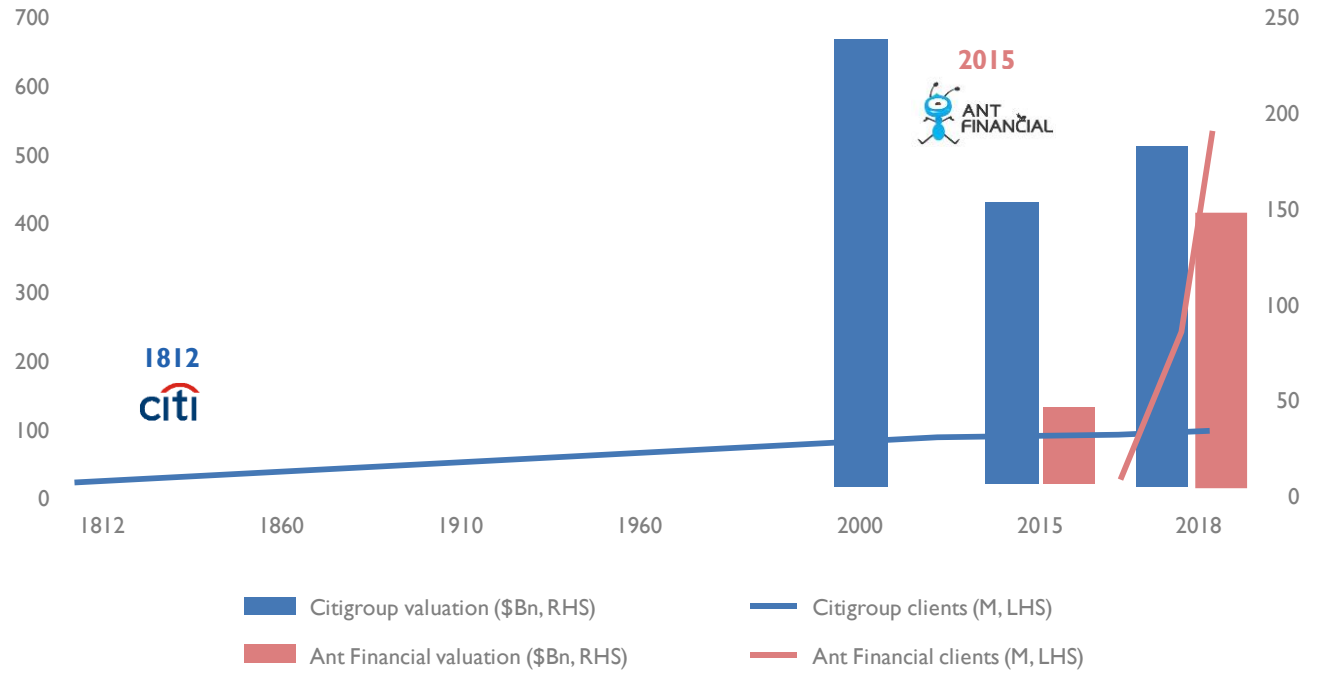
ARCANO

October 2018

The Fintech Revolution

A Chart Is Worth a Thousand Words



Ant is the world's largest mobile and online payment platform, currently the world's most valuable Fintech company. It was renamed Ant Financial in 2014.

Singularity University is a globally renowned academic institution devoted to innovation and education based on the potential development of technologies to solve humanity's challenges and build a better future.

Source: Citigroup, Google and Singular University

Report summary video

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Arcano Economic Research

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Arcano is a leading independent advisory firm with offices in Madrid, Barcelona and New York. The company has three areas of specialisation: Investment Banking, Asset Management, and Multifamily Office. Our team is formed by more than 150 qualified professionals devoted to offering financial advisory services and tailored solutions for our clients with a unique, independent approach.

- Arcano's Investment Banking area leads the Spanish market in the mid- and small-cap companies segment, with a special focus on real estate, both in mergers and acquisitions of capital venture firms, family enterprises and listed companies, headed by Jorge Vasallo (*jvasallo@arcanopartners.com).* On the capital markets side, Arcano offers funding to medium-cap companies mainly via bonds; it is led by Constantino Gómez (cgomez@arcanopartners.com).
- Arcano's specialist team in the financial sector, FIG (Financial Institutions Group), is led jointly by Sofía Mendes (*smendes@arcanopartners.com*) and Andrés Ribón (*aribon@arcanopartners.com*). At present, it has a focus on Fintech and to that aim, it is in close collaboration with both the Arcano Economic Research and Jefferies teams, taking advantage of the latter's strong positioning in the Fintech segment in London.
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About *"The Fintech Revolution"*

"The Fintech Revolution" delves into the principal consequences of the unstoppable technological advances currently in course in financial sector, an industry absolutely key to the economy. The report analyses the factors that have propelled new disruptive Fintech business models, all while the traditional barriers of entry to the financial sector erode. The report also explains the impact on the main lines of business of the sector (payments, deposits, lending, asset management and private banking) and the reaction of banks and large tech companies. It concludes by relating these processes with the economic environment, exposing the role that Fintech could play in monetary policy and in effecting growth.

About the authors[1]

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Executive Summary

Paul Volcker, former governor of the Federal Reserve, joked in 2009 that the only useful thing banks had invented in 20 years was the ATM. He was right to some extent, since many of the great "innovations" of the 21st century precipitated the financial crisis of 2008. A fitting metaphor for the situation is the Chinese ideogram for 'crisis', which also carries the meaning of 'opportunity'. Since 2008, a thriving sector related to financial innovation has been gathering speed: Fintech.

Fintech has been taking advantage of some relevant underlying trends. The two key barriers of entry to the financial sector have traditionally been customer confidence in established brands and the strict regulatory requirements imposed on new entrants. The 2008 crisis eroded the former, and Fintech firms made inroads into business segments which were not burdened by the latter. As a result, competition has sharpened, especially for younger customers who increasingly demand making fast, transparent and cheap financial transactions through their smartphones. Big technological companies like Amazon and Alibaba are also plunging into the financial industry. Alibaba's Fintech subsidiary, Ant, is featured on the cover page of this report for having been able to surpass 200-year-old Citigroup in number of clients and company valuation in just a few years. As we will discuss later, traditional banking is reacting to these major breakthroughs with well-drawn strategies, which on many occasions are based on alliances with Fintech start-ups or with established technological companies. Anyhow, there is no doubt that traditional banking's business model is exposed to risks and that the sector is undergoing a radical transformation, but envisaging the impact of such changes for each individual company is not an easy task. It is also worth noting that algorithm-based processing of massive data (or artificial intelligence), the smartphone revolution, and opportunities fuelled by blockchain technology are behind the emergence of Fintech.

As of 2018, it is possible to have an interest-bearing account at the highest rate in the United States and the United Kingdom through Marcus, a Goldman Sachs-owned app that also grants competitive mortgages. The start-up Revolut provides Visa cards to withdraw commission-free cash in 140 different countries and to pay with commissions six times lower than those charged by a traditional bank. TransferWise's app allows sending remittances to far away countries at a much-reduced cost. It is possible to ask for an instant consumer credit via Ant's app or WeChat – Chinese version of WhatsApp, owned by Tencent – which also has a function to send money immediately to your phone contacts. With Acorns, it is possible to save a small percentage of your daily purchases and make deposits in an account with tax incentives through a robo-adviser, a computer automated platform that searches for the best investment strategy at the lowest cost possible. These examples and others are exposed in this report, together with the underlying trends enabling the technology. Also analysed herein are the possibilities opened up by Fintech to eradicate poverty, and to have central banks reconsider a shift in monetary policies.

The Fintech revolution is already here. There is an old Spanish proverb which says: "only a fool conflates value with price". A more updated version by Warren Buffet goes "price is what you pay, value is what you get". Well, many Fintech companies have been able to spot "value" in the new generations' need for transparent, cheap, fast, app-based financial services. Change is in the air.

1. What has made Fintech possible?

1.1 A brief history of finance, the banking system and technological progress

The history of finance is inextricably intertwined with the history of civilization itself. As it were, some of the oldest written records available are cuneiform boards on which the terms of mortgage loans were etched, allowing historians to infer the cost of capital from five thousand years ago. The development of lending and as a result, of money, is intimately linked to the development of civilization.

The Babylonians left us many examples of their money lending practices, mainly in the form of recorded agricultural loans or tax-paying records (tax collection being even older than the written word). But it was in Ancient Greece and Rome where lending gathered momentum. It is important to clarify that the act of lending money is not considered a banking activity in itself. The basis of banking is to collect money as deposits to then turn around and lend it to those in need of capital. Thus, we can only consider an activity as banking if there is evidence of a link between deposits and loans and unfortunately, records of such practices have not been found in Babylonia, Greece or Rome. For the same reason, the medieval undertakings of the Benedictines, Knights Templar[2] or papal financiers – cubicularii – no matter how sophisticated they were, do not constitute banking activities.

The origins of banking as such, date back to 1261 when it is possible to document the relationship between deposits and credits at the Ugolini merchant house. From that time on, there is an abundance of documentation of banking activities, especially in the North of Italy.

A revolution took place in the 13th century regarding methods of payment, when prototypes of the first bills of exchange appeared, most likely linked to the financing of the Fifth Crusade. King Saint Louis afforded the expenses of his Egyptian military campaign with loans granted by Italian merchants. Such loans were drawn up in documents that were made effective at the headquarters of the Knight Templars in Paris, where the King's treasury was kept in a different currency. A few years later, these documents started to be endorsed as a method of exchange. Possibly the first promissory notes, they are crucial to understanding the commercial and economic evolution of Europe since the mid-to-late 13th century.

The financial structure on which modern banking is based has its foundations in the establishment of the first stock exchange in Amsterdam and the first central bank in England in the 17th century. At first, the whole monetary system was based on the bimetallic standard (gold and silver) and from the end of the 19th century, only on the gold standard, which started to lose momentum in the aftermath of the Great Depression. In 1971, the United States "provisionally" dropped the gold standard, a relationship that was probably as old as written language.[3]

In that same year, the first automated trading system, the NASDAQ, was created, thereby proving that the symbiosis between technology and finance is not new. The first credit cards

[2] Knights Templar accepted deposits and granted loans, at least from the early 13th century. However, there is no real documentary evidence that proves they used funds from deposits (although they likely did, especially the King of France's) for their lending activity.

[3] At that time, an ounce of gold was worth 35 dollars; nowadays, close to 1,200. A good example of the value of money in the long term.

(Diners Club) appeared in the late 1950s. The ATM, a truly disruptive robot, was introduced in 1967 and profoundly changed the banking industry.

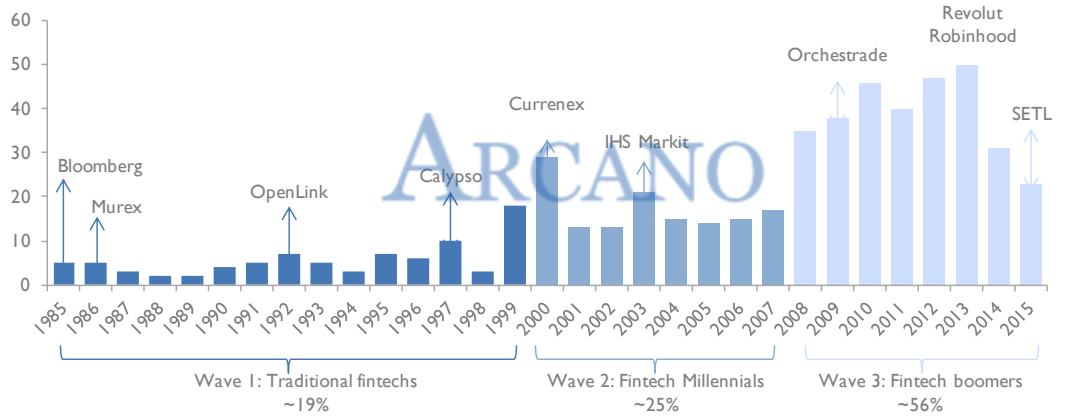
Later on, the use of electronic trading terminals such as Reuters or Bloomberg allowed market operators to access massive amounts of financial data and the execution of electronic market orders became popular in the last decades of the 20th century, paving the way for the revamping of the trading industry.

The origin of modern, electronic, retail banking goes back to the beginning of the 1980s, when long-distance services were offered to clients using the information technology media available at that time: a computer and a phone line. The first online banking service was launched in 1981 in New York City by four of the city's major banks.[4] They offered "personal banking services" using videotext systems such as Pronto so that individuals and small businesses could electronically control their checking accounts and balances, as well as make transfers. Electronic banking reached Europe two years later: the United Kingdom in 1983 and France in 1990. In the late 1990s, the hype was about mixed-models that combined digital and personal banking. Online banking became a strategic must for many institutions. Its appeal lies in reduced operating costs, integrated services and interactive marketing potential, among other advantages that translate to more clients and higher profits. Moreover, comprehensive service packages could be offered thanks to electronic banking. Thus, by 2006 80% of American banks offered online services. Bankinter was the first Spanish institution to join the internet phenomenon with the 1996 launch of Bankinternet, a pioneering online banking platform which gave clients access to their accounts to make financial transactions. All in all, one thing was the technological revolution and another, the cost-efficient distribution of products to attract clients. The digital banks of the time such as Egg were eventually acquired by traditional ones. The former wanted to maximise product distribution while reducing client acquisition costs; the latter, to integrate the technological platforms developed by digital banks.

Financial technology or Fintech developed in three waves (Figure 1). Technology began to permeate our lives when companies of diverse sectors and fields adopted it to increase their productivity levels, paving the way for the creation of new companies and industries. Murex, the first fully technological electronic trading system is an example of this, born as a result of the creation of the automated stock exchange, NASDAQ. The internet boom encouraged companies to explore alternative ways to provide financial services through this innovative channel. As our society evolves and our habits change, Fintech companies strive to adapt their products and services to the new environment.

[4] Citibank, Chase Bank (J.P. Morgan), Manufacturers Hanover (acquired by Chemical Bank in 1991) and Chemical Bank (acquired by J.P. Morgan in 1996).

Figure 1: **The three major Fintech waves (number of companies founded)**



Source: CB Insights, Boston Consulting Group, Arcano Economic Research

As we will discuss, the financial crisis of 2008 reflects the metaphorical ambivalence of the Chinese ideogram for "crisis", with its two opposed meanings of "crisis" and "opportunity". With the crisis, longstanding confidence in the financial system collapsed, eliminating one of the industry's historical barriers of entry. This, combined with powerful technological innovations, opened the door for nascent Fintech companies willing to seize the opportunity. Precisely this is the central topic of our report, dealing mainly with concrete examples in commercial and private banking, as well as asset management.[5]

Before analysing the Fintech revolution that started taking shape post-crisis, it is necessary to understand the underlying trends, the regulations and the role of Millennials and Generation Z in propelling it.

1.2 Technologies behind Fintech

As we have already discussed, the traditional confidence in the banking system broke down after the 2008 crisis, opening up a window of opportunity for Fintech companies. The word Fintech is a combination of two other words: financial and technology. The internet and e-commerce boom, the progress of artificial intelligence, and the advance of blockchain are the three key forces which explain the emergence of Fintech. The report analyses the regulatory and sociological changes that have supported this phenomenon.

1.2.1 The internet and e-commerce

There are 7.6 billion inhabitants of Planet Earth. It is estimated that some 4.1 billion of them now have access to the internet,[6] out of which some 2.9 billion connect via a smartphone. If in the past it seemed most unlikely that large swaths of population in rural areas could become users of financial services due to the high cost, the swift expansion of smartphones and Fintech companies have made it possible.

[5] We have analysed the impact on the insurance sector (InsurTech) and on investment banking, but it will not be detailed in this report.

[6] Internet World Stats (December, 2017).

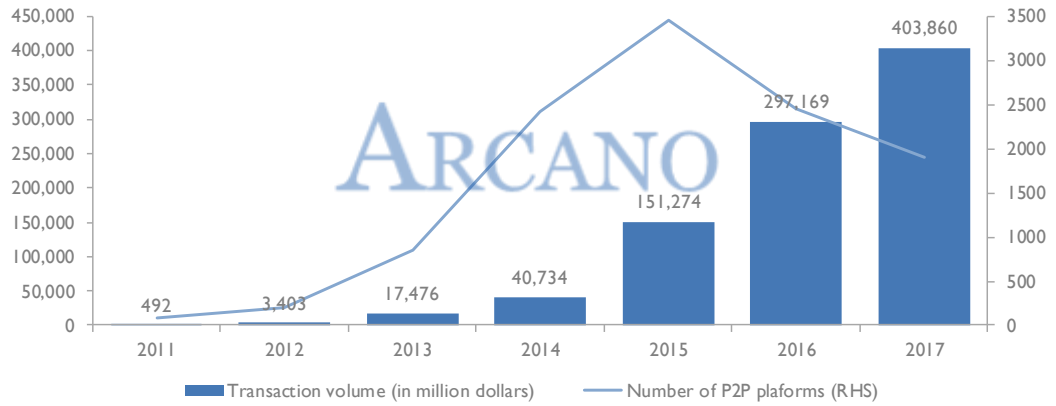
The penetration of e-commerce is around 32% in China,[7] 10% in the United States[8] and 8% in Europe.[9] Electronic transactions are closely related to means of payment and therefore, to quote Fintech expert Zoi Therapou,[10] "it is no wonder that China has become the country with the largest number of Fintech or Bigtech companies thanks to its regulation and culture". We would add two more reasons to the list: its large geographical territory and low rural population density that hinder access to traditional financial services. No doubt, China has been able to reach the highest rate of Fintech adoption out of any major region of the world (Figures 2 and 3), and it is not the only remarkable example. Of the five markets with the highest rate of Fintech adoption, China, India and Brazil occupy the first three positions, suggesting that this kind of technology is more readily adopted in developing regions.

