



UNIVERSITA' DEGLI STUDI DI PADOVA
DIPARTIMENTO DI SCIENZE ECONOMICHE ED AZIENDALI
"M.FANNO"

CORSO DI LAUREA MAGISTRALE IN
BUSINESS ADMINISTRATION

TESI DI LAUREA

"Fintech phenomenon: a financial revolution or a new financial concern?"

RELATORE:

CH.MO PROF. CINZIA BALDAN

LAUREANDO/A: SILVIA SALTARELLI

MATRICOLA N. 1155017

ANNO ACCADEMICO 2017 – 2018

Il candidato dichiara che il presente lavoro è originale e non è già stato sottoposto, in tutto o in parte, per il conseguimento di un titolo accademico in altre Università italiane o straniere.

Il candidato dichiara altresì che tutti i materiali utilizzati durante la preparazione dell'elaborato sono stati indicati nel testo e nella sezione "Riferimenti bibliografici" e che le eventuali citazioni testuali sono individuabili attraverso l'esplicito richiamo alla pubblicazione originale.

The candidate declares that the present work is original and has not already been submitted, totally or in part, for the purposes of attaining an academic degree in other Italian or foreign universities. The candidate also declares that all the materials used during the preparation of the thesis have been explicitly indicated in the text and in the section "Bibliographical references" and that any textual citations can be identified through an explicit reference to the original publication.

Firma dello studente

Silvia Saltarelli

Tables of Contents

Introduction	7
1.The FinTech phenomenon	9
1.1 The development of FinTech in the financial industry	10
1.2 The drivers of FinTech: demand and supply factors	14
1.3 Opportunities and challenges of FinTech	19
1.4 Regulation of FinTech	27
2. Implications of FinTech for banks and banking systems	32
2.1 New FinTech instruments for the banking sector	34
2.2 Banks' performance and profitability	48
3. Impact of FinTechs acquisitions on banks' performance	58
3.1 Collaboration between banks and FinTechs	59
3.2 BBVA and FinTechs acquisitions	63
3.3 Effects of acquisitions on companies' performance: Literature Review	71
3.4 Methodology	75
Conclusions	81
Appendix	84
References	86

List of tables

Table 1: Acquisitions of FinTechs performed by banks between 2014 and 2018

Table 2: BBVA's financial ratios for the acquisition of Simple

Table 3: BBVA's financial for the acquisition of Madiva Soluciones

Table 4: BBVA's financial ratios for the acquisition of Holvi

Table 5: BBVA's financial ratios for the acquisition of Openpay

Table 6: Results of paired t-test for the financial ratios of the acquiring firm

Table 7: Pre-acquisition and post-acquisition ROE

Table 8: Results of the paired t-test for ROE

Table 9: Pre-acquisition and post-acquisition ROA

Table 20: Results of the paired t-test for ROA

Table 11: Pre-acquisition and post-acquisition CIR

Table 12: Results of the paired t-test for CIR

Introduction

The banking industry has always sought to keep up with technological advances and financial innovations. However, in the last decade it is facing a new disruption wave, caused by the introduction of new technologies and significant shifts in customers' needs.

Moreover, the banking industry had to cope with the strengthening of the financial regulation as a result of the 2008 financial crisis. The financial crisis highlighted banking sector's weaknesses related to excessive leverage and inadequate capital. The greater rigidity of the financial regulation increased compliance costs and obligations for financial institutions. Therefore, banks were induced to focus more on compliance instead of innovation.

The combination of these factors favoured the emergence of new players in the financial ecosystem: the FinTech companies (henceforth "FinTechs").

FinTech includes a wide range of new technologies and digital innovations applied to the financial sector and financial activities. FinTechs provide financial services and solutions using new technologies such as distributed ledger technology (DLT), machine learning, artificial intelligence (AI), robo-advisory and application programming interfaces (APIs).

After the 2008 financial crisis, the global investment in FinTechs increased significantly. In 2014 investments tripled in one year to reach the amount of \$12.2 billion (Accenture, 2015). The global investment activity in FinTechs attained a second peak in 2015 (\$25billion), followed by a reduction in 2016 (\$14.2 billion) and in 2017 (\$12.4 billion) (KPMG, 2018). A third peak is expected in 2018 since the global investment in H2'18 is already equal to \$31.7 billion.

FinTechs rely on new technologies to offer innovative financial services that better meet new customers' needs and habits. Moreover, they are based on innovative business models that enable them to increase access to financial services. The features and the rapid growth of FinTechs destabilized the financial ecosystem and especially the banking industry. Traditional player (the incumbents) are facing a fierce competition from FinTechs. They are feeling threatened by FinTechs and they need to change their strategy to survive in the financial sector. The new solutions offered by FinTechs aimed at providing the customers with ease of use, high transaction speed and transparency, and a wider choice of financial services and providers. Financial incumbents are facing new competitors not only digitizing their processes but also investing in FinTechs or collaborating with them. In this way, they gain access to the latest technologies and to new customers without radically changing their infrastructures.

