' health and on health spending by making health services more efficient and effective. Numerous connected things promote a healthy lifestyle and enable better monitoring of medical data (e.g. heart rate, blood pressure, blood sugar level, etc.).

i. Smartphones and mobile apps will have many uses, such as fast and comprehensive access to a patient's medical records or calculation of drug dosage.

ii. The automatic centralization of medical data in hospitals offers new opportunities to identify *patterns*, which will lead to improvements in understanding the underlying causes of poor health, enable a better diagnosis, and suggest the most suitable treatment for a patient. This would also enable self-monitoring to become more widespread and, potentially, encourage healthier lifestyles among the population.

iii. Health and fitness apps are one of the fastest growing categories of apps in terms of use, with time spent by users increasing by 330% during the period 2014-2017.⁶⁶ These apps are complementary to the technical evolution of integrated activity tracking sensors in smartphones and connected devices such as Fitbit and Apple Watch. These devices are used to record movements, altitude, geolocation, heart rate, UV doses, skin temperature, and skin conductance of their users.

iv. Connected things and mobile apps reduce the costs of medical supervision and increase the range of indicators that can be monitored. This means that data can be collected and

⁶¹ <http://apsit.fr/2017/09/14/liot-de-lusage-objets-connectes-developpement-de-nouvelles-opportunités/>

⁶² 18.2% of United States GDP which was 19,390 billion USD in 2017.

⁶³ Statista (2018): <https://www.statista.com/statistics/184968/United-States-health-expenditure-as-percent-of-gdp-since-1960/>

⁶⁴ mHealth Economics program explores the developments of digital health. Their first analyses come from 2010.

⁶⁵ mHealth (2017).

⁶⁶ <http://www.netimperative.com/2017/09/health-fitness-app-usage-grew-330-just-3-years/>

viewed easily and in a more informative way. It may also help to motivate individuals to pursue a healthier lifestyle.

- v. By consolidating the data flows of different users and making correlations with external factors, the analytic capabilities of mobile apps are improving rapidly. Nowadays apps can automatically identify the type of activity of users, offer advice, flag health-related warning signs, and save abnormal events for future analysis by a specialist.

The combination of new mobile apps, *wearable* medical devices, the innovative use of sensors, and the development of new sensors will stimulate innovations in terms of healthcare and in promoting a healthier lifestyle.

The widespread use of connected things combined with rapid innovation will make people with disabilities and the old persons more independent.

- b. **The energy sector:** Consumer decisions have a real impact on energy consumption, and mobile apps offer new opportunities for smart demand management.

Smart meters like Itron can be used to measure consumers' energy consumption in real time.

Figure 15. Photograph of an "Itron" smart meter



Source: Itron

- i. This continuous information flow enables electricity producers to adjust their supply in real time. In addition, the data collected helps electricity producers to estimate future electricity consumption. As electricity cannot be stored on a large scale, production must always be equal to consumption to avoid any loss of supply. So-called smart meters make it easier to achieve this balance.
- ii. To limit energy consumption in households, smart thermostats have also been developed. They enable users to adjust the temperature of their home remotely via a mobile app. These thermostats can mobilize a set of data, such as consumer preferences, humidity level, movement of people in homes, weather forecasts, etc., to deliver the optimal temperature at all times of the day.

Figure 16. Example of the "Nest" smart thermostat



Source: <https://nest.com/>

As the number of connected devices increases, new opportunities are emerging to manage energy production more efficiently (depending on demand and changes in consumer behavior).

3.2 Mobile apps are redefining our consumption patterns

64. Individuals have benefited from the boom in mobile apps in various different sectors. Apps make it possible to access in a new way a wide range of services such as television, radio, information, music, films, and games.

- i. Smartphones represent a new distribution channel for these services, and mobile apps enable consumers to access and consume these services wherever and whenever they want. This facility comes from the frictionless environment that the app economy has created.
- ii. In terms of communications, mobile apps have revolutionized exchanges in the past few years. Mobile apps developed by social networks such as Facebook, Instagram, and Twitter enable users to stay in touch with their family and friends, sharing information via diverse multimedia content (texts, photos, videos, audio messages, etc.) anywhere in the world. Communication apps such as Skype have made video calls more affordable, simpler, and more accessible. Nowadays, the use of instant messaging apps such as

WhatsApp far exceeds texting⁶⁷ (in terms of the number of messages exchanged per day in the world).