Figure 2: **The five markets with the highest rate of Fintech adoption (by country)**

Money transfer and payments		Financial planning		Savings and investments		Borrowing		Insurance	
China	83%	China	22%	China	58%	China	46%	India	47%
India	72%	Brazil	21%	India	39%	India	20%	UK	43%
Brazil	60%	India	20%	Brazil	29%	Brazil	15%	China	38%
Australia	59%	US	15%	US	27%	US	13%	South Africa	32%
UK	57%	Hong Kong	13%	Hong Kong	25%	Germany	12%	Germany	31%

Source: Ernst & Young,[11]

Figure 3: **Volume of internet loans in China (%)**



Source: WDZJ, Arcano Economic Research

[7] PwC. (2017). eCommerce in China – the future is already here.
[8] Statista. (2018). E-commerce in the United States - Statistics & Facts.
[9] E-Commerce Europe. (2017). Key B2C E-commerce Data.
[10] It was during our visit to London, the most important city in Europe for Fintech development, that we met with Zoi Therapou, director of sales and strategy for Confirmation.com, a Fintech specialized in compliance services.
[11] EY. (2017). The rapid emergence of Fintech.

1.2.2 Artificial intelligence and big data

With the outbreak of the internet in the 1990s and the subsequent adoption of cloud computing[12] and mobile technologies, access to and generation of information expanded greatly. The amount of data ballooned on a global scale and being able to process it efficiently became very valuable. The term 'big data' describes the volume of large and complex datasets that can only be processed using powerful algorithms because traditional methods have proven useless. Since the internet continues its unstoppable advance and is nowadays a cheap and accessible tool, it is of great importance that all market players are familiar with data treatment techniques.

Turing, essentially the founder of computer science, who was able to crack encoded German communications during World War II, anticipated in 1950 with his 'Turing Test' that there would be a kind of intelligence where "a human engaged in blind conversation with a computer could be fooled into believing it was a person". He was already contemplating artificial intelligence (AI) which simply explained, is the development of computer systems capable of processing massive data sets, replicating the functioning of the human brain. In fact, there are already automated processes in the financial sector using AI to imitate financial advisors. They are the so-called robo-advisers which at present manage 360 billion dollars globally.[13] As we will explore further on, AI is key for Fintech. An algorithm can analyse large databases and instantly decide whether a consumer loan should be granted or not based on information pulled from a borrower's interaction with an app.

1.2.3 Blockchain

The internet was born in the aftermath of the Cold War when the Defence Department of the United States decided that Chicago should stop being the only communications hub between the East and West coasts, since centralisation rendered the system vulnerable. The creation of several interconnected communication nodes was the very origin of the internet. Over time, it was easier to join these small nodes than it was a bigger one, in this way favouring interconnectivity. Blockchain uses this same philosophy but applied to the world of value, not of communication, which is why it is referred to as the internet of value.[14]

It was in 2008, after the creation of the Bitcoin currency by Satoshi Nakamoto[15] and the subsequent analysis of blockchain, Bitcoin's underlying technology, that it started to be considered as a useful tool for global financial markets. Blockchain is a decentralised log of transactions of any kind, which provides both encryption security and traceability. It is decentralised because all participants, some in public networks and some in private, continuously and automatically validate the transactions. Every participant keeps a copy of the log in real time, so that it is virtually impossible to destroy all copies. Moreover, automatic validations must meet some requirements so that the transaction is accepted. Such requirements have been previously agreed upon by all the participants in the network, creating total confidence between parties. It has been argued that blockchain may be the most disruptive technology since the emergence of the internet, as it could flip the way transactions are made, from buying or selling real estate, to

[12] Cloud computing has been a disruptive technology that has had a major role in slashing the costs of starting up a new business, with Amazon Web Services being the main catalyst. Moreover, it has contributed to largely reducing and turning fixed corporate IT costs into variable costs for global companies, significantly mitigating the associated risks.
[13] Statista.
[14] Faura, (July, 2018). "Alastria, un proyecto del país". Click here to watch the video.
[15] Alias of the individual or group of people who created Bitcoin.

paying dues to the United Nations or even how votes are counted in an election because it reinvents the interaction between the involved parties. As we will discuss herein, some experts state that the expectations are too great and could end up disappointing. It is obvious though, that "it may be a useful tool for the banking industry for its reduced costs, especially as far as settlement is concerned" as Jean-Marc Bonnefous has stated.[16]

1.3 Regulations supporting the Fintech revolution

In January 2018, two key directives affecting the financial industry were announced by the European Union: MiFID II[17] and PSD2.[18] They both share a common goal: enhancing consumer and investor protection. We will review their respective effects hereafter.

1.3.1 MiFID II

MiFID II is aimed at strengthening investor protections. It targets a wide range of products and adds an additional layer of supervision, which affects all the links in the sector's value chain. Before launching new products, investment firms must complete additional processes and incur extra expenses to identify their target market and that of their distributors. Moreover, they must make sure that all potential customers are fully aware of a financial product's features and nuances. Therefore, asset management companies for example, claim that stricter regulation acts as a barrier of entry for innovation.

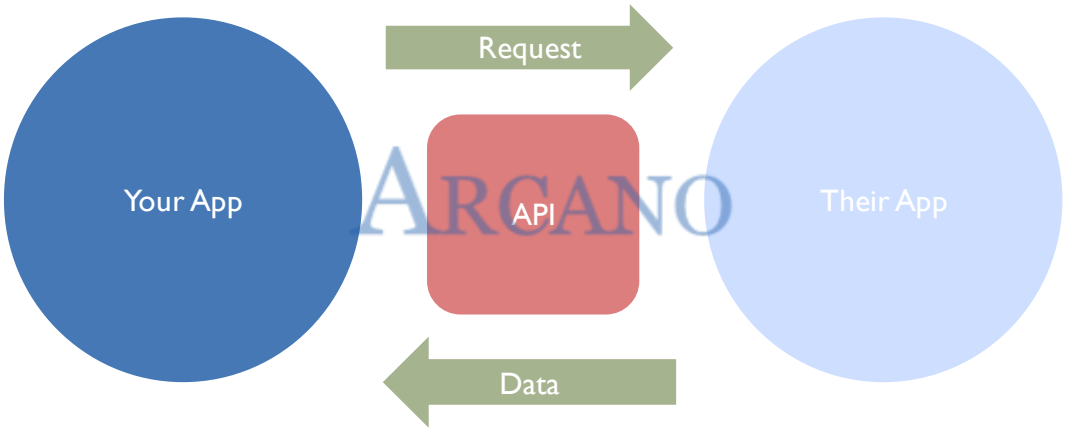
1.3.2 PSD2

The objectives of the PSD2 directive are to improve consumer protections when paying through the internet or mobile devices, enhance the safety of cross-border payments,[19] and promote competition and innovation in financial services. One of its most disrupting effects is that it allows third parties, PSPs (Payment Service Providers, usually Fintech companies) to access consumer data that has been so far "property" of banks (always with the express consent of the owner[20]). This exchange of information is powered by open APIs[21] (Application Programming Interface) and PISPs[22] (Payment Initiation Service Providers), as shown by Figure 4. The access to consumer information allows Fintech or third party companies to provide value-added services, such as aggregating all the financial information of clients on a single platform, spotting inefficiencies (for example, a poorly remunerated account) and offering more competitive products (such as loans at a lower interest rate). Thus, users will be able to see through a single app what institution is offering the best-rated deposit or loan. With the new PSD2 regulation, and in view of the potential enhancement of the information available, the power is now in hands of consumers instead of traditional banks. Consumers may now have access to a wide array of financial services from

[16] Jean-Marc Bonnefous, managing partner at Tellurian Capital Mangement and professor at IE University.
[17] Markets in Financial Instruments Directive II.
[18] Payment Services Directive 2.
[19] European Parliament adopts European Commission proposal to create safer and more innovative European payments. European Commission (October 2015).
[20] Despite PSD2 regulation coming into force on the 13th of January 2018, the most technical aspects of PSP access to banking accounts will not likely be implemented until September 2019.
[21] An API is a series of clearly defined commands, functions and communication protocols between several components, facilitating the transfer of data or messages between two applications. For example, hotel aggregators receive through a common API, all prices and availability of rooms and in turn inform the hotels of the reservations placed through the aggregator's websites (if a hotel wants to appear on their website, they have to connect to the API).
[22] PISP (Payment Initiation Service Provider) is a service provider that can start a payment transaction on behalf of the customer.

different providers, a new concept known as Open Banking. The United Kingdom was the first to implement Open Banking standards in January 2018, demonstrative of London's leadership of the European Fintech ecosystem.

Figure 4: **How an API works**



Source: Arcano Economic Research

MiFID II is sometimes criticised as a "barrier to innovation",[23] for its strict regulatory requirements,[24] as opposed to PSD2, whose goal is to maximise transparency and competition and is considered an "innovation catalyst",[25] because it promotes the development and use of Fintech products. The combination of both regulations opens the door to a world of opportunity.[26]

1.4 Millennials and Generation Z

Technology facilitates operations such as opening a current account or asking for a loan, understandably, younger generations are much more prone to using Fintech-related services. For those born after 1990 (Millennials) and 2000 (Gen Z) mobility and technology are nothing new, and bank branches don't have the appeal they once had for traditional clients. As this new profile accounts for a larger percentage of the population, the market share of Fintech companies will increase accordingly.

[23] Buck, G. (17 February 2017). MiFID II 'a regulatory barrier to innovation'. *The Global Treasurer.*

[24] Barriers to innovation within large financial services firms: An in-depth study into disruptive and radical innovation projects at a bank. *European Journal of Innovation Management* (2018).

[25] Schaefer, C. (14 December 2018). PSD2: regulation as a catalyst for innovation. Banking Tech.

[26] These two regulations have laid the foundations for the emergence of RegTech or Regulation Technology that provides solutions to the ever-increasing compliance demands within the financial industry. RegTech combines technology such as *software-as-a-service* (SaaS) and cloud computing to help companies meet their regulatory obligations efficiently and at a lower cost. The RegTech industry is expected to generate 100 billion dollars already in 2018, and to post significant growth rates in future.

2. The opportunity: Fintech in action

2.1 Applications

2.1.1 Digital Wallet: Deposits, Payment Methods and Loans

Deposits

Until recently, directly or indirectly, money had an equivalent value in precious metal, be it gold or silver (which in turn had a correlative value where in Medieval Europe, 12 ounces of silver held the same value as one ounce of gold). There was an evident tangibility in the value of money, and the uncertainty associated with the transport of it is partly why humans have always searched for "safe" storage for their savings. In the Middle Ages, monasteries were popular safe houses due to their perceived sanctity, and commandries of military orders such as the Knights Templar and Knights Hospitaller were also favoured for the safeguard provided by the warrior-monks.

More recently, money began to be deposited in banks because of the security they afforded. Security in banking increased following the Great Depression of 1929 after the first deposit protection schemes were instated. As previously mentioned, the financial crisis of 2008 significantly dented people's confidence in banks, in part because they were shown to be much less trustworthy than they were historically perceived to be, partly because the regulatory uncertainty generated doubts about which deposits are actually safe and which are not (in the Euro area deposits above 100,000 Euros are not insured), and lastly because quantitative easing as undertaken by central governments has provoked an interest rate slide into the negatives. Consequently, an individual has no special advantages to keeping their savings in one place or another. Additionally, after the crisis, banks who had traditionally offered higher deposit rates to their "premium" clients instead started offering more advantageous conditions to their new clients, eroding the loyalty that many long-time clients felt towards their bank.

Given the context, the emergence of digital wallets it is unsurprising, apps through which money can be virtually deposited, (via a pre-paid card whose funds proceed from a checking account, for example) thereby storing value with the potential for use as a method of payment or savings to buy securities such as stocks, bonds or funds. Their digital format integrates additional functionalities such as being able to store receipts or even identification documents like a driver's license. The relevance of the digital wallet and its associated capabilities bring about enormous opportunities to be capitalised by business alliances between banks and Fintechs.

A noteworthy example of the disruptive power of this technology is the change witnessed in deposits and savings. The once-inextricable link of banking institutions' businesses of receiving deposits and granting loans is slowly unravelling under the pressure of technological competition. Former Federal Reserve officials recently founded The Narrow Bank, a bare-bones, online-only bank which collects savings and deposits them at the central bank, obtaining the according risk free return instead of engaging in the traditional banking activities of investing or loaning deposits. The idea is so revolutionary that the Fed has actually rejected the company's request to open an account at the central bank (perhaps for fear of a massive exodus of funds from other banks to The Narrow Bank) but the trend is unstoppable. Simple,[27] an American Fintech company backed

[27] Noonan, Laura. (25 September, 2018). "Digital bank Simple raises stakes in US deposits". *Financial Times.*

by BBVA offers a deposit rate of 2.02% with a minimum balance of 2,000 euros, considerably above the average deposit rate in the US of 0.08%.

Payment methods

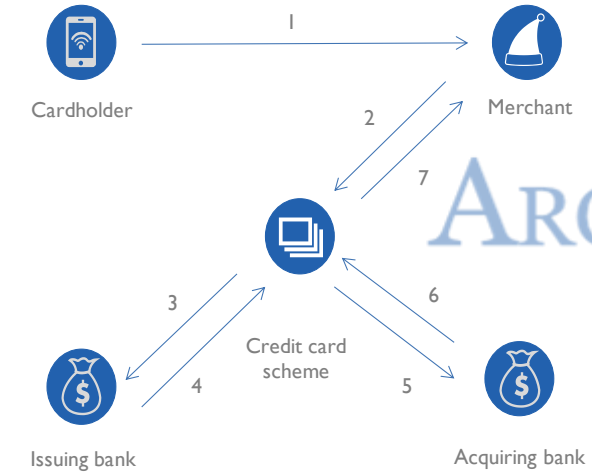
The payment and transfer business is quite lucrative for the financial system. International transfers in general carry high transaction costs and slow execution times. Card payments command considerable commissions by banks from companies who accept the use of them by their clients. Banks also take between 1% and 3% commissions for card payments in other currencies and often charge hefty fees for using international ATMs.

Before the disruption from the internet, payment providers were characterised by the ubiquitous dominance of giants like VISA and Mastercard in the credit and debit card space or by the monopoly of banks in the processing of money transfers. Finally, once internet use became commonplace and e-commerce gained relevant popularity, companies that specialised in payment transfers and online payment emerged. To gain perspective on the significance that these companies have acquired, consider that PayPal has a market capitalization of over 100 billion dollars and that Alipay processes no less than 50% of the payments of the Chinese market (the largest in the world with over 5.5 trillion dollars in transactions). In 2007 Amazon launched Amazon Pay, a payment processing service allowing its users to use their Amazon account to make payments on the private webpages of third party vendors (also Amazon vendors).

Currently, Open Banking as intended by novel directives such as PSD2 is profoundly transforming the payment system. The following example is of a simple purchase at a vendor, before and after the new regulation.

An individual wishes to buy a sandwich at Muffin Inc. with their credit card. The clerk uses the terminal to swipe the card and the following flow of information occurs: The data from the purchase is initially captured by a credit card scheme (Mastercard). The information is then sent to the individual's bank to confirm identity and validate funds. Confirmation is sent to Mastercard, which in turn re-sends this information to Muffin Inc.'s bank. Finally, the bank sends a confirmation to the business through the terminal, confirming the sale to both the vendor and the purchaser, after which the purchaser can proceed to enjoy their sandwich (Figure 5).

Figure 5: **Payment Processing before PSD2**

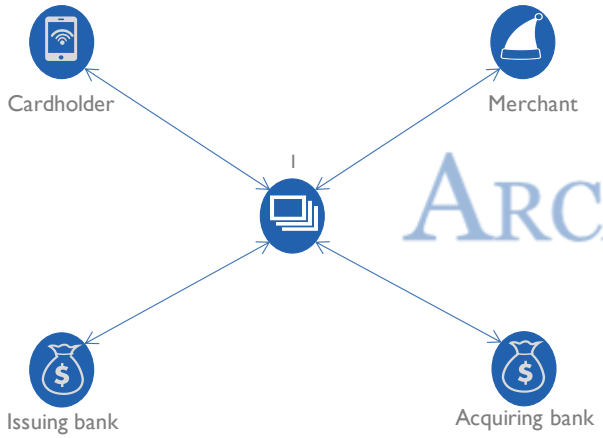


1. Client (cardholder) attempts to pay Merchant for goods and services with card.
2. Merchant's POS system sends information to the Credit Card Scheme.
3. Credit Card Scheme clears the transaction with the client's (issuing) bank.
4. The issuing bank returns information to the credit card scheme.
5. Acquiring bank accepts the payment from the credit card scheme .
6. Acquiring bank returns information to Credit Card Scheme.
7. Merchant receives confirmation of payment.

Source: Arcano Economic Research

What does the introduction of the new PSD2 legislation mean for the process of buying a sandwich at Muffin Inc.? An important simplification it turns out, beneficial to the principal agents of the transaction, the purchaser and the vendor. It would allow Muffin Inc. to integrate a new payment processing system, one with a new central figure: the payment initiation services provider (PISP),[28] which already has access to the necessary banking information from both the purchaser and the vendor. This new system, which could be brought to market by Fintech players, would allow the entire flow of information to be centralised through the aforementioned PISP. Like this, traditional banks could be removed from payment processing, thereby reducing the number of intermediaries and steps in the process. The subsequent cost and time savings get passed on to the vendor and the purchaser (Figure 6).

Figure 6: **Payment Processing after PSD2**



1.The PSD2 directive will make it possible for a new breed of fintech companies called PISP (Payment Inition Service Providers) to provide payment initiation and settling services.

The PSD2 directive allows for this by granting PISPs direct access to the banking and financial information of all parties involved in a transaction.Access to this information means that the PISP can act as an instantaneous, low-cost intermediary, thereby facilitating the transcation.

Source: Arcano Economic Research

However, the rapid pace of technological progress is enabling the construction of a blockchain-based infrastructure, which could shift the payment process from a single centralised network to one of direct contact between parties. This logical 2.0 evolution for payment processing is already underway, especially in emerging countries.

Two systems in particular have an outsized potential to impact the payment processing ecosystem, namely i) digital wallets, and ii) chats (messaging systems through which transfers and payments can be made). The following sections expose important examples of the disruptive power of these systems.