The present work will focus on the relationship between the banking industry and FinTech to analyse the impact of FinTechs on the performance of the traditional banking sector. The dissertation is divided in three chapters. Chapter 1 focuses on the emergence and the development of the FinTech phenomenon. Firstly, we provide a general definition of FinTech and we examine its expansion in the financial industry after the 2008 financial crisis. Secondly, we analyse drivers, benefits and challenges of FinTech for the financial industry. Finally, we conclude with the difficulties in regulating FinTech and with the rise of RegTech.

In Chapter 2 we analyse the main implications of FinTech and FinTechs for the banking industry in terms of performance. In the first section we focus on the FinTech innovations that mostly threaten the traditional banks while in the second section we describe the main financial ratios used in the academic literature to measure banks' performance in terms of profitability and efficiency.

In the first section of Chapter 3 we examine the potential relationships between banks and FinTechs in order to understand the strategy of the incumbents to face the fierce competition from new entrants. In the second part we present a case study to analyse the impact of FinTechs acquisitions on the post-acquisition performance (in terms of profitability and efficiency) of the acquiring company. To investigate this issue, we analyse the acquisitions of FinTechs performed by BBVA, a Spanish banking Group, in 2014 and 2016.

We hypothesize that FinTech acquisitions have no impact on the post-acquisition performance of BBVA. To test this assumption, we compare pre-acquisition and post-acquisition financial ratios (ROE, ROA, CIR) of the Spanish Group using a paired t-test. Finally we comment and discuss the results obtained to assess whether FinTechs acquisition have a significant impact on the post-acquisition performance of the acquiring firm.

1. The FinTech phenomenon

To understand the main features and dynamics of the Fintech phenomenon, it is first necessary to define it. The term FinTech is a neologism that comes from the words “financial” and “technology” and it indicates the connection of new technologies with traditional activities of the financial industry (Gomber *et al.*, 2017).

We can find a great variety of definitions and interpretations in the academic literature (Varga, 2017), but in this paper we will provide a summary.

Following the perspective of the Financial Stability Board (FSB), FinTech is “technologically enabled financial innovation that could result in new business models, applications, processes, products or services with an associated material effect on financial markets and institutions and the provisions of financial services”.

FinTech includes digital innovations and technology-enabled business models in the financial industry and such innovations can transform the traditional industry structure, improve strategic intermediation, increase access to financial services, but also generate privacy, regulatory and law-enforcement changes (Philippon, 2017).

FinTech includes a wide range of digital innovations such as online marketplace lending (also known as online peer-to-peer lending), equity crowdfunding, robo-advice, distributed ledger technology (DLT), cryptocurrencies and machine learning (Schindler, 2017).

Ozaee and Sohrabi (2017) described FinTech as a system of software and digital platforms to deliver financial services to final consumers. In this sense FinTech is an industry that refers to companies that try to make financial solutions more flexible and efficient through a greater support of new technologies. Fintech companies are generally technological start-ups which provide clients with an array of services and strive to consolidate their position in the financial market by competing with traditional banks and financial players (Darolles, 2016).

In Gomber *et al.* (2017) FinTech contains innovators and disruptors in the financial sector that offer more flexibility, efficiency and opportunities than the traditional financial intermediaries. FinTech is considered as “sustaining FinTech” when it refers to existing financial firms that use innovation to strengthen their business, or as “disruptive FinTech” where start-ups and new companies adopt IT to compete with traditional financial firms by supplying new products and services. (Lee, 2015).

Despite the different perspectives, authors agree to define Fintech as the marriage of financial services and information technology (Arner *et al.*, 2016), whose aim is to promise more flexibility, efficiency and security to customers than incumbent financial institutions.

In the first part of our work we will follow the definition of FinTech provided by the Financial Stability Board since our principal aim is to study the dynamics and the effects of the phenomenon and not of FinTech firms.

Summing up, FinTech activities can be organized into five categories of financial services: (i) payments, clearing and settlement; (ii) deposits, lending and capital raising; (iii) insurance; (iv) investment management; and (v) market support (FSB, 2017). For example, the category of payment involves new and innovative payment solutions such as mobile payment systems. P2P transfers and cryptocurrencies; deposits and lending activities include crowdfunding, crowdlending, and microcredit solutions. (Haddad and Hornuf, 2018).

1.1 The development of FinTech in the financial industry

In a broader sense, FinTech is the application of technology to finance, but this is not a novelty for the financial industry (Arner *et al.*, 2016). Technology and innovation have always had a key role in the evolution of the financial sector. Indeed, the last 60 years represent an important step forward in terms of innovation: in the 1950s the credit cards revolutionized the payment system, in the late 1960s the introduction of the Automatic Teller Machine (ATM) replaced branches and tellers, the 1970s promoted the first electronic stock trading on exchange trading floors, during the 1980s financial institutions implemented new ITs, while the 1990s brought Internet and e-commerce business models (Ozaee and Sohrabi, 2017).