- iii. Mobile apps also considerably improve access to information and data collection. A whole range of information is now readily available for consumers thanks to specific apps for weather, transport, finance, shopping, etc. These apps enable individuals to save time and make more informed decisions.
- iv. The development of mapping and geolocation apps using data from real-time traffic also has a significant impact on consumer well-being. This aspect will be developed in more detail hereafter.

Mobile apps enable consumers to discover new businesses. By making it easier for individuals and companies to interconnect, mobile apps reduce research costs and promote the emergence of innovative services in several markets, improving consumer well being.

- a. **Transport services:** in the transport sector, mobile apps offer a plethora of new services such as:
 - i. Viewing traffic information in real time - mobile apps provide navigation and route planning tools, using *open data* such as bus and train schedules, combined with the user's geolocation via their smartphone (examples: navigation apps such as Citymapper, Moovit, Inrix, etc.).
 - ii. Taxi services - Mobile apps enable users to take a taxi or order a private driver (Lyft, Curb, Uber, Mytaxi, etc., for example). In addition, the apps enable service providers, such as drivers, to respond more quickly to their customers' requests.
 - iii. Mobile apps that maximize truck capacity exist for trucking companies - By maximizing the payload capacity of trucks, carriers limit the number of trips, making them more efficient, and helping the carriers to save money, etc. This also has a positive impact on the environment by reducing greenhouse gas emissions.

Numerous mobile apps combine both geolocation and mapping services with social media and cloud computing to aggregate information from carriers and travelers.

Mobile apps also use other relevant data, such as weather and traffic information. This reduces transaction costs and improves decision making and planning for travelers and carriers.

By providing multimodal transport options (for example, walking, cycling, taking buses, or trains) and integrating booking and payment services, mobile apps offer greater freedom of choice to suit all budgets and preferences.

- b. **Education and research:** policy-makers begin to realize the potential of mobile apps in transforming teaching methods. While the use of ICT⁶⁸ in education was previously confined to computers and expensive educational software for schools, mobile apps widen access to education, making learning and teaching more effective with new teaching techniques.

⁶⁷ <http://deloitte.wsj.com/cio/2014/04/28/mobile-messaging-market-watch-mim-vs-sms/>

⁶⁸ Information and communication technologies.

- i. Ease of use, accessibility, and interactivity are the most obvious benefits of educational apps. Online learning and the use of educational apps have become commonplace in recent years, as evidenced by the rapid increase in the number of persons using mobile apps for learning foreign languages. For example, the language learning tool "Babbel" recorded more than 10 million downloads of its learning apps in 2013. Today Babbel has more than a million active users and offers 8,500 hours of courses in 14 languages.

Figure 17. Change in the number of users of the "Babbel" app



Source: Babbel

- ii. Beyond widening access to educational material, mobile apps also provide tools to make learning more effective. Apps such as OneNote and Evernote, enable students to take notes, create images of slides or documents, and share them with their classmates via Facebook and other social media. Using mobile devices (smartphones and tablets) and mobile apps, personalized and collaborative learning becomes easier and more intuitive. Applications (such as Educreation and Zonka) enable students to be evaluated by their peers and also enable teachers to assess the work of students.
- iii. There is an abundance of apps that provide educational material on subjects such as sciences, mathematics, history, music, and art, etc.

- iv. Several studies on the use of iPads in schools have shown an increase in student independence, motivation, and commitment, while encouraging them to take more responsibility for their own learning through the use of mobile apps.⁶⁹
- v. Apps not only improve learning, they also increase teacher productivity and improve education quality. Apps can help teachers to offer more personalized and attractive lessons. VoxVote, for example, is an interactive voting app which enables teachers to ask their students questions. The students' responses are compiled instantly and displayed by the app. Teachers can then discuss the results.
- vi. Administrative tasks and class management can also be simplified and sped up with apps such as Attendance and Remind, which have several features including grade management, making calls, generating personalized reports for each student, communication with parents, etc.

Apps and mobile devices facilitate experimentation and the development of new educational strategies. The potential benefits could be very significant not only for students and teachers, but also for governments and society in general.