Digital wallet payments

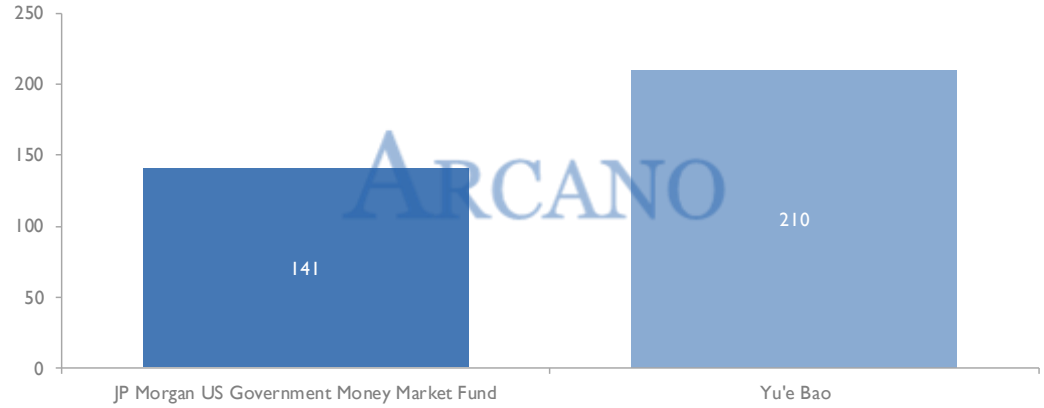
As previously mentioned, Chinese company Alipay,[29] subsidiary of Ant Financial, is remarkable for being the largest payment processing platform in the world. It is important to mention that Ant Financial, in turn a subsidiary of Chinese e-commerce titan Alibaba, is the most significant Fintech in the world with a market capitalization of around 150 billion dollars. Moreover, the large volume of cash flowing through Alipay's platform has encouraged Ant Financial to develop new relevant lines of business such as launching a money market fund called Y'ue Bao, now the

[28] *Payment Initiation Service Providers.*

[29] It is used on smartphones through the Alipay Wallet app, which offers additional functionality like account management, payment with a credit card, P2P transfers, phone credit recharges, ticket purchases, phone bills, insurance selection…

world's largest by far. The fund currently stands at 210 billion dollars of assets under management, considerably more than the next largest, JP Morgan's US Government Money Market Fund (Figure 7). This has all been made possible by having people's savings channelled through Alipay's digital wallet.

Figure 7: **The largest money market funds by assets under management (2018, in billions of dollars)**



Source: Bain, China Merchants Bank, China Private Wealth Report, Arcano Economic Research

Popular digital wallets like Apple Pay, Google Pay or Samsung Pay[30] allow users to replace their physical credit or debit card with a digital copy saved through an app on a mobile device. This replacement can then be used as a payment method at a contact-less point-of-sales system, facilitating and accelerating every day transactions. Thanks to their advantages over plastic cards, digital wallets are becoming very popular with users. Apple was able to register over 1 million credit cards into its Apple Pay system within the first three days of its launch, making it the largest mobile payment system in the United States at the time (2014).

In the UK, the Fintech Moneybox, launched in 2015, automatically channels extra change into savings for its users every time they make a purchase. For example, the purchase of a coffee costing 1.60 pounds sterling will automatically instruct the app to round the transaction to 2.00 pounds, depositing the extra 40 pence into a savings account which can then be invested, all without leaving the app. This type of transaction is taken to the next level by a Fintech called Acorns, portfolio company of the well-known Fintech venture capital fund NYCA, which we visited during our research for this report. Acorns automatically recommends exchange traded funds based one's risk profile and can autonomously set up a diverse portfolio tailored to specific financial habits.

In the UK, a company called Revolut launched a digital credit card which can be recharged with a standard plastic card and bypasses ATM fees in over 140 countries, charging low commissions on international payments even when making purchases in foreign currency. Revolut's app and associated credit card have experienced a massive adoption, especially among travellers and young people. The application allows a myriad of other useful functions such as the ability to instantly transfer funds between users, to the point where if one person orders pizzas for a gathering of four, the other three can instantly reimburse their friend. Revolut also offers a

[30] Wakabayashi, D. (28 October, 2018). Apple CEO Tim Cook Happy With New Apple Pay Service. *The Wall Street Journal.*

savings tool similar to Moneybox. Revolut's most recent valuation is around 1.8 billion dollars (five times what it was worth just one year prior). A similar start-up story is that of online bank Monzo, which unlike Revolut, is not linked to external savings accounts and instead offers accounts directly. Like Revolut, the explosion in the app's popularity is due to the low commissions when withdrawing cash in foreign countries and the transparency and ease of use of the platform.

In the transfer business, Fintech TransferWise burst onto the scene seven years ago, disrupting the industry with an approach to making international transfers that significantly undercut what traditional banks were charging for the same, as well as packaging the service in an easy-to-use mobile application. The firm is now valued at over 1.6 billion dollars, decisively achieving "unicorn"[31] status. The company's main strategy is to form alliances with digital wallet companies to facilitate the flow of capital through its service.

Chats payments

The largest player is Tencent's WeChat Pay platform, which controls 40% of the Chinese market, next only to Alipay's 52% share of the market. From the company's instant messaging platform (similar to WhatsApp, the messaging platform of choice in Spain, although WhatsApp lacks the ability to send and receive cash) it is possible to transfer funds to any user on one's contact list and to pay for goods or services by scanning a vendor's QR code.

Facebook is thinking of including a payment processing service within its instant messaging platform WhatsApp, in a similar fashion to WeChat. The idea is to allow users to make transfers between each other and to pay for any good or service. WhatsApp has over 200 million active monthly users and has begun testing this functionality in India. This country has an emerging mobile payment market which is expected to grow five-fold, reaching a value of one trillion dollars by 2023 according to Credit Suisse.[32] India recently enacted a reform which abolished 86% of cash in circulation, propelling the adoption of digital wallets (there are already around 325 million users). The facilitated transition to digital even provoked the interest of generally low-tech investor Warren Buffet, who recently sunk 300 million dollars into payment processing Fintech One97 at a valuation of 10 billion. The biggest risk to the Fintechs in this sector is the competition from banks, which have launched a platform called the Unified Payments Interface, which could make digital wallets obsolete given that the platform facilitates mobile to mobile payments without the need for one.

The lending business can be divided into personal lending (to buy a new kitchen appliance, for example), mortgage lending (generally to buy a house), and corporate lending (lending to companies, known as SMEs if they are small or medium-sized). Fintech companies have centred their efforts on personal lending and lending to SMEs. Let's examine how and why.

In the personal lending business, Fintech companies use sophisticated artificial intelligence and data mining[33] tools to be able to quickly calibrate the risk associated with a borrower in order to decide whether to make a loan or not and at which cost. Occasionally, large distributors (and

[31] Privately held companies valued in excess of one billion dollars.

[32] (15 February, 2018). Digital payments in India to reach $1trillion by 2023: Credit Suisse. *The Economic Times.*

[33] Data mining or extraction is the process of discovering patterns in large datasets, involving methods on the cutting edge of machine learning, statistics and database systems.

lenders) like Alibaba, have access to relevant information about the borrower,[34] which allows them to calibrate their level of risk with more certainty. An interesting tactic used by companies in their personal credit business is to send a digital survey in which the borrower is asked about their risk profile. If the borrower types something in but quickly replaces it, the program infers that the veracity of the information is possibly questionable, therefore reducing the probability of granting a loan. Chinese company Tencent employs a similar practice. The company is able to concede almost instantaneous credit to its users, about whom the company collects valuable information through its WeChat platform, information which allows the company to quickly make highly sophisticated evaluations about the risk profile of a borrower. Given this environment, it is unsurprising to see alliances forming between Fintech credit risk companies and traditional financial institutions.

In the sector of corporate lending to SMEs, Amazon is poised for dominance given that they have access via their platform[35] to information relevant to the financial solvency of more than five million vendors[36] and can therefore evaluate creditworthiness with a high degree of certainty, reducing Amazon's lending risk. PayPal is also enacting a similar strategy with SMEs in the US who have not been given a good enough service by traditional banks, especially in granting working-capital loans.

Another popular sector into which Fintech companies are muscling is P2P[37] lending and P2B.[38] This type of lending is done from one individual to another (P2P),[39] or to an SME (P2B), through some kind of intermediary or platform. Keeping in mind that Fintech companies operate almost exclusively via the internet, it is understandable how they are able to cut costs in order to offer services at a significant discount to traditional companies in the sector. This can turn out to be attractive for both the lender and the borrower, since the former obtains a higher return than they would by just having cash parked in a checking account and the latter can access more than just the traditional financing alternatives. Nonetheless, because the business model relies on non-guaranteed loans in which the only mediator is a company or Fintech with access to both parties' information, there is an important element of risk for the lender (the borrower could stop paying, especially in the case of an economic recession). For this reason, regulators have tended to closely supervise these platforms in order to prevent future loses to small retail lenders. Fintechs make their cut from the operation of intermediary platforms. This type of service is very popular in the United States, UK, China and South Korea.

Among the most well-known companies in the sector are LendingClub, an American Fintech, and British Zopa and Funding Circle. Founded in San Francisco in 2006, LendingClub has a market capitalization of around 2 billion dollars and has already granted over 40 billion dollars[40] in loans. Zopa was born in the UK in 2005 and is considered a leader in P2P lending, having granted a total of 3.5 billion pounds in personal credit. Funding Circle is the UK's largest digital lender, operating in Germany, Netherlands, Spain and the United States, having granted loans to over 25,000 businesses,

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[34] The borrower has developed a system of social credit, tracing payments, spending habits and other personal information so that the algorithm can rate the credit score of each individual.

[35] Through which vendors and manufacturers can sell their products, next to Amazon's own.

[36] Businesses and manufacturers that make sales through the platform.

[37] Peer to peer.

[38] Peer to business.

[39] It is worth highlighting that many of these companies are really developing P2B, since they are the channel for institutional investors that do not have their own distribution networks, such as hedge funds or credit funds.

[40] LendingClub Statistics.

both in P2P and P2B. It has been recently listed and its market capitalisation nears 1.4 billion pounds sterling.

It is important to emphasise that the Fintech revolution in lending is so recent that no one has been able to observe the impact that an economic recession could have on the global outstanding loan portfolio, which would bring scrutiny to the quality of credit rating and loan granting systems. We maintain a healthy scepticism until authoritative data is obtained after a full economic cycle.

2.1.2 Private banking and wealth management: *Robo-advising*

It is possible that an individual would keep cash in the bank because of the peace of mind that liquidity brings them. However, most people who hope to increase their personal savings realise the enormous benefit to investing spare cash into financial assets that provide a higher rate of return. For these people, it was traditionally banks who would advise them on what product (money market funds, insurance) to buy. This process has been lucrative for banks, who occasionally recommend "in-house" products, meaning the bank takes a commission for the sale and a commission for the management of the product. After the sale of an investment product, the money leaves the bank's balance sheet to the balance of the investment fund. The problem resides in the conflict of interest that advisors have when suggesting the bank's own funds. Profitable for the banks, the moral question becomes whether the most adequate product for the specific individual was recommended. The situation is comparable to a pharmacist at a Bayer operated pharmacy answering a client question of whether Aspirin is better than Advil…

If a client's investment potential is even higher (around 2 million euros, for example), advising becomes "Wealth Management", objective of which is to offer a service tailored to the needs of these high-net worth individuals. This industry can also be highly lucrative and prone to conflict of interest (recommending the best product for the client vs. recommending the most profitable product for the advising bank). If the client is an ultra-high net worth individual, they are likely to constitute their own private investment office, known as a family office, or multi-family office if they are joined by other ultra-high net worth families to directly purchase investment products from vendors.

The whole personal financial advisory business is under fire from so-called robo-advisers. These are artificially intelligent systems which take into account large amounts of data about a person and then cross-reference that information with financial product databases to advise clients on their ideal portfolio allocation, avoiding conflict of interest and human error (sometimes associated with financial psychology) and reducing costs. Another interesting aspect of these robo-advisers is the reduced balance needed to access their services, attracting low-net worth clients to the system.[41] Offering investment advice was only profitable for the adviser if the client's wealth was above a certain threshold, but this technology has cut the cost to the point where it is worth advising even the smallest retail investors.

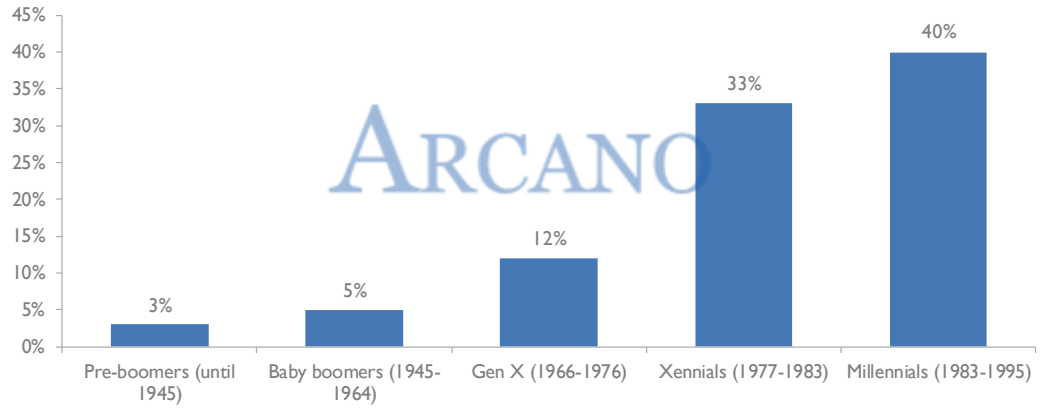
Critics affirm that it is impossible for robo-advisers to offer the full breadth of personalization for a client, and that no matter how good the robo-adviser; there will always be a need for the human element of assessing a client's complete situation. Also, robo-advisers are not really financial planners, since a good adviser goes far beyond just investing funds and minimizing tax expenses for their client. A financial planner should know their client as well as possible (their fears and phobias, their exact risk aversion…) to know what products and services are most

[41] MiCappital, Spanish robo-adviser focused on Millennial and Gen Z clients.

beneficial to them. Finally, robo-advisers have been roundly criticised for their inability to outperform passive investing (via indexing).[42] These valid criticisms are why there is a tendency to integrate the functionality of a robo-adviser with the personalised service of a human adviser. With that said, there are specialised robo-advisers that recommend the cheapest and most efficient passive funds (exchange traded funds or ETFs), such as the previously mentioned Acorns.

Another compelling argument in favour of robo-advisers is that they attract Generation Y consumers (Figure 8). Because young people generally have less experience in investing and less money to invest, robo-advisers can be a great resource. Their easy access and negligible investment requirements have unsurprisingly made Millennials the primary users of such services who, unlike investors in previous generations, do not yet require professional and personalised investment services. The demand-side change points to a big disruption down the road in how future generations manage their money.

Figure 8: **Rate of robo-adviser adoption for different generations**



Source: JD Power Research, Arcano Economic Research

Today's leading robo-advisers are Vanguard's Personal Advisor Services (manages over 112 billion dollars with robots), Charles Schwab (33 billion), Betterment (14 billion) and Wealthfront (10billion). Still, the success of this strategy is not guaranteed if the robo-adviser is not competitive and doesn't generate value. UBS recently closed their robo-advisory service and sold the tech to SigFig because it was underperforming.[43]

In any case, the sheer emergence of robo advisers as a new business model is broadly triggering lower advisory fees throughout the financial industry. A recent article[44] published in The Wall Street Journal, "The Price of Financial Advice Is, Finally, Falling", exposed that commissions are already falling in the United States mainly driven by:

- Technology, which opens up a world of choices and enhances the operating efficiency of advisors.
- The in-depth screening by heirs of large fortunes who are more familiar with digital vs traditional advice.

[42] Beioley, K. (24 August, 2018). Robo advisers fail to beat market benchmark. *Financial Times*.
[43] Beioley, Kate. (29 August, 2018). UBS closes its UK robo-advice service to new customers. *Financial Times.*
[44] Beilfuss, Lisa (7 October, 2018). The Price of Financial Advice Is, Finally, Falling. *The Wall Street Journal.*

- The fact that a more comprehensive service is being offered at the same cost. Many companies provide qualified advice which goes beyond portfolio management, and includes tax management, business consultancy, retirement planning and even savings plans for children's education.

2.1.3 Asset Management: Algorithmic Trading and Electronic Settlement

When a manager or an individual decide to buy or sell a stock, the order is executed by a broker on the stock exchange and settled through a clearinghouse. The purchaser then receives a certificate of ownership representing the value of the stock, but the amount given to the broker is no longer in the purchaser's savings account. As previously mentioned, even though the trading floor was digitalised in 1971 with the introduction of the NASDAQ exchange, open outcry auctions existed until very recently. The process of a manager instructing a broker which stock to buy or sell, and then the broker executing this order on the market, later clearing the transaction through their back-office[45] has only been automated as of very recently, but has since reduced the cost of executing a transaction by over 90%. However, in the bond market, a large majority of sizeable orders are still executed manually, carrying a considerable cost burden.

Part of the process is automated but the inherent cost reduction has not fully affected the end user, especially in the case of retail investors. This way, if an individual instructs their bank to buy stock in Walmart for example, the individual will end up paying broker's fees significantly higher than the cost of executing a similar electronic transaction through an online broker.

With the intention of resolving this issue, American entrepreneurs in San Francisco launched the Fintech platform Robinhood, based on a mobile application, which massively facilitates the process of purchasing and selling stocks: they charge no commission for executing a transaction. The company generates revenue by offering a type of credit to their users called margin lending, by which an individual can leverage their current assets (cash or liquid securities) to invest more than they would otherwise be able to. Additionally, since users deposit cash into their Robinhood account, the company can obtain a return from managing these unspent funds. The company was valued at 5.6 billion dollars[46] after its last round of funding.

As we have already explored, when a bank or a wealth manager contracts a product from a fund manager, the money gets transferred from the bank to the fund owner, who invests it for a commission or a percentage of profits. Investments can vary between fixed-income products (bonds, treasury bills, CDs), equities, or alternative assets (Private Equity, infrastructure, real estate, etc.)