Even though financial players have always looked for and adopted new solutions to best satisfy their clients, the waves of financial and technological innovation of the last decades caused important changes in the financial landscape, concerning not only products and services but also regulatory issues (EBA, 2017).

To understand how and why FinTech today influences financial players and markets, it's fundamental to summarize the evolution of this phenomenon.

1.1.1 The process of FinTech evolution

Arner *et al.* (2016) tried to understand how FinTech established itself in the financial market and what factors drove its development. The authors distinguished three phases of FinTech evolution, specifying that the term Fintech does not refer only to specific sectors or business

models, but it entails all services and products offered by incumbent financial institutions. The first stage (1866-1987) is FinTech 1.0 and it allowed the transition from an analogue industry to a digital one; new technologies developed during the 19th century facilitated the transmission of financial information, transactions and payments across borders. The technological innovation of this period favoured the establishment of a modern infrastructure, which increased the global interconnection of financial institutions (Varga, 2017).

1987 marked the beginning of a new era characterized by the globalization and digitalisation of financial processes based on electronic transactions between financial players and their customers around the world. Financial institutions began to adopt computerized trading systems, banks developed IT infrastructures for internal operations and relationships with their retail clients and new regulatory standards were drawn up to face new risks in the financial industry. With the emergence of Internet most of banks fully digitized internal processes and relations with outsiders and retail customers. Even though the innovation occurred during this era was initially regarded as disruptive, it represented the “birth of modern banking” (Varga, 2017) based on IT infrastructures, branch-focused business models and advanced technological systems.

With the internet evolution in the 1990s, technological advances transformed the nature of the financial services industry and led to the development of electronic finance (e-finance) which refers to many financial services such as banking and stock trading performed through electronic means (Lee and Shin, 2017). The mobile finance asserted itself during the 2000s thanks to important innovations in the smartphone user base and this facilitated the emergence of new services such as mobile payment and mobile banking that are an extension of e-finance. The innovations introduced in the two last decades favoured the success of FinTech especially after the worldwide crisis of 2008 by combining e-finance, internet technologies, artificial intelligence and big data analytics.

Until 2008 FinTech included traditional regulated financial players that provided financial services and products using new technologies; after the global financial crisis new start-ups and established technology companies emerged in the financial industry, which began to offer financial solutions and services directly to businesses and final customers.

Since the 2008 global financial crisis represented the turning point for the growth of FinTech 3.0, we decide to briefly discuss the consequences of the crisis, that accelerated the development and the success of FinTech in the financial industry.

1.1.2 The role of the 2008 financial crisis in the development of FinTech

The financial crisis in 2008 is only one of the factors that caused significant changes in the banking and financial sectors (Nicoletti, 2017). As underlined by Darolles (2016) the financial crisis had a strong influence both on the regulation of the traditional financial institutions and on the trust of clients in their banks.

Since the crisis of 2008 revealed systemic risk in the activities of traditional players, post-crisis reforms reinforced the regulatory framework mainly for banks.

The consequences of the crisis were amplified by the failings of the banking sector such as excessive leverage, low-quality and inadequate capital, and insufficient liquidity buffers (BCBS, 2010a). Therefore, the banking system was not able to absorb the resulting losses, and the financial crisis was transferred to the rest of the financial industry and the real economy, causing a significant reduction in credit and liquidity availability.

The Basel Committee on Banking Supervision (BCBS) decided to intervene after the financial crisis to increase the banks' ability to absorb shocks and reduce risk of spillover from the financial sector to the real economy. The post-crisis reforms have been referred to as "Basel III" whose main aim concerns a stronger capital and liquidity regulation mixed with improvements in banks' supervision, risk management, greater transparency and disclosure. For BCBS it was fundamental to restore the health of the banking system, as it is the centre of the credit intermediation process between savers and investors and it provides a wide range of financial services to customers, SMEs, large companies and governments. (BCBS, 2010b).

The effects of the financial crisis were so strong, since the global banking system faced the crisis with an insufficient level of high-quality capital. For this reason, the new regulation redefines the bank capital, focusing on common equity, which is considered the highest quality component of a bank's capital. The regulatory capital comprises Tier 1 Capital, made up by Common Equity Tier 1 (CET1) and Additional Tier 1, and Tier 2 Capital. The new rules introduced new restrictions for these categories: a minimum CET1 ratio of 4.5% of risk-weighted assets at all times with a conservation buffer of 2.5% to all forms of capital; Tier 1 Capital must be at least 6.0% of risk-weighted assets at all times and the Total Capital (Tier 1+ Tier 2) must be at least at 8.0% of risk-weighted assets at all times (BCBS 2010b, Cosimano and Hakura 2011).

Since the BCBS considered the inadequate liquidity in the financial system as one of the main culprits of the 2008 crisis, it decided to implement the liquidity coverage ratio (LCR), a short-term measure to verify whether banks have enough liquidity to meet expected future outflows within a 30-day period (McNamara *et al.*, 2014). In particular, the aim of the LCR is to guarantee, that banks own sufficient high-quality liquidity assets (HQLA) to survive a 30-day

stress scenario and the timeline established by the BCBS imposed on banks to achieve a LCR of 60% by January 1, 2015 and a LCR of 100% by January 1, 2019.