3.3 Mobile apps and the companies of tomorrow

65. **Productivity gains:** mobile apps are revolutionizing companies. They change how workers perform the tasks, and they affect every department of companies (accounting, human resources, sales, and logistics etc.). Mobile apps are easy to download and relatively inexpensive compared to heavy computer programs. Mobile apps can influence business operations in the following ways:

- i. By creating a flexible work environment that encourages working remotely - Communication apps, collaboration tools, and cloud computing enable data to be accessible anywhere in the world, and thus, encourage new patterns of work to emerge. Slack⁷⁰ is an app that brings all communication together. It organizes conversations, collects files and tools, and facilitates remote working.
- ii. By improving the ways employees are organized (calendars, lists, task manager, motivation, etc.) - Numerous apps that optimize work processes within companies have emerged in recent years. They improve the way employees are organized. These mobile apps have a positive impact on employee productivity. Apps like Expensify allow workers to gain time by scanning their receipts for reimbursements and get their forms prefilled by the app.
- iii. By increasing the visibility of businesses - Apps like LinkedIn and Twitter allow businesses to be more visible. These apps can be used by businesses to potentially expand their client base and also attract new talent to their organization.

⁶⁹ <https://files.eric.ed.gov/fulltext/ED564168.pdf>

⁷⁰ <https://slack.com/>

Today, an increasing number of companies, in all types of industries, use mobile apps. These companies use mobility to completely change their way of doing business while increasing employee productivity.

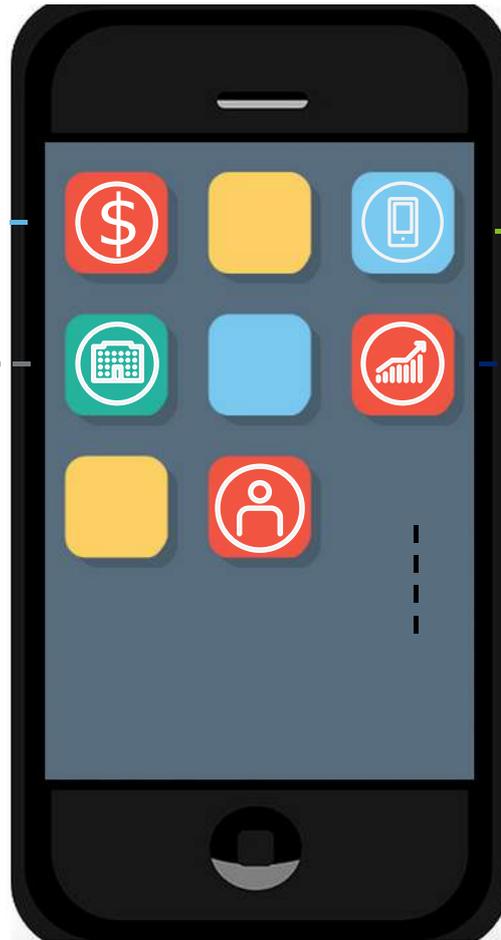
66. **New forms of commerce**: the sharing economy is driven by the advent of mobile apps. Mobile app platforms have facilitated the possibility to share goods and services between consumers through the creation of a frictionless environment. Mobile apps have enabled the sharing economy to emerge by popularizing sharing economy companies such as Airbnb and Uber.
- i. The sharing economy facilitates the exchange of goods and services between individuals and lowers prices for goods and service. Apps such as Airbnb, for example, offer consumers cheaper alternatives to hotel rooms. Car-sharing apps, such as Uber and Lyft, enable consumers to travel in an easier and cheaper manner. Other apps like Spin enable users to rent bicycles that are usually unused.
 - ii. Increasingly, consumers are ready to share their goods (their car, for example) if they have the chance to be able to share them to make money. The sharing economy might also reduce the environmental footprint.

Mobile apps offer new opportunities for sharing because they provide simple and quick access to efficient sharing platforms and secure payment systems.

4 Conclusion

67. As demonstrated by the comprehensive economic analysis, mobile platforms have a positive and important impact on the U.S. economy. The reduction of transaction costs facilitates innovation and makes it cheaper for app developers to enter new markets. App stores' main role is to connect users to app developers, and in doing so, they create a frictionless environment where users and app developers are able to interact in a simple and easy manner. The life of Americans, across consumer and enterprise contexts, has experienced a drastic change through the introduction of mobile apps in the society.
68. In this study we quantified, using public data and a specific Economic Model, the weight of the mobile app market in the United States. App developers generate more and more revenues, and several industries in the supply chain benefit from the app economy. Moreover, revenues distributed to employees of the app economy and related industries increase household consumption at a national level.
- a. Today nearly **3 Americans in 4** have smartphones.
 - b. The app economy generates more than **\$568.47 billion in revenue**, of which \$206.5 billion comes from mobile-commerce, \$114.4 billion from advertising revenue and \$18.7 billion from paid downloads, subscriptions, and in-app purchases. The indirect impact on other sectors is estimated to be \$228.77 billion.
 - c. This sector represents more than **5,74 million jobs** in the United States of which 1,436,120 are direct jobs and 4,308,361 are indirect jobs.
69. The weight of mobile apps in the U.S. economy is expected to increase in the future. **Mobile apps will play a key role in the economy of tomorrow** via the Internet of Things. Major changes are anticipated with regard to habits and consumption, from health apps to improve the health sector, to businesses' production and distribution systems to increase worker productivity.