The asset management industry spans an enormous number of passive funds, pension funds, insurance products etc., totalling an estimated 50 trillion dollars of assets under management. Fund managers base their activity on the analysis of their employees, including financial analysis to decide the best way to allocate resources within the company's scope of business.

No surprise, Fintech disruption is also provoking a profound transformation of this industry. In the same way that it has been debated whether or not a robot is a more efficient and effective portfolio adviser than a human, there is an argument of whether a machine can make better investment decisions than a human in certain segments of the asset management industry.

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[45] The back office is the set of internal functions supporting all client-facing operations of a business.

[46] Lynley, M. (19 May, 2018). "Free stock trading app Robinhood rockets to a $5.6B valuation with new funding round", *Tech Crunch*.

For example, a fund manager could decide to buy or sell Walmart stock based on the information and analysis available, as well as their own personal experience. A machine would make or reject the decision by mining millions of data points about Walmart and its stock price. The gleaned information would then be cross-checked with historical information to see what information actually had an impact on the price of the stock. Those data points that have historically affected movements in the stock are then registered into the algorithmic system determining whether the stock is a Buy or a Sell. To give a simple example, the system could identify that there is a logical correlation between Walmart's stock price, its sales, and the number of cars parking in its shopping centres (Figure 9). From this correlation, real time analysis of hundreds of satellite images of car parks can provide instant information about whether sales at Walmart will be better or worse than the market expects. At this point, the decision to buy or sell would be made. These capable systems are called algorithmic trading.

Figure 9: **Satellite imagery of Walmart parking lots**

Source: Arcano Economic Research

The adoption of this technology will occur with listed securities for which information is more accessible before the adoption for non-listed investment such as venture capital, where information is scarce. Undoubtedly, the degree of penetration of these systems will depend on the underlying assets and on the level of trust earned by the algorithm. Currently 35% of bonds under management by American asset manager Alliance Bernstein (500 billion dollars of assets under management) are managed by their algorithm Abbie.[47]

2.1.4 Cryptocurrencies & Initial Coin Offerings (ICOs)

This section analyses the surge and subsequent reconsideration of cryptocurrencies and Initial Coin Offerings (from now on ICOs). In the Fintech and economic development section, we analysed the potential benefits and consequences of the use of cryptocoins by central banks.

Cryptocurrencies

A cryptocurrency is a type of alternative currency, a digital asset designed to function as a method of exchange, using advanced cryptography to guarantee the end-to-end security of the payment process. In this way, cryptocurrencies use a decentralised operations processing

[47] Wigglesworth, Robin. (May, 2018). Bond trading: technology finally disrupts a $50tn marker. *Financial Times.*

mechanism through blockchain technology, totally antithetical to a traditional currency, whose emission is a monopolistic function of the central bank.

In December of 2017, Arcano Economic Research published a report called "The Bitcoin Bubble: Invaluable but Overvalued". The report explained how it was possible for cryptocurrencies to have no intrinsic value, and voiced fundamental doubts over the use of cryptocurrencies as a substitute payment method or as an alternative to traditional currencies. Since then, the price of Bitcoin has plunged more than 65% from its historic high. Still, it is worth diving much deeper into the cryptocurrency phenomenon, reviewing not only Bitcoin, but several other relevant examples of this technology.

The most significant cryptocurrencies today are Bitcoin, Ether, XRP and Bitcoin Cash:

- Bitcoin is the largest in terms of market capitalization, valued at over 110 billion dollars,[48] with over six million users.[49]
- The total value of all Ether, created by a start-up called Ethereum to considerably improve the efficiency of Bitcoin processing, is just over 22 billion dollars.[50] Whereas Bitcoin's ledger only consists of names and amounts, Ethereum's ledger offers the possibility of introducing scripted programs instead of amounts, giving the ledger the ability to model functions and enact so called "smart contracts":[51] sequences of computer code that can broker the exchange of money, assets, content, or anything else of value upon fulfilment of pre-programmed conditions. Essentially, these smart contracts exist on a public record, executing autonomously and securely.
- XRP, literally coined by the company Ripple, has a total value of over 11 billion dollars.[52] Apart from the cryptocurrency, the company has a project called the Ripple Payment Protocol, an advanced digital infrastructure for the processing of interbank transactions using XRP as the unit for value storage. The technology is an interesting solution to the inefficiencies of the current systems, but there are enormous obstacles to integrating it with infrastructures in place today. XRP, like all cryptocurrencies, lacks the confidence required by banks and their clients.
- Bitcoin Cash is an off-shoot of Bitcoin, created with the objective of improving some of Bitcoin's characteristics like the processing speed and cost burden. Whether it even achieved this is subject to debate, but ultimately Bitcoin Cash failed to fix the fundamental problems of Bitcoin.

Initial Coin Offerings (ICOs)

Initial Coin Offerings or ICOs are financing mechanisms which entail issuing a cryptocurrency as a method of capturing funds. ICOs have become a source of alternative financing for companies, particularly for small or medium projects of a technological nature, generally involving some aspect of blockchain technology. The peculiarity of investing in this type of offering is that one buys 'tokens' (restricted use coupons, chips, pieces), thus contributing funds to the project. Those tokens that represent an ownership stake in a company are referred to as 'security

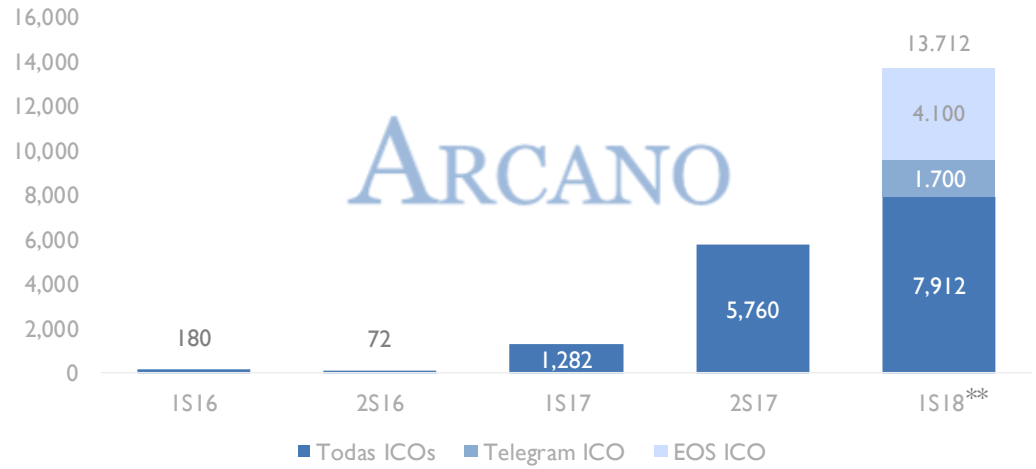
[48] Coinmarketcap.com
[49] University of Cambridge (2017). Global Cryptocurrency Benchmarking Study.
[50] Coinmarketcap.com
[51] *Smart Contracts* programmed protocols that can facilitate the exchange of money, content or anything of value. Executes the "contract" upon fulfilment of "the conditions".
[52] Coinmarketcap.com

tokens'[53] and may be subject to international securities regulations. For example, American company Swarm 'tokenises'[54] real assets under SEC guidelines,[55] making the owner of the coin legally entitled to future earnings of the underlying asset. 'Utility tokens'[56] are a type of offering where the coin represents value in the form of a future, non-financial benefit from the company. Start-up Filecoin raised 247 million dollars by issuing utility tokens which represented access to its decentralised cloud storage platform (similar to Dropbox) once it was developed. Meanwhile, the tokens can be traded on exchanges, setting their value according to supply and demand.

They could increase in value either if the project is so successful in marketing itself that demand for the tokens increases, if tokens are required for payment for the project's final product or service (increasing demand and therefore value, if the project is successful), or through pure speculation. It is worth mentioning that almost half of projects launched in 2017 have failed in 2018 and 13% of the surviving projects are considered 'semi-failed'.[57] In most cases, it is because no realistic business plan was ever developed, and in some cases companies are simply dishonest. Surprisingly, despite the negative reputation of some ICOs, between January and June of 2018 13.7 billion dollars[58] were raised via this financing method, a figure that trumps the entirety of 2017 (Figure 10).

One of the most important ICOs to date was Telegram's. The cloud-based instant messaging system successfully raised 1.7 billion dollars by offering a new cryptocurrency to some 200 private investors.[59] The company will invest the funds in the development of a digital payment system they have called the Telegram Open Network (Figure 10).

Figure 10: **Capital raised through ICOs (in millions of dollars)***



(*) Calculation based on cryptocurrency exchange rates during the final days of the ICO. Given that cryptocurrencies Ether and Bitcoin are highly volatile, the actual market capitalization could vary widely from the figures depicted in the graph.
(**) ICOs until 05.29.2018.
Source: PricewaterhouseCoopers, Crypto Valley, Arcano Economic Research

[53] Equity rights (economic and/or voting rights).
[54] Tokenising is the process of turning the value of an asset into a virtual cryptotoken, in order to trade it through a blockchain infrastructure.
[55] SEC: U.S. Securities and Exchange Commission.
[56] Rights to the future use of the service or product associated with the project being financed through the ICO.
[57] Morris, D. Z. (25 February, 2018). Nearly Half of 2017's Cryptocurrency 'ICO' Projects Have Already Died. *Fortune*.
[58] PwC. (2018). Initial Coin Offerings – A Strategic Perspective (Junio 2018 Edition).
[59] Vigna, P. (2 May, 2018). Telegram Messaging App Scraps Plans for Public Coin Offering. *The Wall Street Journal*.

Critics have blasted the lack of security of ICOs as well as the poor security of the exchanges that host them (the Coincheck case in Japan[60] as an example). With all these antecedents, it is not surprising that the regulatory reaction is ever more hostile towards cryptocurrencies and ICOs. The latter have recently been outlawed in China, along with digital token exchanges. The American SEC has prohibited operating in ETFs with exposure to cryptocurrency futures[61] and in general, regulators are closer to considering ICOs as an issuing of negotiable assets, dropping them from the current regulatory limbo which has occasionally permitted abuses of the system.

These ICOs can sometimes be reminiscent of the internet stock boom at the beginning of the 21st century. It was already known then that the internet would have an enormous economic impact, but it was not clear what projects would end up being successful. Most of them indeed failed (returning no value to investors), but the ones that survived took home an important piece of the pie and recorded astounding returns. Amazon, valued at just over 400 million dollars in its 1997 IPO and now worth almost a trillion dollars, is a good example. The risk of losing everything in an investment like this is much higher than the chance of earning a lot. ICOs, even more risky and opaque, have been described as "financing the construction of a casino in exchange for poker chips. But those poker chips are only worth something if the casino is built".

2.2 Impacts on the financial sector

Global investment in Fintech has grown steadily for the last years (Figure 12). Today the hubs of Fintech innovation are in the United States (New York City and Chicago), London (which attracts 75% of investment in Europe),[62] Luxembourg (where London based companies requiring regulatory protection are moving to following Brexit), China and India. Fintech is changing the business model of traditional financial service providers. Nonetheless, it is still too early to predict how and how much the sector will change. Only a small minority of these companies can be considered multinational. The majority of new competitors remain in the start-up phase, seeding doubts about their sustainability and their potential to generate profit (especially since many are unprofitable). There is no way of knowing whether these Fintechs will end up occupying an important segment of the financial industry or if they will hone in on specific niches. It does appear though that the traditional companies of the sector perceive value in the activities of Fintech companies, and they have started opening their cheque books to partner with them, invest in the underlying technology, and make outright acquisitions (WePay was recently acquired by JP Morgan for 400 million dollars).[63] As we will explore in the following pages, technological disruption in mature industries is always rooted in the exploitation of concrete opportunities.

[60] In January 2018, Coincheck was hacked due to a lack of strong security measures, and thieves made off with tokens worth over 530 million dollars. No suspects have ever been charge in connection with the theft.

[61] Browne, Ryan. (10 Sept, 2018). SEC suspends trading in Bitcoin and Ethereum-related products over ETF confusion. CNBC markets.

[62] CB Insights (2018). Global Fintech Report Q1 2018.

[63] Browne, R. (18 October, 2017). JPMorgan buy Fintech start-up WePay. *CNBC.*

Figure 11: **Global Investment in Fintech. 2010-Q2'2018 (in billions of dollars)**

Source: KPMG, Pitchbook, Arcano Economic Research

2.2.1 Reducing Barriers of Entry

The success of any business is based on the existence of potential barriers of entry, intimately related to the business' competitive advantage. Traditionally, the banking industry held two important advantages: the confidence of their clients (key when talking about safeguarding money) and regulation (supervisimon by a central bank). The latter acts a filter, allowing entrance to the business only those firms with plentiful resources, assuring the financial solvency of banks but at the same time generating costs that small firms could not affront.

How have the traditional barriers of entry changed?

The financial crisis which began in 2008 turned out to be seismic. With it, the historical confidence in banks soured when iconic institutions like Citigroup had to ask the State for help, a process which also affected many smaller but historically successful enterprises like Spanish savings banks. The crisis provoked public outcry towards the sector not just because of the bailouts, but for the perception that banks had not been acting in the interest of their clients. This view has not really changed since then, with little reason for it to. As recently as July 2018, the same month in which the Bank of England was announcing an interest rate hike, many British banks proceeded to lower their deposit savings rate by 0.25% just to raise them following the announcement of the BOE, thinking their clients would never notice.

On the other hand, regulation has also paradoxically accelerated the loss of confidence in traditional banking institutions. Central banks, responsible for ensuring the solvency of the financial system, lost some of their prestige and credibility when they failed to recognise the incredible instability leading up to the market crash. The central banks reacted with a historic experiment in quantitative easing, which proved fruitful in some cases but also generated more distrust in the fiat currencies on which financial systems are based. It is true however, that trust is returning to the fiduciary system, fact that along with other factors, is contributing to the recent dive in cryptocurrency prices.

Technology has allowed for the separation of the lending and saving business (as was the norm before the 13th century). Regulations on banking are strict because of the risk associated with funding loans with people's savings, so if a company focuses on a singular function, they may be able to generate less systemic risk and avoid regulatory barriers of entry. If Fintech disruption causes there to be companies specialised in deposits and others specialised in lending, we may

have to reconsider the very fundamentals of what we understand as banking. Either way, one would hope that both worlds can coexist.

In certain terms, the gradual reduction of the traditional barriers of entry to the banking industry will pose a significant risk to the sector's giants. Potentially the biggest risk is that Fintechs will attack the most profitable segments of the banking industry, leaving traditional banks with the crumbs of less lucrative lines of business, such as taking deposits. It is just one more threat to an industry which, for the last decade, has seen muted performance due to the low interest rates environment and the enormous losses linked to credit defaults during the financial crisis. The whole situation is troubling given that banks play an essential role in recycling deposits into loans that sustain economic growth. For that reason, it would be bad news for society if the business of banking were no longer profitable.

2.2.2 Transition from a relationship model to a transactional model

Banking has traditionally followed a relationship model, centred on the client. Slowly, this has migrated towards a more transactional model, centred on the different types of operations which each division could execute with a client with the purpose of maximizing profitability, especially since the financial crisis of 2008.

This shift, understandable in its scope, entails two liabilities:

- First, the fact that the abundant data that banks have about their clients could not be handled with the required speed and accuracy to exploit artificial intelligence fully. This gap was promptly filled by Fintech companies (generally start-ups) and by Bigtech companies (big technology companies such as Apple entering in the financial business, as we will discuss later).
- Second, in going from a customer-centric, relationship banking model to a transaction model, operations have been carried out without prioritising the best interest of the client. Thus, a gap widened between cost and value so that customers, especially the younger ones, perceive more value in what Fintech companies offer, which is a new way to provide financial services.

Perhaps the future, spurred by the new *Open Banking* and PSD2 regulations which force banks to share their customers' payment information at the customer's approval, entails that the user of financial services will have an app that centralises all their deposits, loans and, perhaps, insurance products from different supplier entities. This would allow for a better analysis of one's global position, the ability to consolidate of positions and better decision-making tools to contemplate the most appropriate investments available. However, it will complicate the traditional banking model, because the client will have much more information available and will be able to opt for different banks to provide different services (for banks, cross-selling will be more complicated) in an ecosystem with a lower entrance barrier. That is how for example, a German app solarisBank, compares the profitability of deposits in user accounts, and scans the market searching for better alternatives, making instant suggestions. A similar but more global application is carried out by Fintech company Plaid, launched in 2013 in the United States as a tool to administer funds, which today manages a platform that aggregates all of a user's bank accounts. Plum offers investment funds through its smart chatbox,[64] powered by AI (Figure 12). Clarity Money[65] was recently purchased by Goldman Sachs to integrate it with the

[64] O'Hear, Steve. (October 2017). Plum bets on Facebook Messenger as the place to manage your finance. *Tech Brunch.*
[65] Resnick-Ault. (16 April, 2018). Goldman Sachs buys personal finance start-up Clarity Money. Reuters.

aforementioned Marcus (primarily loans) and offer services such as cancelling subscriptions (Spotify…), recommending credit cards, and managing savings. However, moral dilemmas can also arise from the use of these apps. By knowing our data, companies could predict the highest price that we would pay for a service and then maximise what they charge us... so a conflict of interest would continue to exist.