During the financial crisis banks were forced to reduce their excessive balance sheet leverage and this caused additional downward pressure on asset prices and contraction in credit availability. Hence, the Basel Committee decided to introduce a simple and non-risk based leverage ratio to constrain the increase of leverage in the banking sector – avoiding deleveraging processes that can damage the financial system and the economy- and reinforce the risk based requirements (BCBS, 2010b)

Consequences of Basel III on the banking sector are the subject of many debates in the literature (Cosimano and Hakura, 2011).

Some authors (Admati *et al.*, 2011) argued, that higher capital requirements can generate significant benefits by reducing leverage and the risk of bankruptcies in the banking sector. Increasing bank equity allows to limit systemic risk events, because banks are required to fund themselves with more equity than they did before the financial crisis. In addition, the authors demonstrate that the social costs of rising capital requirements are very small for large financial institutions.

On the other side, Arner *et al.* (2016) asserted, that the greater rigidity of the new regulation has increased the compliance obligations of banks and modified their incentives and business structures.

Basel III has also reduced the capacity of banks to provide low-value loans with damages especially to SMEs or private individuals, who usually choose new players or innovations to fund themselves.

Spinassou (2013) showed, that the capital requirements, imposed by Basel III, reduce the credit supply without guaranteeing an improvement in the financial stability and that the higher leverage ratio, introduced since 2010, induces banks to prefer risky projects to safe ones. Cosimano and Hakura (2011) focused their analysis on the impact of new capital requirements of Basel III on the behaviour of banks in developed countries from 2001-2009. The results suggested, that the new standards determine higher loan rates and slower loan growth, even if banks' reaction vary from one economy to another one, considering the cross-country variations in banks' net cost of raising equity and the elasticity of loan demand with respect to changes in loan rates.

Even though the main goal of Basel III was to defeat the weaknesses of the banking and the financial sectors, banks reduced their activities, since they were obliged to keep greater reserves and they are still considered by the public opinion as the real responsible for the financial crisis (Darolles, 2016).

Financial crisis has also changed the public perception of the banking system (Arner *et al.*, 2015). The authors underlined the effect of the financial crisis on the labour market focusing on two sets of individuals. Firstly, many financial professionals either lost their jobs or were less well remunerated after the financial crisis and consequently most of this under-utilized educated workforce has been admitted to the new industry of FinTech 3.0. On the other hand, the financial crisis has indirectly damaged the newer generations, that are facing many difficulties in the labour market, even though their education and skills are in line with FinTech innovations.

Especially younger generation have lost their faith in banks since the financial players were not able to manage their risks during the financial crisis and they avoided the bankruptcy only thanks to significant injection of public money (Darolles, 2016).

Finally, several studies pointed out that the loss of confidence in financial institutions mainly on the part of European and American consumers is accompanied by a substantial increase in confidence in financial services provided by technological institutions (Fujitsu, 2016). This attitude bolsters the acceptance of FinTech innovations especially among the young at the expense of traditional providers of financial services.

1.2 The drivers of FinTech: demand and supply factors

After analysing the historical evolution of FinTech, we focus on the main drivers and determinants of this phenomenon to understand, why it is exploding right now in the financial sector.

Schindler (2017) adopted a demand and supply framework of financial innovation, that is then applied to the definition of FinTech.

1.2.1 The supply side factors

Starting on the supply side, supply drivers represent what leads someone to provide new products or services to the financial market; in this category we can find continuous technological progress, regulatory environment, revolutionary innovations and the macroeconomic landscape (Kerenyi and Molnar, 2017).

As analysed above, technology has always played a key role in the evolution of the financial sector: ATMs, Internet, e-finance, online banking and mobile payments have been important technology advances, representing a great breakthrough in the financial innovation.

Technological innovations could have material impacts on the structure of the financial system in terms of concentration, contestability and composition (FSB, 2017). A decrease in concentrations is generally associated with greater competition, lower market power of players

and lower prices; technology reduces concentration, when it allows new or non-traditional service providers to compete with incumbents and to offer goods or services, that overcome the existing regulation.

Considering contestability, technology may reduce costs for new entrants and facilitate their access to technology. However, the consequence is the reduction of the incumbents' pricing power.

Finally, technology may favour the unbundling of financial services, leading to a change in the composition of service providers and to a great amount of activities, that are not subject to the regulatory framework.

Financial innovation is often driven also by regulation which comprises changes in regulatory and supervisory requirements.