**317,673
companies**



**77% of
Americans own
smartphone
devices**

**A high growth
market**

**5,744,481
jobs**

5 Appendices

Appendix 1 – Breakdown of the direct, indirect and induced effects of the app economy in the United States

Presentation of the findings of the Input-Output analysis (in \$ million)

	Direct impact	Indirect impact	Induced impact	Total
Accommodation and food service activities	0	3 083.56	6 540.42	9 623.97
Activities auxiliary to financial services and insurance activities	0	822.24	2 860.22	3 682.46
Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use	0	43.82	151.17	194.99
Administrative and support service activities	0	12 854.95	5 469.57	18 324.52
Advertising and market research	0	1 907.90	740.99	2 648.89
Air transport	0	875.13	897.67	1 772.79
Architectural and engineering activities; technical testing and analysis	0	3 425.59	1 389.14	4 814.73
Computer programming, consultancy, and related activities; information service activities	133150	4 437.69	1 440.31	139 028.00
Construction	0	478.87	1 214.77	1 693.64
Crop and animal production, hunting, and related service activities	0	233.80	2 465.05	2 698.85
Education	0	364.21	2 322.32	2 686.53
Electricity, gas, steam, and air conditioning supply	0	678.97	2 680.26	3 359.23
Financial service activities, except insurance and pension funding	0	2 932.45	4 165.77	7 098.22
Fishing and aquaculture	0	40.04	95.86	135.90
Forestry and logging	0	67.31	154.49	221.80
Human health and social work activities	0	183.10	16 548.23	16 731.34
Insurance, reinsurance, and pension funding, except compulsory social security	0	1 455.32	7 096.52	8 551.84
Land transport and transport via pipelines	0	1 305.14	2 360.01	3 665.15
Legal and accounting activities; activities of head offices; management consultancy activities	0	6 958.66	5 231.78	12 190.44
Manufacture of basic metals	0	735.62	672.61	1 408.23

Manufacture of basic pharmaceutical products and pharmaceutical preparations	0	384.17	844.74	1 228.91
Manufacture of chemicals and chemical products	0	831.76	2 740.67	3 572.43
Manufacture of coke and refined petroleum products	0	1 066.49	3 691.25	4 757.73
Manufacture of computer, electronic, and optical products	0	1 631.92	797.58	2 429.50
Manufacture of electrical equipment	0	384.02	378.12	762.14
Manufacture of fabricated metal products, except machinery and equipment	0	1 516.51	1 045.79	2 562.30
Manufacture of food products, beverages, and tobacco products	0	567.49	6 405.09	6 972.59
Manufacture of furniture; other manufacturing	0	428.40	932.24	1 360.65
Manufacture of machinery and equipment n.e.c.	0	506.17	561.73	1 067.91
Manufacture of motor vehicles, trailers and semi-trailers	0	327.23	1 737.61	2 064.83
Manufacture of other non-metallic mineral products	0	611.87	354.77	966.63
Manufacture of other transport equipment	0	262.39	328.39	590.78
Manufacture of paper and paper products	0	527.60	869.37	1 396.97
Manufacture of rubber and plastic products	0	543.15	890.55	1 433.69
Manufacture of textiles, wearing apparel, and leather products	0	124.16	459.25	583.41
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	0	896.82	298.25	1 195.07
Mining and quarrying	0	679.13	1 996.70	2 675.83
Motion picture, video, and television programme production, sound recording and music publishing activities; programming and broadcasting activities	0	1 091.62	1 607.79	2 699.41
Other professional, scientific, and technical activities; veterinary activities	0	612.63	244.43	857.06
Other service activities	0	1 631.85	5 435.99	7 067.85
Postal and courier activities	0	793.72	513.15	1 306.86
Printing and reproduction of recorded media	0	781.91	376.03	1 157.94
Public administration and defense; compulsory social security	0	2 181.30	5 842.40	8 023.70
Publishing activities	0	1 218.97	1 054.73	2 273.69
Real estate activities	0	6 218.16	19 649.43	25 867.59