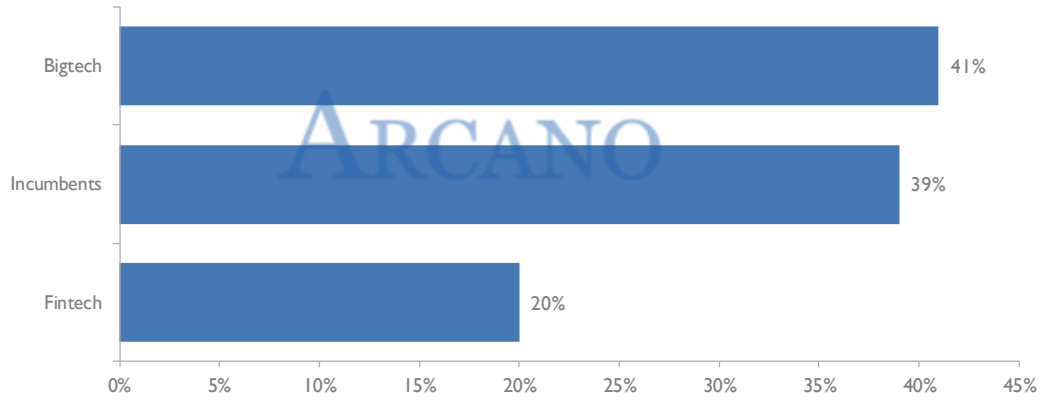
Figure 12: **Plum's Chatbot offering investment funds**

(*) Survey, percentage of responses
Source: Plum, Google

2.2.3 Bigtech's reaction: from Fintech to Techfin

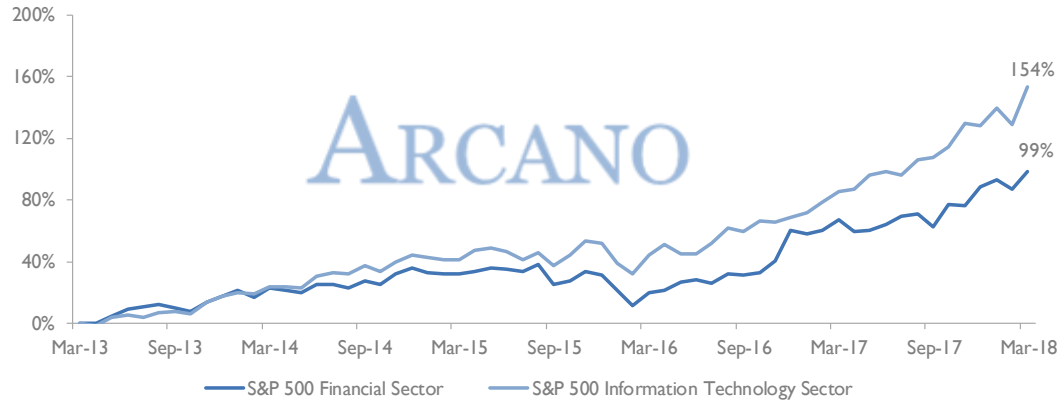
Currently, the technology giants, also known as Bigtech, already offer financial services: Google and Apple have a payment system, Amazon gives loans, and Alibaba manages its clients' capital as if it were a fund manager. In the next five years, they may become the most impactful companies in the financial sector (Figure 13). These companies have something in common with Fintech: they are slowly gaining market share in the lucrative banking business without having to abide by the same strict regulations. Duly, the evolution of Bigtech in the stock market is far superior to that of the banking sector, even though Bigtech has also faced an environment of low interest rates that harms its profitability (Figure 14).

Figure 13: **Types of businesses with greatest potential impact over the next five years***



(*) Survey, percentage of responses
Source: McKinsey, Arcano Economic Research

Figure 14: **Technology stocks outperform the financial sector for the last several years**



Source: S&P 500, Bloomberg, Arcano Economic Research

One of the most notable examples of a tech giant who has burst into the financial sector is Amazon. The company is intruding into the sector from all possible angles: payments, loans, insurance, and very soon, checking accounts. To state that Amazon is focusing all of their efforts into creating a new-generation bank would be an exaggeration, but offering a series of financial products is designed to support their principal strategic objective: being increasingly present among their clients. This strategic objective aims to augment the number of sellers and clients, by simultaneously facilitating the buying and selling process. Currently, Amazon offers payment and finance methods. In 2007, they began developing the Pay with Amazon system, in which it has invested strongly – also logically, because payments are highly linked to their original business of selling products online. It is also possible to use Amazon Pay, a digital payment service which has 33 million clients in 170 countries. Another banking activity that Amazon has put in its crosshairs is lending, which launched in 2011 to help smaller businesses grow and sell more through the Amazon platform (in the United States alone, more than 300,000 companies sell through Amazon's platform). Up until the end of 2017, in only six years the company has lent 3 billion dollars to 20,000 businesses in the United States, the United Kingdom and Japan. Currently, they are associating with banks all over the world to increase their market share. An example of this is the Alliance with Bank of America to offer loans, with principals ranging from 1,000 to 750,000 dollars.[66] Apart from financing small businesses, Amazon also commercialises consumption credits using credit cards for *Prime* clients, a fruit of Amazon's deal with Visa, and is also exploring the cashback system by which part of a client's purchase price is returned. Amazon Cash is another Amazon service, destined for clients who either have very limited or entirely lack access to banking services; according to a recent poll by the FDIC (*Federal Deposit Insurance Corporation)*, there are more than 33 million American households in this situation. Furthermore, Amazon has plans to set up a new banking alliance, in this case with JP Morgan, to create a product similar to a checking account.[67] Their next goal will probably be to enter in the insurance business. To date, their only experience in this sector is Amazon Protect, a product that clients in the United Kingdom enjoy, which insures products acquired online in case of theft or accidental damage. It is rumoured that the company plans to offer life, health and home insurance (it has just announced an alliance with Mapfre in Spain). Another possible market for

[66] Kim, E. (14 February, 2018). Amazon has partnered with Bank of America for its lending program. *CNBC.*
[67] Glazer, E. (5 March, 2018). Next Up for Amazon: Checking Accounts. *The Wall Street Journal.*

Amazon is mortgage lending, and as such, they have already strategically signed executives from the sector.[68]

However, the fact that many banks and financial institutions are quite active when it comes to adopting new technology has turned them into lucrative clients for big technology companies. The business of the internet and cloud computing grows at a dizzying speed and has become a priority for many of these giants, including Amazon, Google and Microsoft, who count banks among their clients. Leading entities such as JP Morgan and UBS have made significant investments in new technologies and it is starting to become part of usual operations to transfer processes and sensitive data to the cloud, so it is expected that this item of expense will increase significantly in the coming years.[69] This is one of the reasons for which the big technology companies have abstained from fully diving into the banking business for now.

Instead of trying to steal market share by providing banking services themselves, it is becoming more frequent for technology companies to enter in the sector by allying with banking entities. This is a strategic move for the technology companies, because it allows them to operate in the financial industry without having to apply for the pertinent licenses. In other words, they sell their technology to banks, a process which has been denominated "Techfin." For example, Goldman Sachs has teamed up with Apple to co-launch a new credit card at the beginning of next year under the Apple Pay brand.[70] This alliance could expand into other services, such as in-store loans offered for clients purchasing Apple products.

It should be noted that, despite the theoretical "non-aggression pact" Bigtech seems to be carrying out with traditional banks, the banks do not stop looking at them with a certain apprehension. In fact, the most coveted raw material for Bigtech tends to be data, the more essential for understanding a client's profile, the better. This allows them to apply their advanced algorithms and maximise personalization for sales, optimizing the process (maximizing the probability of commercial success and minimizing costs at the same time). Also, the traditional Bigtech/bank alliances can uncover for Bigtech data as sensitive and useful as financial status and cash flow patterns. In principle, this fact does not mean that Bigtech will begin to massively acquire banking licenses to compete directly with financial institutions. However, with time, it may cause them to reflect on whether they truly need the banks as allies when they already have the asset they most desire, the customer data.

Finally, it is important to reflect on the dangers that Bigtech offering all types of financial services to its clients/users could cause to society. Like the development of the 2008 crisis, it was partly due to perverse incentives from banks to lend in excess to individuals (mortgages) and real estate. What would happen in a benign moment in the economic cycle if, for example, Facebook could grant loans to its perfectly profiled users with a simple click? What if the algorithms detected via photo or message, a transient moment of personal euphoria, and they took advantage of the opportunity to "invite" them to take out a loan for a luxurious vacation? Although the algorithms could identify excessive risk in the concession of said loan, history offers us clear proof of what entrepreneurial short-sightedness and the desire to quickly generate profits can cause. Many employees of banking risk management departments in 2007 also saw

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[68] Gaffney, J. (8 March, 2018). Amazon hiring head of newly-formed mortgage lending division. *HousingWire.*

[69] It is estimated that the banking sector will invest over $12bn in cloud computing infrastructure by 2021, compared to current investment of $4bn. Worldwide Semiannual Public Cloud Services Spending Guide. International Data Corporation (2018).

[70] Mickle, T. (10 May, 2018). Goldman Sachs, Apple Team Up on New Credit Card. *The Wall Street Journal.*

risks in the medium term... but senior executives paid more attention to the potential short-term benefits of lending.

2.2.4 Reaction of banks to Fintech companies

Fintech companies are targeting the banking business, although the industry is bracing itself to adapt to the digital world. The capacity to embrace new technologies and adapt to potentially major breakthroughs in a competitive scenario will be one of the keys for the future of the industry in the next five years. For example, some reports estimate that those banks that take longer to integrate technology will see their profits go down 15-20%, whereas early adopters may see them rise by some 15%.[71] The competitive advantages of Fintech companies allow them to challenge banks, not in terms of compliance but in reaching higher levels of customer satisfaction. Therefore, most Fintechs are not pursuing a bank charter that would make them bear the associated regulatory costs, and prevent them from targeting some of the most important business of traditional bank basing on their more efficient and better-priced product offer. Their lower cost structures do not have to bear the sunk costs associated to extensive branch networks.

However, the real competitive edge of Fintech companies is the radical shift that the consumption patterns have undergone derived from the smartphone revolution. In the end, the amount and quality of data available to consumers has soaring fuelled by 24-hour connectivity to the internet. This reduces significantly the information asymmetry from which the banking industry has historically benefited, and increases exponentially their bargaining power, thus potentially eroding the return of the traditional financial sector.

Anyhow, although Fintech companies encourage innovation in the financial sector, they have not been able yet to reach substantial market shares on an aggregate level. In the 2017 World Economic Forum, Fintech companies were depicted as "disruptive", "revolutionary", armed with "digital tools" and with the ability to "eliminate the barriers" of longstanding institutions. However, the reality is that many of these companies have had to cope with problems as the high costs of winning new customers (in the absence of a network of physical branches or of enough financial muscle to invest in costly advertising) or lack of scalability.

Although they are growing at a robust pace, there are but a few purely digital banks and they may not yet boast either a remarkable number of customers or a wide product range. Fintech companies have been more successful in methods of payment since they have contributed to an improved customer experience and to noticeably reduced costs in international transactions. On the other hand, loans and robo-advisers have not got off the ground yet. For example, in the United Kingdom, they barely account for a combined market share of 1%.[72]

Nonetheless, banks and other financial institutions have realised the value behind Fintech and have started to adapt their strategies and business plans –more often than not, via acquisitions –. Goldman Sachs, for example, has just acquired Final, a start-up in the methods of payment business, and BBVA is now the owner of Openpay. Furthermore, Goldman Sachs itself, which bought a traditional banking license during the crisis, spotted an opportunity in digital banking by acquiring General Electric's commercial bank (GE Bank), and using its technology to launch in the United States Marcus, a digital bank. Marcus uses an app to attract high-yield deposits (already

[71] Barclays Research (2018). Future of Banking: Digital Banking Vol. 1.
[72] Barclays Research (2018). Future of Banking: Digital Banking Vol. 1.

amounting to close to 20 billion dollars) and to offer mortgage loans. Marcus has just started operations in the United Kingdom, where it will have to compete with similar companies like Atom, supported by BBVA.

Besides, the sector has become aware that strategies should be based on investing in technology directly and at an internal level. Many institutions are already developing new products and some of them, like Bankia, Santander and BBVA (already testing facial recognition for payments) have even backed start-up incubators. Supported by Royal Bank of Canada and ANZ Bank, JP Morgan has rolled out a blockchain-based pilot payment platform. Its goal is to improve efficiency and protect the payment business, especially as far as international operations are concerned, ahead of the increasing challenge from Fintechs. Close to 75[73] banks have recently joined the program, among which is the Spanish Santander. On the other hand, the disruption in the transfer business created by digital wallets has prompted some traditional players in the industry, like Western Union, to face competition from newcomers by launching a digital platform for operating at a lower cost.

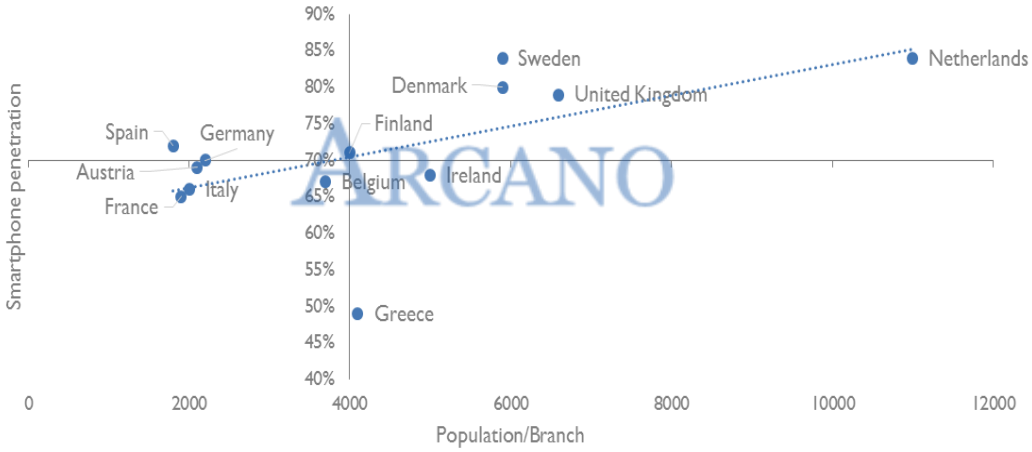
Finally, banks are already forging partnerships with Fintech companies for consumer and SMEs financing-related business. Santander has joined forces with the American Kabbage to provide loans to small firms through a fully automated platform. The process, which used to last from two to 12 weeks, takes now only a few minutes from the moment the request is filed until the decision is taken. The funds are received on the same day.

Our conclusion is that Fintech companies have enhanced competition in financial markets since they provide the same services as traditional financial institutions do, but probably in a more efficient way and with an upgraded customer experience. However, Fintechs will not replace banks in key operations. In most cases, they render the same services in a more streamlined way, but the bank industry is also well positioned to embrace innovation and implement technological advances on their own, especially thanks to their bigger scale.

One of the strategical clues of this revolution for the banking industry is the capacity to cut costs, apart from that of offering customers a more user-friendly experience in their daily operations. Thus, if the adoption of technology continues on the rise, financial institutions could depend less on their branch network, not only as far as transactions are concerned, but also regarding marketing activities. The high rate of smartphone and internet users (63% and 77% of the population, respectively) could contribute to this reduction in the number of offices (Figure 15).[74] At present, there are 2,300 individuals per branch on average in Europe, and 1,600 in Spain. On the other hand, Figure 16 shows how banking operations have been migrating from the internet towards the mobile channel in the last few years both in the United States and in the United Kingdom.

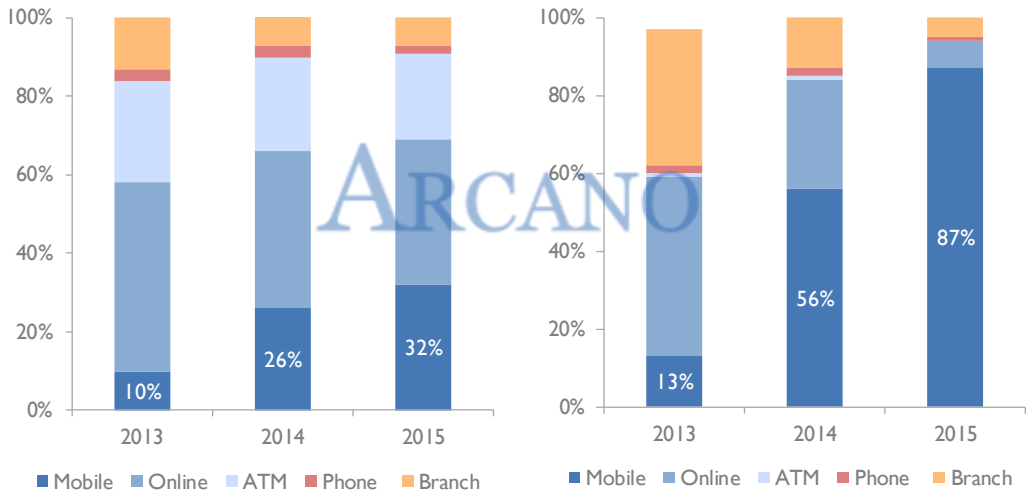
[73] William-Grut, Oscar. (25 September, 2018). 75 banks have joined JPMorgan´s blockchain 'party'. *Business Insider.*
[74] European Central Bank.

Figure 15: **Penetration of smartphones and number of inhabitants per branch**



Source: BCE, Eurostat, Arcano Economic Research

Figure 16: **Banking channels: US (transactions) and United Kingdom (current account)**



Source: BCE, Eurostat, Arcano Economic Research

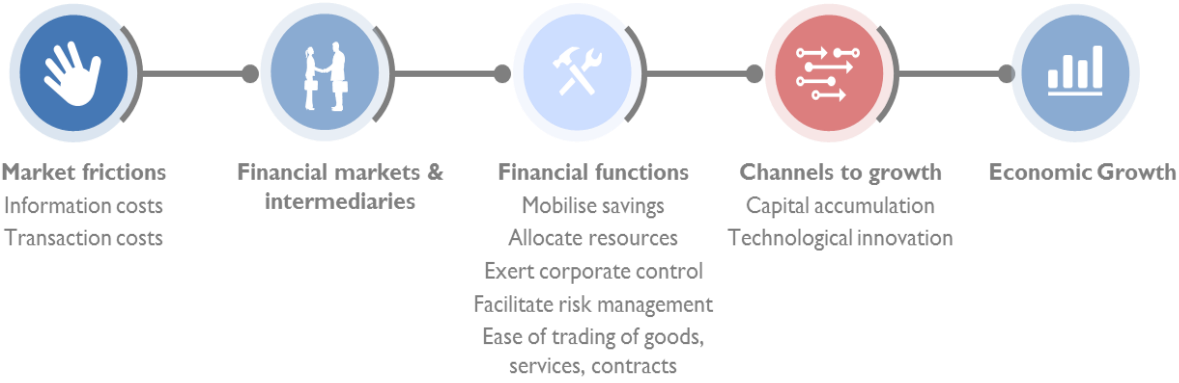
3. Fintech: Repercussions on global growth and monetary policy

3.1 Relationship between Fintech and economic growth

In John 12:8 Jesus tells Judas that "you will always have the poor among you". However, it is possible that Jesus was referring to those of poor character, because if we define poverty as "extreme poverty" according to World Bank's criteria (those living on less than a dollar ninety a day of income per capita), another reality emerges. Since globalisation's rapid acceleration beginning in the early 90s, 52 million people a year have escaped extreme poverty.[75] By 2018, less than 10% of the global population lives in extreme poverty (approximately 738 million people). At this rate, it is well possible that poverty will be eradicated from the planet within 30 years.[76]

There exists a very significant correlation between the financial services sector and economic growth (Figure 17). Many academics have studied this phenomenon extensively, notable among which are King and Levine[77] for their empirical analysis and argument that the financial sector optimises the allocation of capital throughout the economy, that the financial sector channels excess cash from the wealthy (investors) to those who require capital for their productive means (entrepreneurs). Because of the financial services sector, there are more productive transactions circulating in the economy, accelerating economic growth. The associated costs (i.e. opening physical branches) especially in poor countries with low population densities, act as an obstacle to the development of the financial service sector. Fintech, for its characteristics, could help overcome this obstacle and immensely contribute to growth and prosperity.