As underlined above, the causes and consequences of the 2008 financial crisis induced regulators to improve the previous set of rules with a great impact on the business incentives of incumbents and new players (FBS, 2017). By increasing the rigidity of the requirements for the banking sector, banks reduced low-value loans and were forced to move away from short-term funding (Schindler, 2017). Now banks must comply with stricter standards, whose aim is to protect the financial intermediary system and the consumers from another financial meltdown (Kerenyi and Molnar, 2017). Since the new regulation damaged the ability of banks to meet the needs of all types of customers, this favoured the emergence of new financial players, that took the place of incumbents in providing financial products and services to clients and businesses. In many cases an innovation creates in turn another innovation, which trigger an "innovation spiral", leading to a natural sequence of innovations (Schindler, 2017). In this sense, innovation can be interpreted as a supply factor because it allows the emergence of another innovation.

Innovation can be revolutionary, when it transforms the market conditions and features in a radical way (Kerenyi and Molnar, 2017). Considering the FinTech sector, the distributed ledger technology (DLT) is an example of disruptive innovation, that deeply modifies payment, clearing and settlement (PCS) processes (Mills *et al.*, 2016). DTLs allow their users to collect and access information relating to a given set of assets and their holders in a shared database, which can be used to settle the transfers of securities and cash without the need of a central ledger or authority (Pinna and Ruttenberg, 2016). This technology executes a large number of real-time transactions rapidly, reducing the operating costs of payments and especially cross-border money transfers (Kerenyi and Molnar, 2017).

Financial innovation is usually driven by changes in the financial and macroeconomic landscape (Schindler, 2017). The author stated, that the collapse of the American housing market on the eve of the crisis caused a significant rise in the quantity of real estate, owned by

banks and financial institutions; this situation encouraged many financial players to securitize the rental income from the real estate they owned. This led to an important innovation in the financial sector, since it would be more difficult for financial institutions to create such a product without the collapse of the housing market which left them with lots of real estate.

Considering the macroeconomic landscape, the increase in the number of FinTech players has been favoured also by the low interest rate environment caused by the international financial crisis (Kerenyi and Molnar, 2017). After the financial meltdown, the result was the implementation of an active monetary policy with a cut in interest rates and the introduction of quantitative easing measures. Although the stricter and risk-averse regulation introduced after the 2008 crisis reduced the instability of the financial system, in several countries, especially in Europe, it has become more difficult to fund and support innovations and initiatives; therefore, the innovations that characterize FinTech often come from new market players (start-ups, technology companies) which are not subject to that regulation (Zilgalvis, 2014).

1.2.2 The demand side factors

Considering the demand side, financial players can create and offer lots of products and services, but there is a necessary condition for their success: there should be a sufficient market demand for these products.

Consumer habits and preferences are the first demand driver for financial innovation. Consumers' and companies' habits have changed with the evolution of technology and the penetration of Internet not only in their everyday life, but also in how banks conduct their activities (Kerenyi and Molnar, 2016). Customers are now looking for more convenient, tailored and faster financial solutions than in the past, and they expect an immediate access to financial services, that are in line with the rest of their online activities (Wilkins, 2016).

The customer base of FinTech services is composed mainly by younger generations, that have developed different habits from their elders. Younger people require personalised solutions, that are in strong contrast with the traditional approach of banks and other financial institutions, which are prone to offer products for the mass market (Darolles, 2016). In addition, younger generations are more comfortable in using latest technologies and for this reason they represent the targeted customers of FinTech companies. Despite the success of FinTech solutions among youngers, financial incumbents are aware, that they should satisfy their demand with more innovative and interactive products and services (Schindler,2017).

Besides demographics, Schindler recognized, that regulation acts both as supply factor and as demand driver, since it can contribute to demand for new products and services. To prove this hypothesis, the author focused on the liquidity coverage ratio (LCR), which requires banks to

hold an adequate stock of high-quality liquidity assets (HQLA) to meet their liquidity needs within a 30-day period (BCBS, 2013). So, if a bank has issued a bond or another instrument that is coming due within 30 days, the bank must hold HQLAs to cover the impending outflow. From the author's perspective, this creates demand for products, that do not lead to the implementation of the LCR; one of these products is the callable commercial paper.

A commercial paper typically includes short-term promissory notes issued by corporations or other issuers to fund future operations. In case of commercial papers, banks provide back-up liquidity facilities to the issuers, which can draw upon them to repay a maturing issue of commercial paper, if the issuers are not able to sell a new issue of commercial paper to do so (a process called "rolling over"). If the issuer draws upon the back-up facility during the 30-day period of LCR, the new regulation introduced by Basel III imposes on the facility provider to maintain corresponding HQLA. The consequence of LCR is an increase in the cost to banks of providing backup liquidity facilities for commercial papers that mature in 30 days or less. To avoid such draws occurring within the 30-day LCR window, banks developed commercial papers, that include a call provision allowing issuers to redeem the commercial paper before the start of the 30-day period. Therefore, if a commercial paper is redeemed before it reaches its maturity (30 days), then the issuer of the commercial paper cannot draw upon the liquidity facilities within 30 days and consequently banks do not need to maintain any HQLA in support of the facility (McNamara *et al.*, 2014).

In this case, the regulation (Basel III), that introduced the LCR, created demand for a new product (on the part of issuers of commercial paper) and induced someone (banks) to supply the new product.