Repair and installation of machinery and equipment	0	80.05	274.51	354.56
Retail trade, except of motor vehicles and motorcycles	0	501.62	9 406.61	9 908.23
Scientific research and development	0	1 894.80	735.90	2 630.70
Sewerage; waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services	0	214.40	877.27	1 091.67
Telecommunications	0	3 117.72	3 800.73	6 918.45
Warehousing and support activities for transportation	0	1 114.62	967.47	2 082.09
Water collection, treatment, and supply	0	23.17	91.60	114.76
Water transport	0	71.78	243.81	315.59
Wholesale and retail trade and repair of motor vehicles and motorcycles	0	504.14	2 688.27	3 192.41
Wholesale trade, except of motor vehicles and motorcycles	0	2 989.06	6 921.60	9 910.65
Total	133150	79 215.13	149 561.01	361 926.13

Source: Microeconomix analysis

Appendix 2 – Occupation profiles in the app industry

Code of occupation	Occupation title
15-1132	Software developers, applications
15-1133	Software developers, systems software
15-1134	Web developers

Appendix 3 – Bibliography

ACT | The App Association. State of the App Economy Fifth Edition 2017

ACT | The App Association. State of the App Economy Sixth Edition 2018

Amit and Zott (2001). Value creation in e-business

App Annie 2017 Retrospective

App Annie 2017-2022 Forecast

Cachon et al. (2008). On the effects of consumer search and firm entry in a multiproduct competitive market

Caribou Digital. Winners & Losers in the Global App Economy 2016

Cheiko, Avin (2015). The adoption of technological innovations by customers and its impact on the customer relationship - The example of mobile banking. Business and Management - University of Nice Sophia Antipolis

Copenhagen Economics (July 2017). Jobs in Apps.

Cuadrado et al. (2012). Mobile application stores: success factors, existing approaches, and future developments. IEEE Communications Magazine 50.11 (2012): 160-167

Ershov (2018). The effect of consumer search costs on entry and quality in the mobile app market

For Censors, App Stores Offer One-stop Shopping 2017

Frieden, Rob (2017). The Internet of Platforms and Two Sided Markets: Implications for Competition and Consumers

Heitkoetter et al. (2012). Mobile Platforms as Two-sided Markets. AIS Electronic Library

Holzer, Adrian, and Jan Ondrus (2011). Mobile application market: A developer's perspective. Telematics and informatics 28.1 (2011): 22-3

Hyrnsalmi et al. (2014). Sources of value in application ecosystems. Journal of Systems and Software 96 (2014): 61-72

International Telecommunications Union (ITU). The Race for Scale: Market Power, Regulation and the App Economy 2016

Lee et al. (2014). Determinants of mobile apps' success: Evidence from the app store market

McIlroy, Ali and Hassan (2016). Fresh apps: an empirical study of frequently-updated mobile apps in the Google play store

mHealth App Economics. Current Status and Future Trends in Mobile Health 2017

Morgan, Steve (2018). Cybersecurity has been a part of Apple's DNA for a long time, and embedded into all of its products. Cybersecurity Ventures. Cybersecurity Q1 2018 Trends and takeaways. (<https://investingnews.com/daily/tech-investing/cybersecurity-investing/cybersecurity-update-q1-2018-review/>)

OCDE (2013). The App Economy. OECD Digital Economy Paper, no. 230, OECD, Paris

Parker, G., & Van Alstyne, M. W. (2000). Information complements, substitutes, and strategic product design. In *Proceedings of the twenty first international conference on Information systems* (pp. 13-15). Association for Information Systems

Pon, Bryan (2015). Locating digital production: How platforms shape participation in the global app economy. Caribou Digital

PPI. U.S. App Economy Update 2017

Radosevic, Slavo (2017). *Advances in the Theory and Practice of Smart Specialization*, Academic Press

Rochet, J. C., & Tirole, J. (2004). *Two-sided markets: an overview* (Vol. 258). IDEI working paper

Rochet, J. C., & Tirole, J. (2006). *Two-sided markets: a progress report*. *The RAND journal of economics*, 37(3), 645-667

Roma et al. (2012). *Factors influencing prices in the mobile apps' store distribution model: An empirical study*

Tang, Ailie K. Y. (2016). *Mobile App Monetization: App Business Models in the Digital Era*

Yun et al. (2017). *Growth of a platform business model as an entrepreneurial ecosystem and its effects on regional development*. *European Planning Studies* 25.5 (2017): 805-826

Zhan et al. (2017). *Platform Recommendation in Search Markets: Theory and Evidence from the Mobile App Market*

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