Figure 17: **Theoretical approach in the finance-economic linkage**



Source: "Financial Development and Economic Growth: Views and Agenda". Ross Levine (June 1997), Arcano Economic Research

Even though it is clear that financial development positively affects economic growth (with a demonstrable correlation between developed countries and the penetration of the financial services sector), its impact on inequality is not necessarily so. Some of those in society who wish to borrow money to start a new business cannot do so because they do not meet the credit requirements set by banks and lenders, who prefer to extend credit to people with high-income

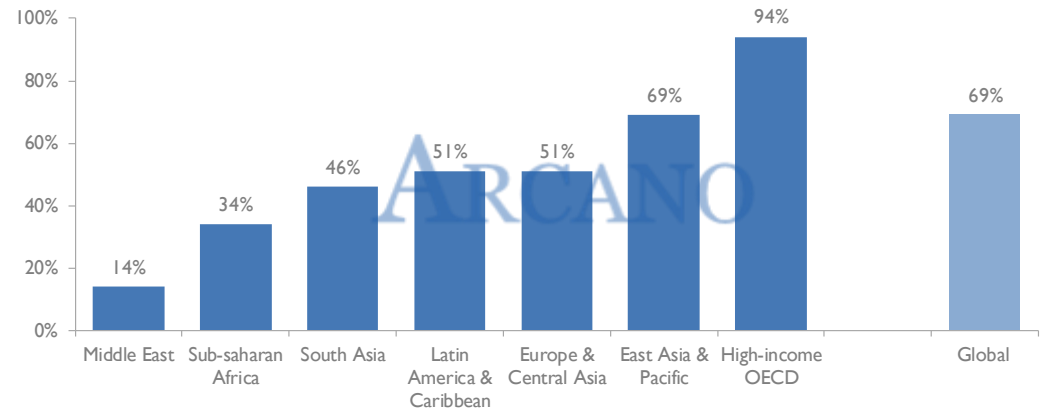
[75] Roser, M. and Ortiz-Ospina, E. (27 March, 2017). Global Extreme Poverty.
[76] World Bank (2018). Pobreza Panorama General.
[77] King, R. G., and Levine, R. (1993b). Finance, entrepreneurship and growth.

or existing businesses. Thus, the evolution of the financial sector does not reach nor benefit everyone equally, thereby exalting inequality.

Many initiatives have been launched with the goal of reducing this vicious cycle. For example, in Peru in the 1990s, Hernando de Soto initiated a series of reforms that allowed the poorest in society to register goods they possessed (even the humblest living space) into a national registry in order to facilitate their access to banking. The country managed to quickly cut the poverty rate from 60% to 20%.[78] Also micro-loans, introduced in the 1970s by Muhammad Yunus in Bangladesh and now used worldwide, provided small loans generally to women and for agricultural projects. These loans contributed to the significant increase in agricultural productivity – for example, by facilitating the use of fertilisers – at the same time that they reduced the need for child labour, allowing children to go to school and thereby enriching future generations. The Bill & Melinda Gates Foundation has invested enormous sums in trying to incorporate the rural unbanked to the financial system, substituting bank branches with mobile phones. Their project has helped some of the world's poorest to have access to financial services (i.e. opening a bank account) and to increase the number of micro-loans granted. The intensive use of technology, and its associated cost cutting, has largely contributed to financial inclusion.

The Fintech ecosystem could also help combat poverty by facilitating access to the financial system. The World Bank affirms that today only 69%[79] (3.8 billion) of adults have a bank account (Figure 18), meaning that close to 1.7 billion adults worldwide still do not have access to financial services. Approximately half of those 1.7 billion adults come from seven countries (Figure 19): China (13%), India (11%), Pakistan and Indonesia (6% each), Nigeria (4%), and Mexico and Bangladesh (3% each). In developed countries, 93% of the population has a bank account, roughly the same percentage that owns a smartphone. In developing nations, 79% of the population owns a smartphone whereas only 58% have access to a bank account. This is an incredible opportunity for Fintech (Figure 20).

Figure 18: **Percentage of adult population with a bank account**

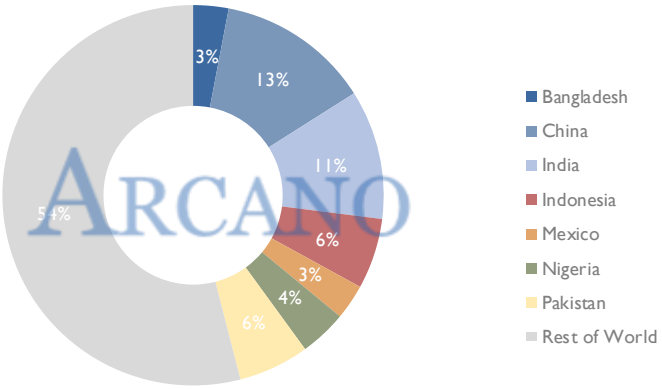


Source: World Bank, Arcano Economic Research

[78] World Bank.

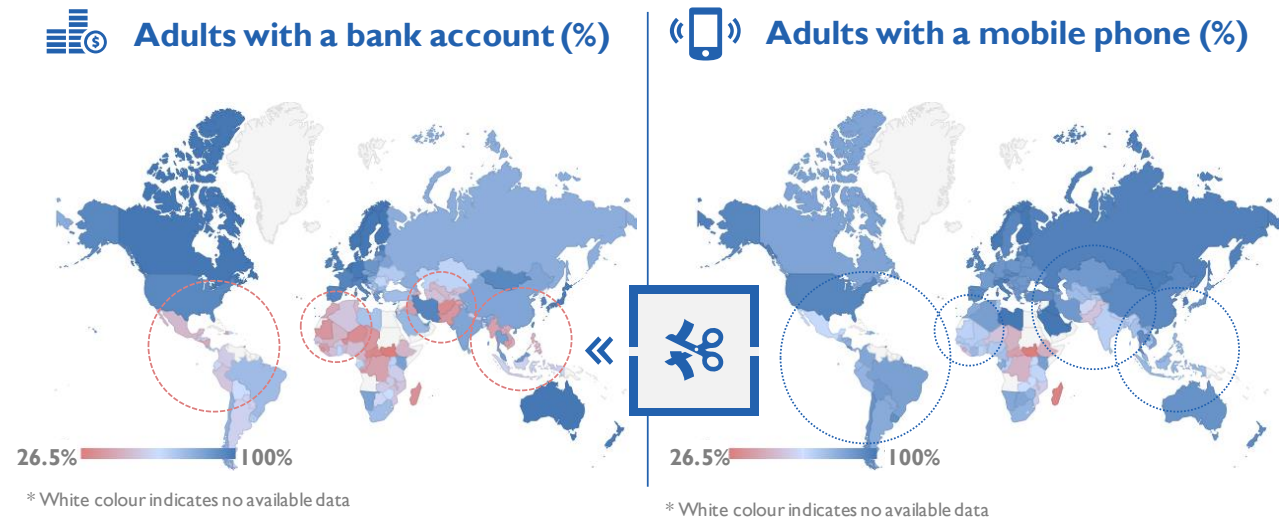
[79] International Finance Corporation. (2018). Financial Inclusion in the Digital Age.

Figure 19: **Adults without an account by country, (% of global adult population), 2017**



Source: World Bank, Arcano Economic Research

Figure 20: **Opportunity for Fintech in emerging markets**



Source: World Bank, Arcano Economic Research

A final interesting remark is the potential impact that increasing digitalisation may have on the decline (not disappearance) of the underground economy: drug trafficking, corruption, fraud, terrorism financing, etc. This is a great potential benefit from the point of view of economic development.

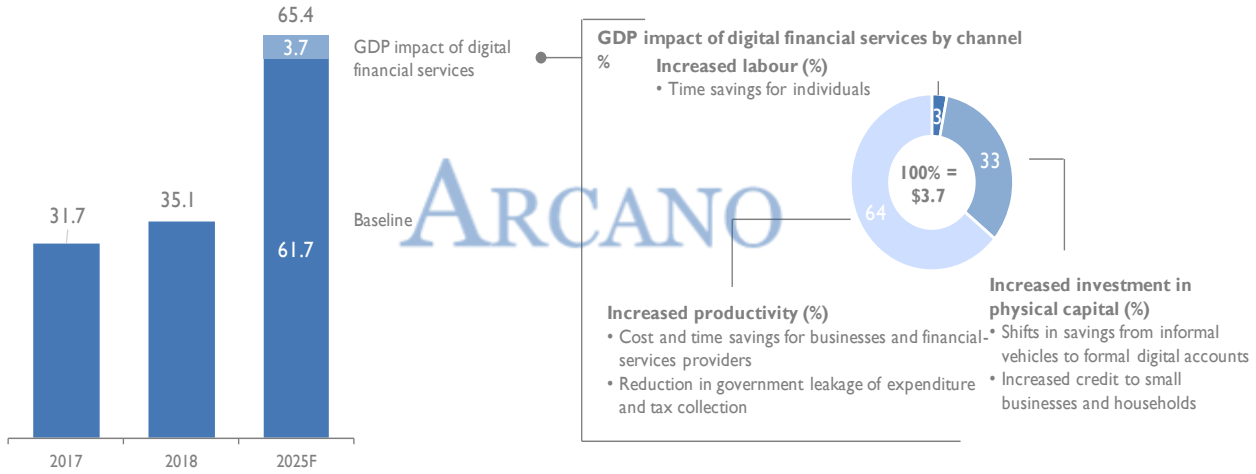
3.2 Fintech, financial inclusion and its impact

The main challenge is financial inclusion, facilitating general access to this type of service, especially in rural emerging markets where there is no proliferation of basic banking services. There are barriers to entry even in developed countries, where there are a large number of financial products available, but often a lack of transparency. Another common problem, not exclusive to emerging markets, is that the available products do not respond to the socioeconomic situation of the population, for example by setting stringent credit score requirements or minimum net worth requisites. The greatest challenge for financial products and services is becoming accessible and useful for those segments of the population, and that their

providers are either adequately incentivised to make investments in these areas or able to absorb potential losses.

Aside from individuals, there are roughly 200 million small to medium enterprises (SMEs) in emerging countries which do not have access to credit or to savings methods. Even those that do, often find obstacles for funding their growth activities like for example high interest rates or a limited product offering. Financial inclusion for these people and enterprises could potentially add 6% or a total of 3.7 trillion dollars to the GDP of these emerging countries by 2025 (Figure 21, LHS).[80] This trillion-dollar figure is equivalent to the entirety of German GDP and greater than that of all African economies combined. Of these 3.7 trillion, 64% would result from the productivity increase (efficiency improvements with an impact on education, for example), 33% from the increase in investment (upon registry of digital bank accounts), and 3% from the improvements in labour efficiency (Figure 21, RHS). This would translate to 95 million new employment opportunities in every sector of emerging economies and the positive impact generated by a digital financial infrastructure would be even greater (Figure 22). The effect on GDP for Nigeria, India and Ethiopia could range between 10% and 12%. As a matter of fact, these are the countries with the largest percentage of financially excluded population.

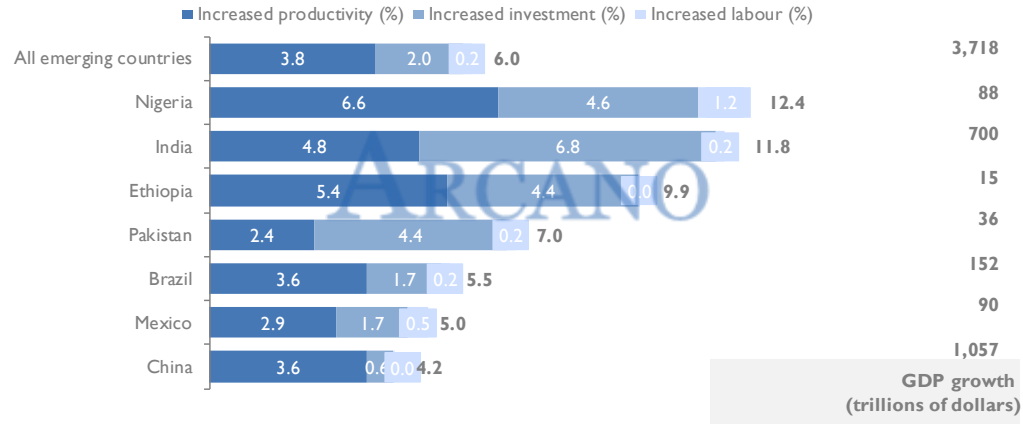
Figure 21: **GDP contribution to emerging economies (in trillions of dollars)**



Source: McKinsey Global Institute, Arcano Economic Research

[80] McKinsey & Company. (2016). How digital finance could boost growth in emerging economies.

Figure 22: **GDP impact of digital financial services across countries in 2025**



Source: McKinsey Global Institute, Arcano Economic Research

Services that move and store money through a mobile device (digital wallets) present an enormous opportunity for those without access to banks, and could add 3 trillion dollars in potential payments[81] to the global economy. A notable case study is M-Pesa, a payment system put into place in Kenya in 2007 and which over 20 million Kenyans now use (transiting almost 60% of Kenyan GDP through the SMS based platform).[82] A study carried out by MIT and Georgetown showed that having access to mobile financial services generates enormous benefits, especially for women who are users of financial services at a lower rate (54% of adults without a bank account are women) by reducing gender inequality as (1) savings increased more than 20%, (2) 185,000 women were able to stop working in the fields to develop businesses or trading activities, and (3) the number of women in a situation of extreme poverty was cut by 22%.[83]

With respect to risk management, the same analysis shows that having access to digital financial services helps the poor manage risks, for example by making it easier to collect money from friends or distant family members when needed.[84]

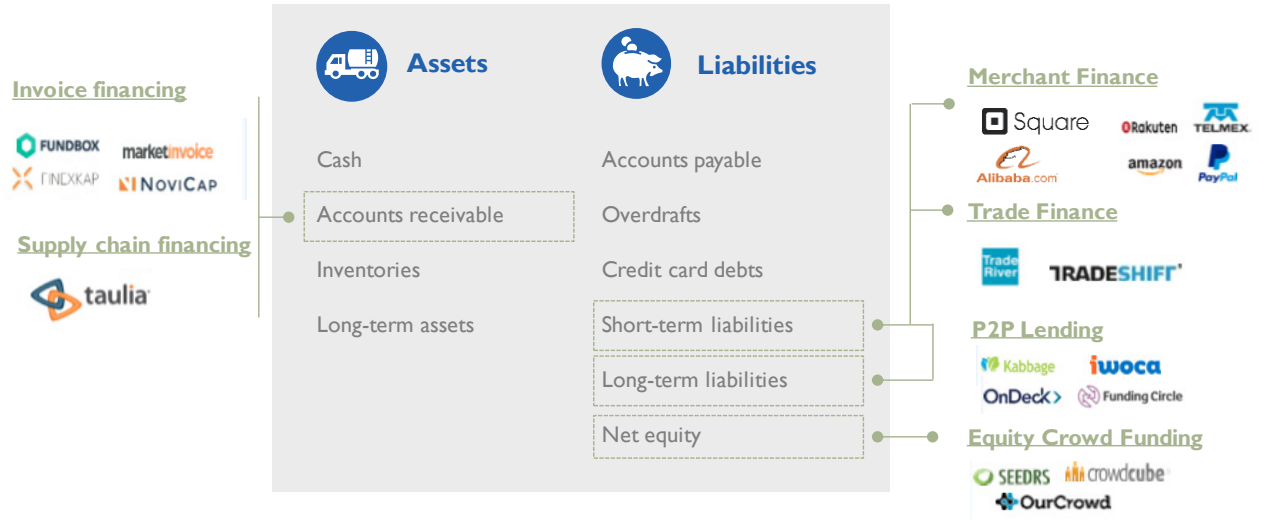
Nigerian researchers discovered that during a five-month program, the recipients of government pensions saved over 20 hours in travel and wait time when the government switched to a mobile payment system designed to significantly reduce transaction costs[85] and the risk of corruption. On the other hand, the cost of administering this social aid was reduced by 20%. In India, another impactful study concluded that the corruption associated with pension payments is reduced by 47% when the payments are conducted digitally instead of in cash.[86]

In regards to employment, SMEs could gain access to 2.1 trillion dollars in loans via Fintech platforms, which would result in increased employment offerings.[87] Right now, half of SMEs in developing countries do not have the possibility of obtaining credit, the interest rates offered are

[81] PwC (2016). The un(der)banked is FinTech's largest opportunity.
[82] Harford, T. (13, February 2017). Money via mobile: The M-Pesa revolution. *BBC.*
[83] Suri, T., and W. Jack. (2016). The long-run poverty and gender impacts of mobile money, *Science* 354, 1288–1292.
[84] Ibid.
[85] Aker, Jenny C., y Ksoll, C. (2016). Can mobile phones improve agricultural outcomes? Evidence from a randomised experiment in Niger, *Food Policy* 60, 44-51.
[86] Muralidharan, K., Niehaus, P., y Sandip Sukhtankar. (2016). Building State Capacity: Evidence from Biometric Smartcards in India, *Poverty Action Lab.*
[87] McKinsey & Company. (2016). How digital finance could boost growth in emerging economies.

virtually unaffordable, and using primarily cash makes a business more susceptible to collateral costs like being robbed or having difficulties in monitoring and controlling their activities. This situation could greatly improve thanks to Fintech, given that an additional 2.1 trillion dollars would be deposited in financial entities, which in turn could be employed as loans. Figure 23 shows how Fintechs are penetrating different parts of the balance sheet of a SME, providing services that only a large enterprise could access before the Fintech revolution.[88] As the use of digital payments and other financial services increases, so will SMEs access to capital and their ability to hire workers, all positively affecting GDP.