1.2.3 The emergence of fintech companies

In the first part of this paragraph, we analysed the main drivers of the FinTech phenomenon, considering demand and supply side, even if many studies also focus on factors, which favoured the emergence of fintech companies.

Haddad and Hornuf (2018) examined the main economic and technological determinants, that explain the formation and the success of fintech start-ups, which are categorized into nine different types: those that operate in financing, payment, asset management, insurance (insurtechs), loyalty programs, risk management, exchanges, regulatory technology (regtech) and other business activities. The study focuses on fintech start-ups formation in 55 countries between 2006 and 2014 and it is based on four main hypotheses. First, the authors supposed, that well-developed economies and capital markets facilitate the formation of fintech start-ups. Indeed, these start-ups need enough financing to start and carry on their business models and

so, if the traditional capital markets are well-developed, entrepreneurs have better access to the necessary resources to fund their businesses. In addition, in more advanced economies it's more likely, that individuals require innovative services and new financial tools especially within large financial markets, which offer greater possibilities of changes through innovation and digitalization.

A second driver is the availability of the latest technology in the economy. As already analysed for the FinTech phenomenon, technological advances are a fundamental prerequisite to introduce new solutions and to disrupt the traditional financial sector. Fintech companies need technological innovations to satisfy new customers' needs, by implementing faster payment systems and offering easier operations, to improve the sharing of information and to reduce the costs of banking transactions. To encourage the supply of fintech solutions, latest technologies need to be accompanied by a supporting infrastructure, that should be already available in the economy of the country.

The third factor of Fintechs formation relates to the nature of the financial sector. The 2008 financial crisis played a key role in the sudden upsurge of fintech start-ups for several reasons. The lack of trust in banks after the crisis benefitted FinTechs, which interrupted the vicious circle of distrust and reduced financial soundness.

The financial meltdown also increased the cost of debt for many SMEs and in many cases, banks stopped lending money to businesses, while many FinTech start-ups in the area of crowdlending and crowdfunding were able to fill this gap. Therefore, the demand for FinTech services should be higher in countries which were more strongly hit by the financial crisis and where the banking sector is less sound.

Lastly, the authors considered the role of credit, labour market and regulation in FinTechs formation. The authors observed, that economies should adopt a supportive regulatory regime to attract entrepreneurs and to promote the emergence of start-ups. Furthermore, individuals are more prone to establish a new business, if there are no significant restrictions on how the credit is supplied to the private sector and no controls on interest rates, that interfere with the credit market.

The authors also tried to understand how the features of the labour market can affect FinTech start-ups. First, an economy should allow market forces to determine wages and conditions, so that start-ups can find talented individual and to easily hire and fire employees. Indeed, large bureaucratic costs and complicated administrative requirements might prevent any new business activity.

Following the report by Ernst&Young (2016), the Fintech ecosystem is based on many attributes, among which there are talent and entrepreneurial availability. A country with a large

workforce of skilled talent has a more positive influence on the emergence of FinTech companies.

Analysing all these aspects, the authors concluded that FinTech start-ups are more frequent in countries and regions with a more supportive regulation and a larger labour market.

Despite the great success of FinTech start-ups, they are not the only ones, that operate in the FinTech sector. (Kerenyi and Molnar, 2017). Indeed, in the recent years many large non-bank companies have started offering financial services, that once were a prerogative of traditional financial institutions. Technology companies have become the most successful FinTech companies, since they can overcome entry barriers to the banking market thanks to their features: they have a large customer base, the adequate IT infrastructure and a solid reputation. Although most of technology companies provide their existing customers with online and mobile payment systems (for example: Google Wallet, Apple Pay and Amazon Payment), some of them takes part also in lending activities.

1.3 Opportunities and challenges of FinTech

FinTech is a very complex movement, that includes both technological innovations applied to financial services and fintech companies that provide innovative financial services. Considering the double nature of FinTech, we will examine benefits and challenges of both the general phenomenon and companies operating in the FinTech sector, since both have the potential to reshape and at the same to disrupt the existing financial sector.

1.3.1 Benefits of FinTech in the financial industry

Financial innovations arise as solutions to market inefficiencies or imperfections and they provide benefits by improving at least one inefficiency (Henderson and Pearson, 2009).

Starting from the upsides, FinTech seeks to globalize simple financial services by improving financial inclusion especially in developing and emerging countries, where the financial services are not yet widespread. To increase financial inclusion, FinTech offers simple financial products and services thanks to new instruments and technologies.

With respect to traditional incumbents, which generally adopt a mass market approach, FinTech may entail benefits for customers through improved quality and user experience, more tailored products, easier access to financial services and cheaper financial solutions (EBA, 2017). By utilizing big data, FinTech analyses individual customers preferences, and so it offers personalised tools and solutions (Nakaso, 2016). Indeed, FinTech companies pay more attention to customers' specific needs and attitudes, because the final decision is up to clients,

that are looking for interactive and flexible services according to their wants (Ozaee and Sohrabi, 2017).

FinTech can generate efficiencies also for credit and other financial institutions: cost reduction, faster provision of services, increases in customers number thank to greater financial inclusion and lower regulatory compliance costs (EBA,2017). FinTech companies decrease banking costs due to bricks and mortar branches, complex procedures and severe industry regulations, since FinTech disrupters are not constrained by rigid regulations, legacy IT systems or branch networks like traditional financial players are. (Ozaee and Sohrabi, 2017).

Moreover, FinTech companies can meet mainly SMEs loan applications, that in many cases banks are obliged to refuse because of stricter standards imposed after the 2008 financial crisis. This is possible as most of FinTech lending companies use alternative data and ways of assessing credit risk by increasing credit availability for consumers (smaller, younger, less profitable and minority-owned businesses), that previously were underserved (Jagtiani and Lemieux, 2017). Some FinTech lenders have developed their own algorithms and online lending platforms, which include non-conventional information (sales data, shipping data, cash flow analysis from business checking accounts) to evaluate the credit risk of the borrowers. FinTech lenders have access to non-traditional information, which are not used or not available to traditional bank lenders, such as FICO scores (which estimates the credit worthiness considering: payment history, current level of indebtedness, types of credit used, length of credit history and new credit accounts) and DTI (debt-to-income) ratios.

All these innovations favour a more stable credit landscape and allow FinTech firms to avoid two basic risks of banking activities: mismatched maturities and leverage (Ozaee and Sohrabi, 2017). Indeed, banks act as financial intermediaries: they take deposits, provide loans to borrowers and liquidity to depositors (fractional-reserve banking), even if these functions may cause bank run, which sometimes triggered crisis in the past (Nakaso, 2016). FinTech companies do not accept deposits: in case of online lending platforms, they simply match borrowers and savers directly.

In a broader sense, FinTech can benefit the financial industry through the provision of new services and business models, the rise in market transparency and improvements in the efficiency of information exchange (EBA, 2017).

In conclusion, FinTech revolution has significantly modified the financial industry and the activities of traditional financial players: (i) it has transformed business models, financial intermediation and customer access to new solutions; (ii) it provides new financial products and services with a higher level of personalization thanks to the application of big data analytics;

(iii) FinTech companies substituted some of traditional banks' activities and deliver their services through new and more attractive non-banking channels (Gomber *et al.*, 2018).

1.3.2 Risks and challenges of FinTech in the financial industry

Despite the benefits of FinTech innovations, they also bring new issues regarding payment and settlement (Nakaso, 2016). Firstly, FinTech may introduce significant changes in the structure of settlement and other financial services. As already mentioned, DLT is one of the most revolutionary innovation introduced by FinTech, and its emergence can significantly affect the traditional settlement structure based on centralized bookkeepers, since DLT promotes "decentralization-oriented" technologies. Increasing automation could guarantee greater efficiency and certainty, but at the same time it could increase financial volatility, which may be only short-term or create procyclical dynamics (Wilkins, 2016).

The digital transformation of finance has increased the potential for cyber-attacks, as most of innovations are founded on digitisation, interconnected IT systems and the sharing of data across a wider set of parties (EBA,2017). FinTech technologies and networks are becoming accessible especially through open gateways such as internet and smartphones, and this increases the need to strengthen appropriate measures against cyber threats (Nakaso, 2016). Therefore, if cybersecurity systems are hacked, there will rise operational, legal and reputational issues and financial losses for institutions and this may weaken long-term trust in new solutions, leading to lower adoption rates (EBA,2017). At worst, there might be a wave of coordinated attacks causing a liquidity squeeze in the financial market and threatening the solvency of financial players (Darolles, 2016). The FinTech process has made the financial industry more vulnerable to attacks, and cybersecurity is the clearest example of how FinTech needs a regulation (Arner *et al.*, 2016).

FinTech initiatives have generated important challenges regarding regulation and traditional financial players' behaviour relative to technology adoption (Nicoletti, 2017). Although we are going to discuss the relationship between FinTech and regulation in next pages, we have already underlined, that many FinTech activities and companies emerge and operate outside the traditional regulatory framework. On the one side this favours more flexibility, greater speed and lower compliance costs for FinTechs; on the other side it makes more difficult for regulators to monitor these activities and there is a lower level of coordination among financial services, FinTech companies and regulatory officials (Nicoletti, 2017).

The evolution of FinTech has created some challenges for traditional financial players. Relative to the digital transformation promoted by FinTech evolution, incumbents have only few possible strategic solutions to compete with newcomers (Darolles, 2016). FinTech companies

have a competitive advantage thanks to the adoption of innovations, while financial players try to be fast adopters (Merler, 2017), by expanding the technical skills of their IT teams and encouraging their staff to adopt new working methods and procedures. This might also imply the purchase of financial products and services from FinTech firms or directly the acquisition of FinTech start-ups, even if this last solution is rare. Traditional financial players seem to be hostile to merge a new entity with their existing infrastructures, although the acquisition could bring important advantages to traditional incumbents.