Figure 23: **General balance of SMEs and Fintech-penetration areas**



Source: World Economic Forum, Arcano Economic Research

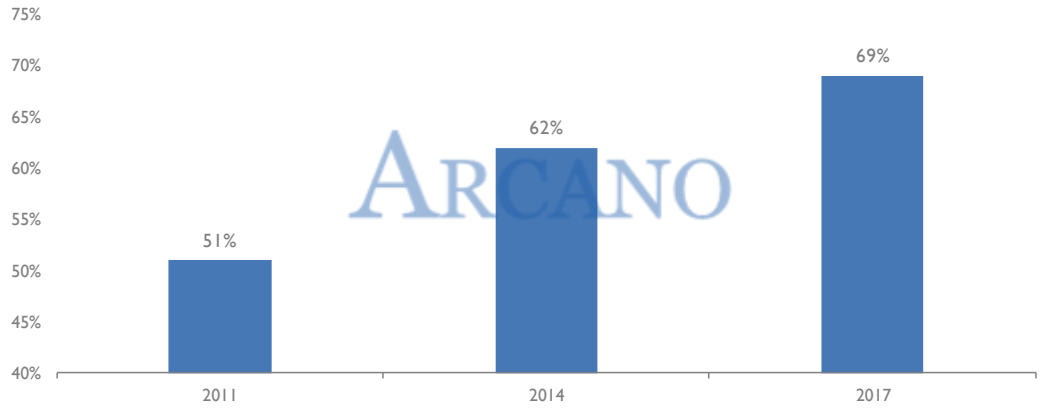
The enormous potential that an established banking system supposes for the general population, especially in emerging countries, opens the possibility of notably increasing the flows of capital towards those in need. The opportunity for Fintech is evident. Through the pursuit of improving credit risk management technology, or applying blockchain infrastructure, this breed of company could end up connecting borrowers and lenders in a more secure and efficient way.[89]

For the reasons laid out, Fintech will have a highly relevant global impact when it comes to achieving financial inclusion. Africa presents huge potential for the reduction of poverty and inequality given that it is the region of the world with the lowest rate of Smartphone adoption in the world, something which will undoubtedly change. The GSM association[90] projects an increase from 44% in 2017 to 52% in 2025 in the number of mobile internet subscribers. This means that approximately 280 million more Africans will have internet connected mobile devices by 2025. The World Bank affirms that a great deal of work has been done in terms of opening accounts at financial institutions and increasing access to mobile phones in developing nations. In 2011, close to 51% of the population had an account at a financial institution. By 2014 this had increased to

[88] Anon., 2018, Moving the Needle – SME Financing in Emerging Markets | SOCAP, Social Capital Markets | SOCAP.
[89] International Finance Corporation. (2017). Blockchain: Opportunities for Private Enterprises in Emerging Markets.
[90] GSM represents the interests of mobile operators around the globe, uniting more than 750 operators with more than 350 companies in the same mobile ecosystem, handset and device makers, software companies, equipment providers and Internet companies, as well as organisations in related industry sectors.

62% and by 2017, to 69% (Figure 24). This is to say that between 2011 and 2017, over 515 million adults all over the world opened a bank account and were included in the financial system.

Figure 24: **Adults with a bank account (%)**



Source: World Bank, Arcano Economic Research

To conclude this section about Fintech, financial inclusion and economic impact, it is worth noting that not all the opinions about the topic are favourable. There are scholars who put into question some of the abovementioned statements. As a matter of fact, a report published by FSD Kenya[91] remarks that despite digital lending rapidly expanding across Kenya and Tanzania, there is little evidence of how and by whom it is used, as well as of the risks faced by borrowers. As for microfinancing, so far it has not returned the results many expected even dating back to the 70s. Another paper released by the American Economic Association in 2015[92] concluded that the impact had been mildly positive, but nonetheless transformative in terms of development (freedom of opportunity and reduction of inequality).

3.3 Central banks and digital currencies

The BIS (Bank for International Settlements), referred to as the central bank of central banks, considers that the possible issuing of a digital currency by central banks (known as CBDC or Central Bank Digital Currency) would have 3 main objectives:

- To be a safer instrument for monetary transfers
- To reduce the use of cash
- To improve the efficiency of payments in the private sector

The following paragraphs will analyse the claim that CBDC could function as a secure, alternative tool for effecting monetary transactions.

To begin, let us quickly review the fundamentals associated with monetary policy developed by central banks. Commercial banks increase the amount of money circulating in the economy by creating loans from funds pooled from the bank's depositors. Consequently, the more deposits the bank holds, the more loans it can create, thereby creating and circulating more money through the

[91] A Digital Credit Revolution. Insights from Borrowers in Kenya and Tanzania. Michelle Kaffenberger and Edoardo Totolo, with Matthew Soursourian. October 2018.

[92] Banerjee, Abhijit, Dean Karlan, and Jonathan Zinman. "Six Randomized Evaluations of Microcredit: Introduction and Further Steps." American Economic Journal: Applied Economics 7, no. 1 (January 2015): 1–21.

economy. Nonetheless, banks cannot loan 100% of deposits; they must keep a minimum percentage of deposits stored at the central bank (reserve coefficient) to guarantee that depositors can withdraw part of their funds at any time. The reserve coefficient is usually around 3%-10%,[93] meaning that 90%-97% of money created comes from loans issued by commercial banks. This allows them to lend money that is mostly not theirs and stretch their own capital, under the watchful eye of regulatory bodies, the supervision of central banks and a certain set of accounting rules that supposedly reduce insolvency risk and forces banks to disclose expected losses due to credit default.

All things considered, history repeatedly shows us that the requirements set on financial institutions have not always insured the full value of deposits, resulting in financial crises. In the face of an unstable economic situation provoked by the creation of money through lending, governments occasionally have to react by offering public assistance in the form of guaranteeing lost deposits. This has provoked enormous cyclical shocks and impacts on budgets for all agents, often interrelated with economic crises. Finally, central banks have resorted to artificially printing money to finance the copious public deficits associated with an economic stimulus plan. Still, commercial banks have the privilege of issuing money, process by which the gains are private and the losses, sometimes extreme, are public, demonstrating evident fragilities in our current banking system.

Understandably, economists, central banks,[94] retail banks and others (Fintech included) have begun looking for how new technologies could be implemented into our banking systems. Among these potential applications is the emission of digital money by central banks which would require a fully secure underlying technology (blockchain). Anyhow, a transition to this type of infrastructure could be slow and complex.

The definition of money would not change. It would still have to act as a unit of measurement, a means of exchange and as a value storage unit. The emission of a digital currency by a central bank would meet these three criteria, separating it from the current swath of cryptocurrencies since they are not generally accepted means of exchange, nor are they good for value storage due to their high volatility.

The concept of a digital currency issued by a central bank presents similarities and differences to the two principal liabilities on its balance sheet: cash and banking reserves

Bank reserves are those deposits which financial entities keep with the central bank for regulatory and monetary policy purposes, with the objective of managing the liquidity of the banking system, the lifeblood of the economy. These reserves are currently held in a digital format, they are simply accounting notations shared between central banks and commercial banks and remunerated by a deposit facility. We must note that deposit facilities are remunerated at a different interest rate than compulsory and excess liquidity reserves. On occasion, like now for instance in the Eurozone, interest rates are negative. Cash, in its physical form, has universal access but is anonymous and non-interest bearing. In European countries, the use of physical cash is between 4.5% (in Switzerland) and 29.3% (in Spain) of GDP (Figure 25).

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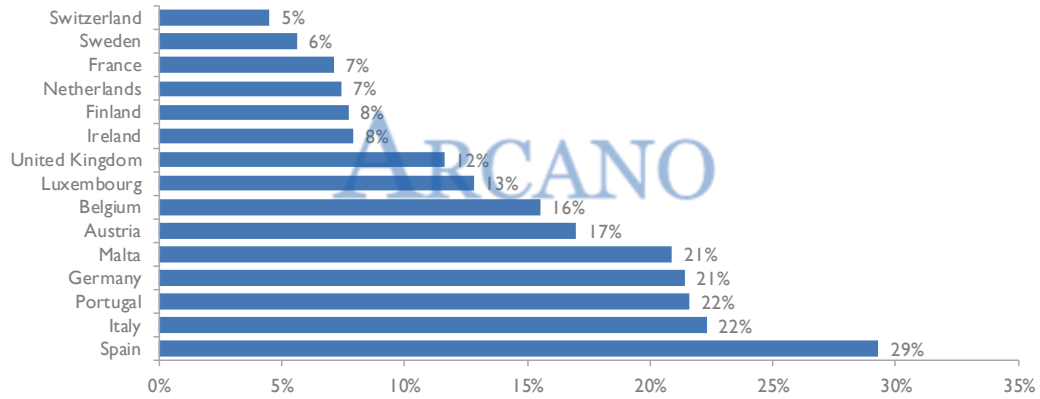
[93] The United States requires 5% and Europe 3%.

[94] The Bank of England has a research-dedicated programme, the Bank of Sweden is considering to start issuing a digital currency that replaces cash and Mario Draghi stated on the 14th of September that the European Central Bank is analysing the consequences of doing the same thing. Switzerland has held a "Sovereign Money" referendum and both the Banking Association and the central bank support the current scheme.

The use of cash varies depending on the country. For example, cash use in Nordic countries continually decreases, while in other countries like Japan, cash remains at a stable rate of use.

Figure 25: **Weight of cash on European economies**



Fuente: Banco Mundial, Arcano Economic Research

CBDCs offer a digital format for storing savings, allowing customisation options like being anonymous or public, having universal or restricted access, being remunerated or non-remunerated.[95] This flexibility will contribute to the "transmission of monetary policy, and facilitate the management of liquidity in the banking system"[96] (Figure 26).

Figure 26: **Main features of currencies and CBDC**

	Reserves	Cash	CBDC
Form	Digital	Physical	Digital
Access	Restricted	Universal	Universal
Anonymity	Not anonymous	Anonymous	Not anonymous
Interest bearing	Yes	No	Yes: for monetary policy transmission
Risks			Financial instability: deposit outflows from less secure banks (in crisis)

Source: World Bank, Arcano Economic Research

Implications for the transmission of monetary policy

In the case of the implementation of a non-interest bearing CBDC, the interest on reserves of commercial banks at the central bank would still constitute the lowest short term interest rate in the interbank market, which is the fundamental variable in the transmission of monetary policy decision, given that any alteration of this rate would translate to a change in the cost of borrowing for companies and individuals in the real economy.

[95] Here we refer to the possibility of all agents having universal access, meaning banks, governments, companies and families.
[96] Jean-Marc Bonnefous.

In the case of interest bearing CBDCs, as long as said interest is never below that of banking reserves, this would still be the floor for interest rates in the transmission of monetary policy. Given that CBDCs offer an alternative way to make savings deposits for companies and families, the interest rate on these would affect the saving and spending habits of all economic agents, either directly via the interest rate on funds deposited at a central bank, or indirectly through its effect on the interest rate on deposits at commercial banks. There is no doubt that in a scenario with an interest bearing CBDC, a central bank could exercise increased control over general financial conditions of the economy and therefore on aggregate demand. On the other hand, a relevant question to analyse is whether commercial banks would see themselves forced to offer deposit rates higher than that of the central bank in order to prevent the loss of funds, leading to increases in the cost of credit so as to not destroy its profitability. This possible reduction of the intermediation margins could lead to a contraction in credit offerings and of the banking sector.

Lastly, it is worth mentioning that even in the case of not being interest bearing, the introduction of a CBDC could affect the stability of the entire financial system, given that in a financial crisis the perception could exist that central bank money is safer than the deposits in commercial banks. For this reason, depositors, especially the large institutional ones whose deposits far exceed the amounts covered by public guarantees, could be tempted to make huge withdrawals from commercial banks to deposit in CBDC, feeding into the hypothetical frenzy and thus exacerbating the financial crisis itself.[97]

Conclusions regarding CBDCs

Digital money deposited in central banks, given that it would proceed directly from the savings of families and businesses and is not a promise of repayment, would not need any protection and would be considered safe.[98] There would be no risk of these depositors not being able to recover their funds. Additionally, a central bank-backed digital currency could potentially securely increase the efficiency in the payment system, which would result in economic benefit for all. The aforementioned Narrow Bank simply captures deposits and stores them at the central bank, thereby obtaining a risk-free interest rate, all without the need of having physical bank branches. Nonetheless, if a CBDC could compete with banking deposits, while having a lower degree of risk (especially in times of an economic crisis), the mere existence of such a CBDC could provoke a panicked withdrawal of funds from commercial banks to the central bank. This event would be completely pro-cyclical –precisely the effect that conventional monetary policy looks to avoid.—and would accelerate banking and economic crises. Also, the possibility that central banks themselves could use people's savings (via digital currency) to invest in the implementation of non-conventional monetary policy (purchasing certain assets) generates great uncertainty. Keeping in mind that central banks could have to manage bulky balance sheets, the risk would be that a large part of the credit conceded would be "directed" by state institutions, instead of by the private sector, which is usually more efficient in the allocation of resources. Undoubtedly there are considerable structural risks associated with CBDCs, likely reducing the probability of their actual implementation.

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[97] One way to minimise this risk in the case of an interest bearing CBDC would be to impose a negative rate on CBDCs in the case of a financial crisis to discourage potential massive withdrawals of funds.

[98] On the 10th of July, Switzerland held a referendum to bar retail banks from lending the money deposited by their clients, that is, creating money each time they make loans, the so-called real money. This initiative was rejected by 75% of voters.

4. Conclusions

Globally for the last decade, the accelerating technological advances have been truly disruptive. One year ago, our report "Technological Disruption is Already Here" comprehensibly detailed the predominant technologies exciting general interest: artificial intelligence and robotics, the Internet of Things, autonomous vehicles, blockchain and others. We then addressed the evolution of their social impact and their main macro and microeconomic applications. This year, we have deepened our study of the influential technological disruption at play in one particular sector, one that is essential to the economy in a transversal way: the financial sector (more concretely, the business of retail banking and asset management), so-called Fintech.

The technology has certainly taken an important and growing role in banking. Since the end of the last century internet use has proliferated, especially as the preferred channel for minor financial operations such as consulting a checking account, making a transfer, executing a trade in the market or investing in a fund. Until now, the strategy of banking has been to use physical presence with traditional banking branches to literally get closer to their clients so as to better understand and advise them, or in some cases, to better cross-sell them. Through this, they have tried to compensate the elevated fixed costs of maintaining a far-flung web of branches with the increase in profit.

Coinciding with the crippling global economic banking crisis befallen the last decade, a precariously disruptive situation has formed for the financial sector. On one hand, banking has been more centred on cleaning up their balance sheets, following stricter regulatory guidelines (especially solvency requirements) and surviving, than innovating and making strategic technological investments. On the other, public confidence in traditional financial systems has fallen considerably. New relevant regulations (apart from solvency requirements) are still emerging such as PSD2, which could allow non-financial institutions (Fintechs) access to individuals' banking information. Finally, the world has changed regarding life habits (leisure, social relationships by way of social media, etc.) and consumer spending habits, precisely because of the precipitous technological advances facilitated by connectivity through the internet and the exponential proliferation of smartphones. With it, massive and immediate access to infinite data has enabled artificial intelligence and advanced algorithms to develop analysis tools for tremendously complex datasets (big data).

Duly, the user of traditional banking services now has instant access to more and better information, increasing their negotiating power in front of a bank (thus harming its structural profitability). Also, banking itself is facing a much more competitive environment due to the aforementioned deterioration in public confidence, the stricter solvency regulations,[99] the absence of sufficient investment in technology, the loss of the physical branch's relevance as a client relationship channel (because of the clients' new habits), and the possibility of having to share banking information about its clients with third, non-financial parties due to the new regulations. For this reason, new and clear opportunities are emerging for financial agents other than traditional banks (operating without banking's inherent issues and liabilities). These new

[99] Nonetheless, when Fintech companies reach critical mass, they will be able to, in aggregate, generate certain systematic risk, threatening the consumer by causing instability in the financial system. When that time comes they will run the risk of being regulated in a similar fashion to banks, thus losing their competitive advantage.

agents are defined as Fintech, although in the specific case of large tech companies attempting to take advantage of the situation in the financial sector, they are known as Bigtech.

Fintech and Bigtech are attempting to overcome banking's traditional barriers of entry (consumer confidence, regulatory compliance, and size and resource requirements) and to fill voids ignored by the sector. The new agents attempt (and achieve in many cases) to offer services that allow for simpler, cheaper and more agile operation (a better and more convenient experience for the client). This is the competitive advantage that they are exploiting to grab their piece of the pie from traditional banks. This is why the Fintech phenomenon is gaining traction and could in time mean a real revolution in a sector as essential to the economy as financial services (especially remarkable could be the accelerating effect that incorporation into the financial system will have for future generations, especially those digital natives who don't even consider the world of physical products and services as an alternative). It is worth mentioning that Bigtechs have only made light forays into the business of banking, partly because they don't want to irritate their powerful bank clients, partly because the margins in banking are generally lower than that of their core businesses and partly to avoid the collateral regulatory obligations. Still, in the future, their large size, strong financial position and their insatiable search for data that can increase product and service sales (banking information is highly valuable for this) will likely turn them into a serious threat to banks.

Once the surge of the Fintech phenomenon and its important potential impacts on the critically important financial sector is explained, the next step is to make clear its specific principal applications. Payment methods (payments and transfers including currency exchange) have been among the first activities targeted by Fintechs due to the great potential for development. The digital wallet, which facilitates payments and other banking transactions from the comfort of one's mobile phone, is also causing upheaval throughout the sector. Other activities of interest for Fintechs are wealth and asset management (robo-advisers, online asset allocation algorithms), lending and rating credit (managed via digital platforms), success of which won't be able to be judged until at least one full economic cycle is completed. Simultaneously, advances in investment activities such as algorithmic trading and online brokerage, using artificial intelligence and algorithms in the design of investment strategies, are also moving at a breakneck pace.

We also must highlight the relevance of the world of cryptocurrencies (digital money like Bitcoin) and ICOs (fundraising process for companies investing in blockchain applications by which the Company offers digital tokens representing some underlying value to its investors). Digital currencies recently experienced an unrestrained bubble of over-optimistic expectations which culminated in a massive correction, wiping the gains of most speculators. We believe there are serious doubts about Bitcoin's ability to reach a minimum share of financial transactions globally because of its extreme volatility and for the powerful network effects of its principal competitors, traditional state-backed currencies (in the end, if few people believe that Bitcoin will be a relevant method of exchange, only those few people will want to own the coins in a sort of self-fulfilling prophecy). In regards to ICOs, we believe that there is a strong speculative component to investment in these, reminiscent of the dot com era in which internet companies were affronted with a binary and risky scenario. It was known that few companies of the time would truly succeed, but predicting the winners and losers is far from a proven science.

How are banks reacting to the threatening scenario for banks painted by the Fintech and Bigtech disruptors? Fintechs have not yet reached the critical mass necessary, nor are they sufficiently profitable (many still are not cash-flow positive) to prompt serious short-term worry for traditional financial services providers. However, numerous studies indicate that significant

declines in the revenue of traditional banking institutions could take place in the mid-term if banks do not react in time, given that the segments of their business most under threat tend to be the most lucrative (payments, asset management, customized investment activities). Banks are reacting by developing competing systems internally, by acquiring Fintech companies and technology, or aligning themselves with Fintech (or Bigtech) contemporaries. As we previously indicated, banks are ultimately confident in their dominance over the short-term, but are significantly wearier of their mid-term prospects. In any case, the main preoccupation and challenge of the banking sector is the preservation of their trusted relationships with their clients (loyalty for online customers is much less significant than that of a personal relationship), and how to turn a passive relationship (waiting for a client to make contact, then addressing their needs) into an active relationship. This implies the development of new products, including offering the best products available, be they in-house or from a third party.

We consider it essential to highlight the importance that financial development has on the economic process, demonstrated by multiple studies and the empirical evidence that countries with a developed financial services infrastructure are economically more advanced. Precisely, Fintechs have the potential contribute to the historically challenging development of financial infrastructures in poor and rural areas in a major way. Connectivity via the internet and smartphones can exacerbate financial inclusion and with it economic development, reducing inequalities and possibly becoming the engine of future increases in productivity and consequently growth.

Lastly, it is important to underscore the effect that Fintech development could have on monetary policy. Central banks are studying the possibility of creating digital currencies with the purpose of allowing individuals to make deposits directly at the central bank. There is no doubt that although this would increase efficiency in payment systems, the security of those deposits and the control of central banks over the money supply (aiding execution of monetary policy) would also generate notable risks such as potentially exacerbating panicked withdrawals from commercial banks in times of economic uncertainty (further fuelling the decline of the economic cycle), or by delegating excessive responsibility to a public entity. This could happen if many individuals simultaneously decided to deposit their savings at the central bank, generating a massive balance for the bank, which would then have to decide to whom to lend.

Glossary

API (Application Programming Interface): an API is a series of clearly defined commands, functions and communication protocols between several components, facilitating the transfer of data or messages between two applications. For example, hotel aggregators receive through a common API, all prices and availability of rooms and in turn inform the hotels of the reservations placed through the aggregator's websites (if a hotel wants to appear on their website, they have to connect to the API).

Artificial Intelligence (AI): the theory and development of algorithms which mimic the functioning of the human brain and are therefore capable of performing tasks which usually require human intelligence. Basically, AI uses a certain "awareness" of its surroundings to process and analyse subsequent data to draw conclusions that it has not been directly programmed to come to.

Baby Boomer: persons born in the period directly following World War II, characterised by the explosion in population of certain Anglo-Saxon countries.

Big data: collection, analysis and management of enormous volumes of data that cannot be analysed through conventional means because of the limits of traditional management and analysis tools. The key to big data is to be able to quickly work through the quantity to find hidden information, recurring patterns or new correlations that facilitate decision making, ideally in real time.

Bigtech: large technology companies looking to enter the digital financial services or Fintech business.

Bitcoin: a decentralised digital currency, not backed by any central bank or government, which acts as a medium of exchange and storage of value while eluding the conventional financial and banking system.

Blockchain: a combination of technologies which make it possible for computers and other devices to manage data through a shared, decentralised, synchronised and distributed ledger, instead of using traditional databases. Even though the ledger is publicly accessible, sensitive information is protected by advanced cryptography. Once the ledger receives a new piece of data, it cannot be deleted and can be seen by all contributors, adding great transparency for all.

CBDC (Central Bank Digital Currency): a digital currency issued by a central bank.

Chatbot: a program which simulates a conversation with a user by employing artificial intelligence. Chatbots usually communicate with humans, but applications for them to communicate amongst themselves are currently in development. They are often used for online customer service requests, call centres and videogames.

Crowdfunding: a system of cooperation where any creator of a project (professional or not) can solicit support from other individuals or groups. Backers, as these supporters are known, receive non-monetary rewards that can range from personalised acknowledgements on the creator's website to the possibility of applying for a job with the project.

Cryptocurrency: a digital medium of exchange. Despite not existing in a physical form, its uses are essentially the same as any conventional coin. Bitcoin is a cryptocurrency.

Datamining: a combination of techniques and technologies that allow for the exploration of large databases in an automatic or semiautomatic way with the objective of finding repeated patterns, trends, or rules that explain the behaviour of the data in a certain context.

Digital wallet: a computer program which stores virtual value, be it an electronic credit card or a cryptocurrency.

Fintech: a term that comes from the joining of the words "financial" and "technology" and refers to financial services companies which use the latest technology to offer innovative financial services and products.

Generation X: those persons born between the mid-1960s and the mid-1980s.

Generation Y: those persons born between the mid-1980s and the mid-1990s.

Generation Z: those persons born between now and the mid-1990s.

Initial Coin Offering (ICO): financing method used by companies which involves issuing a digital coin called a token in exchange for fiat currency or existing digital tokens. The funds from backers buying the new coins finance a project. The token's functionality is relevant to the project being financed and the token holders enjoy some pre-defined benefit from their coins.

Internet of Things (IoT): the interconnection via the internet of data-gathering devices (or everyday objects with embedded computing devices) enabling a bilateral transfer of data which can be analysed with algorithms. The valuable information gathered from these devices can be used to program the object to react in certain ways to determined stimuli. The objective is to be able to improve the "intelligence" of the objects around us to increase efficiency and reduce human intervention.

Joint-venture: the temporary strategic alliance of an organization, group or individuals who maintain their juristic independence but act under one set of norms and directions to carry out a specific commercial operation.

Insurtech: the adaptation of the traditional insurance business model to the new technological environment.

Machine learning: the scientific discipline of creating systems which "learn" automatically by identifying complex patterns in millions of data points and subsequently predicting future behaviour. The algorithms which guide these systems are not only capable of analysing and predicting information, they are also capable of using their own conclusions to automatically improve themselves over time.

Margin-lending: a type of loan which uses the borrower's cash, managed funds or shares as security in exchange for investable money.

MiFID II (Markets in Financial Instruments Directive II): a new directive related to the market of financial instruments, which improves its supervision and transparency while reinforcing protections for investors.

Millennials: persons born between the mid-1980s and the mid-1990s. Also known as Generation Y.

Open Banking: refers to the third-party access of banking information to develop transactional processes through a non-bank platform.

PISP (Payment Initiation Service Provider): a third party with access to the financial information of all the agents of a transaction, made possible by Open Banking, which in turn is made possible by PSD2.

Pre-Boomer: persons born before 1945.

PSD2 (Payment Services Directive II): a new European directive which gives third parties access to banks' internal infrastructure to provide transaction solutions and develop the use of digital payments.

P2B: peer to business.

P2P: peer to peer.

Regtech: the application of technology to help companies comply with regulatory requirements.

Robo-adviser: an online financial management service which utilises AI algorithms to match investors with the funds most adequate for their level of risk. The robo-adviser evaluates the client's needs and the status of the market to make automatic investment recommendations.

Smart contract: contracts which can automatically and autonomously execute once certain predefined conditions are met.

Smartphone: a mobile telephone capable of interacting with the internet.

SMEs: small and medium enterprises.

Start-up: new or early-stage companies whose objective is to implement a new business or business model. Although these companies can be found in every sector, they usually have a strong technological component.

Token or Cryptocoin: unit of value issued by a private entity which is usually part of a blockchain network and ledger. A token has more potential uses than a standard unit of conventional currency. Within a private network, a token can be used to grant certain rights to holders, as an incentive, to pay for goods or a service, as a way for holders to benefit from a better customer experience, etc. Tokens can also store multiple layers of value, which gives the coin's designer the ability to decide the value of that particular token.

Xennials: persons born between generations X and Y, between the late 1970s and the early 1980s.

Company Glossary

Acorns: An app-based robo-advice platform where users are able to invest spare change from other financial transactions into investment funds that match a user's profile.

Alibaba Group: Chinese conglomerate dedicated to e-commerce through their 18 subsidiaries, including Ant Financial.

Amazon: the largest e-commerce Company in the world with a market capitalization of close to one trillion dollars, pioneer in the sale of goods via the internet. The company also provides cloud-based computing solutions.

American Express: financial institution known for their traveller cheque and credit card business.

Andreessen Horowitz: founded by Marc Andreessen and Ben Horowitz, this company is a private equity firm known for their investments in electronic services and products.

Ant Financial: previously known as AliPay, this company is the most valued Fintech company in the world (150 billion dollars), and provides a mobile payment system to over 600 million users.

ANZ Bank: Australia and New Zealand banking group is the fourth largest bank in Australia with headquarters in Melbourne.

Apple: designer and manufacturer of electronic equipment, software and online subscription services.

Assurant: global provider of risk management products and services.

Atom Bank: backed by big banking players like BBVA, Atom is a native digital bank with no physical branches.

Banco Santander: Spanish banking group with a network of affiliates that span the globe.

Bankinter: Spanish bank headquartered in Madrid, forms part of the IBEX 35.

Bank of America Merrill Lynch: investment banking division of Bank of America.

Bankia: bank founded in Spain in 2010 following a restructuring of the Spanish financial system.

Barclays: financial services companies operating at a global level with its headquarters in London.

Bayer: known as the makers of Aspirin, Bayer is one of the largest pharmaceutical companies on the planet.

BBVA: Spanish banking entity based in Bilbao.

Betterment: online broker and investment manager focused on offering services to retail investors.

Bloomberg: private American company founded by the former mayor of New York City, Michael Bloomberg, which offers financial software, news and data. Revenues at Bloomberg top 9 billion dollars.

Calypso: American enterprise provider of software focused on capital markets, risk management, clearing, collateral, treasury and liquidity.

Canadian Imperial Bank of Commerce (CIBC): one of the five large Canadian banks.

Charles Schwab: banking firm and broker founded by Charles R. Schwab in 1971, recording 2017 profits of 365 million dollars.

Citigroup: the largest financial services company in the world with a market cap of almost 180 billion dollars.

Coca-Cola: producer of the famous carbonated drink.

Coinlancer: a platform and company which forms smart contracts between freelance workers and employers through Ethereum's blockchain technology. The company was financed with an ICO and the virtual currency has the symbol CL.

Credit Suisse: financial services company based in Zurich.

Currenex: one of the most widely used foreign exchange trading platforms.

Deloitte: largest professional services company in the world. Considered one of the Big Four Auditors.

Diners Club: first independent company to issue credit cards, founded in 1950 by Frank X. McNamara, Ralph Schneider & Casey R. Taylor.

Egg: a pioneering, exclusively-online bank established in the UK in 1996 under the wing of Prudential Banking.

Ethereum: open and decentralised platform which allows for the creation of smart contracts, using blockchain technology as the driver and intermediary of the contract.

Final: a credit card start-up, acquired by Goldman Sachs.

Fuding Circle: a lending marketplace for peer-to-peer loans, allowing investors to directly lend money to SMEs or individuals.

General Electric: a major multinational diversified conglomerate operating in the fields of financial services, infrastructure, consumer goods, and communication.

Goldman Sachs: one of the world's largest investment banking groups.

Google: company specialised in internet services, operator of the most utilised search engine in the world.

IHS Markit: provider of global information, especially about markets and certain sectors of the economy. Based in London.

ING: retail banking arm of the Dutch group ING Bank NV.

JPMorgan: financial services company created through the merger of JP. Morgan & Co and Chase Manhattan Corporation.

Kabbage: company making loans to small companies and consumers through an automated lending platform.

Lending Club: a peer to peer lending company based in San Francisco.

Marcus: designed by Goldman Sachs, this online bank specialises in small loans and deposits.

Mastercard: issuer of the Mastercard credit and debit cards.

McKinsey: global strategic consulting firm focused on resolving strategic administrative problems.

MiCappital: investment platform with a robo-adviser designed for small investors.

Microsoft: company founded by Bill Gates which designs, develops, manufactures, licenses and provides software for all types of electronic devices.

Mitsubishi UFJ Financial Group: Japanese conglomerate with a full suite of financial service solutions.

MoneyBox: mobile application for saving and investing launch in England by Ben Stanway and Charlie Mortimer.

Monzo: British digital bank based on a mobile application and designed for mobile users.

Murex: founded in 1986 by Laurent Néel and Salim Edde, Murex is a company that creates technological solutions for trading, treasury, risk and post-trade operations.

NASDAQ (National Association of Securities Dealers Automated Quotation): the second largest electronic market place for buying and selling securities in the United States.

N26: a fully digital bank with a European banking license, offering its services in 17 of the Eurozone countries.

Narrow Bank, The: an online bank founded by ex-Federal Reserve advisors which stores deposits directly at the central bank, thereby reducing risk for depositors. The bank's petition to operate was denied by the Federal Reserve and is currently inactive.

NYCA: a New York-based start-up incubator investing exclusively in Fintech companies.

One97: online enterprise bringing content to millions of mobile consumers. Also owner of Paytm, India's largest e-commerce platform.

OpenLink: a firm selling finance, risk management and operations software.

Openpay: online payment services company facilitating the use of online payments for small companies and websites.

Orchestrade: a cross-asset trading, operations and risk management platform for banks, financial advisors and fund managers.

Paybase: company offering a payment processing and compliance system.

PayPal: company founded by Elon Musk and Peter Thiel among others operating a worldwide online payments system that supports online money transfers and serves as an electronic alternative to traditional payment methods. Listed on NASDAQ with a market cap of over 100 billion dollars.

Pepsi: American conglomerate manufacturer of the famous carbonated beverage.

Plaid: company developing APIs which connect consumers, Fintech companies and traditional financial institutions.

PwC: considered one of the Big Four Auditors, PwC offers a full suite of auditing and consulting services.

Reuters: news agency based in the UK known for providing information about financial markets.

Revolut: British firm with over 2 million clients offering free financial and banking services to individuals.

Ripple: through their open-source platform, Ripple issues XRP, a cryptocurrency that unlike others, is centralised and used by traditional financial entities.

Robinhood: mobile investment platform that does not charge commissions for allowing its users to invest in publicly listed companies and in a multitude of funds.

Royal Bank of Canada: first bank of Canada and a significant financial services company in North America.

SETL Development: Provider of a blockchain infrastructure solution for the financial service industry.

solarisBank: developer of an open API for companies wanting to offer financial services.

Standard Chartered: international bank of which 90% of earnings come from Asia, Africa and the Middle East.

Telegram: mobile messaging platform specialised in end-to-end encryption for its users. This company also issued a cryptocurrency through an ICO process which raised over 1.7 billion dollars.

Tencent: Chinese multinational owner of WeChat among other internet services and products.

TransferWise: international fund transfer service based on a peer to peer exchange network. The company was developed in Estonia and the UK and monthly moves over 2 billion GBP for its 3,000,000+ clients.

UBS: investment and private banking firm based in Zurich with 2018 profits of over 8 billion Swiss Francs.

UniCredit: Italian banking entity that resulted from the merger of Credito Italiano and UniCredito. It is currently the number one bank in Italy in terms of number of clients.

Vanguard: after BlackRock, the largest provider of exchange-traded funds (ETFs) in the world. The firm was founded in 1975 by the legendary investor John Bogle.

Visa: American company with a market capitalization of almost 330 billion dollars, issuer of Visa credit and debit cards.

Walmart: multinational retail corporation operating large discount department stores, hypermarkets and grocery stores.

Warranty Group: global provider of risk management products and services, now part of risk management company Assurant.

Wealthfront: this firm created a robo-adviser to offer automated investment services.

WeChat: an application which began as an online messaging service and has since become China's most widely used social media with over one billion active monthly users.

WeChat Pay: online payment service forming part of the WeChat social network, allowing users to transfer funds between each other or to make purchases directly through the app.

Western Union: financial services company specialised in international money transfers.

Westpac Banking Corporation: Australia's largest bank and a multinational financial services provider.

Yu'e Bao: created by Ant Financial, Yu'e Bao is currently the world's largest money market fund with over 250 billion assets under management.

Zopa: a British firm offering online currency exchange and peer-to-peer lending services.

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