Another solution is the collaboration with FinTech companies to develop new services and to move traditional client relationships towards a more interactive and tailored system (Darolles, 2016). The collaboration may benefit both FinTech companies and traditional financial players; indeed, to sell their services, FinTechs need partners who know how to operate in the financial industry, and incumbents in turn can provide their products to third parties in unbranded forms. This solution is adopted by traditional financial players to create ties with FinTechs and exploit their distribution channels and customer base. In this new model incumbents operate as product design platforms, selling unbranded solutions to FinTechs and so becoming more capable of satisfying changes in users' needs. The only risk with this model is that FinTech companies, which have a direct relationship with clients, might bypass the platform supplying the financial products.

Despite risks and challenges, the lack of FinTech innovation would lead to a risk of technology complacency and obsolescence relative to other countries (Nicoletti, 2017). Without technological advances, financial institutions might lose their competitive advantage and therefore, their financial environment might become non-competitive in the global financial market.

Some authors try to investigate the effects of FinTech also in relation to the real economy, in terms of economic growth, GDP per capita and industry volatility.

Beck *et al.* (2014) assessed the relationship between financial innovation and economic growth and volatility. Analysing a set of 32 countries over the last decade, the authors found that: (i) a higher financial innovation leads to stronger growth opportunities for a country and to a higher GDP per capita growth; (ii) a higher financial innovation is associated with higher growth of industries, that rely more on external financing; (iii) a higher level of financial innovation causes higher growth volatility among industries, which rely more on external funding.

In addition, the authors underlined, that the relationship between financial innovation and real economy also depends on the features of the market environment, the financial structure and the regulatory framework. For example, the positive effect might be stronger in market-based

financial systems than in banks-based financial systems. Indeed, the first ones are more prone to stimulate financial innovation, completing financial markets and exacerbating negative effects; the second ones are more focus on the innovation in the retail sector, improving customers' experience through new products and services. Concerning the regulatory framework, we have already discussed the consequences, that the tightening of bank regulation after 2008 had on the evolution of financial innovation. On the one hand, more restrictive requirements increased banks' difficulties and limited the possibilities to innovate; on the other hand, they facilitated the success of FinTech solutions, giving banks more incentives to innovate in their turn.

The results of this study confirmed, that there are both "bright" and "dark" sides to financial innovation, since it encourages a stronger economic development, but at the same time it turns out into higher volatility in industries, which benefit more from financial innovation.

Since finance has a strong connection with economy, the positive effects of FinTech on the financial industry also spread to the real economy sector (Nakaso, 2016). FinTech innovations stimulate and improve financial inclusion, which in its turn has a positive impact on economy; if people have access to new financial services, they have the opportunity to expand innovative businesses such as e-commerce and e-learning, which in developing countries are hindered by the limited access to payment services. Therefore, FinTech contributes to economic development with new financial services and opportunities, even if in developed countries it is more difficult to quantitatively assess the impacts of FinTech on the economy because of the high level of technological innovation.

1.3.3 FinTech and financial stability

FinTech might have significant implications in the financial industry in terms of financial stability.

As underlined by the Financial Stability Board (FSB), FinTech can either support or undermine financial stability; indeed, innovations could guarantee a more efficient provision of financial services and a reduction in financial frictions, but at the same time they could intensify existing difficulties or introduce new ones.

The main benefits to financial stability first include decentralisation and diversification, which can curb the consequences of financial meltdowns in some circumstances. Specially in developing countries, financial market diversity is a necessary condition for financial stability; indeed, the failure of a single financial institution has a weaker influence on the market, since there would be other providers of the same financial services. Efficiency in operations also provides support to financial stability, since it favours stable business models of financial

institutions and creates advantages in terms of overall efficiency in the financial system and the real economy.

A third factor, that contribute to a greater financial stability, is transparency, as it reduces information asymmetries and it allows to assess and price risks more accurately. Securitisations are an example of modern financial innovation; the opacity of securitisations was considered by many scholars as one of the main issues, which led to the 2008 financial crisis by generating severe agency problems in loan underwriting, screening and monitoring. To reduce the opacity, both the EU and the US adopted new regulations, that impose more asset-level transparency for many types of asset-backed securities. Ertan *et al.* (2016) demonstrated that new standards, especially in Europe, have encouraged securitized loans of better quality in terms of lower default probability, lower delinquent amount and lower losses upon default.

Moreover, transparency stimulates the creation of financial instruments with exposure to specific risks, completing markets and increasing market participants' ability to manage risk.

The last benefit of FinTech to financial stability is represented by the access to and the convenience of financial services. We have already discussed, that for example FinTech credit increases the availability of credit mainly for households and SMEs, who are generally underserved by traditional financial players. Besides the access to financial services, FinTech innovation also improves financial inclusion by providing new technologies and instruments. Therefore, access to and convenience of financial services are two fundamental conditions for supporting sustainable economic growth and providing a diversification of exposure to investment risk.

The FSB also analyses the factors that could undermine the financial stability, separating micro-financial risks and macro-financial risks. Micro-financial risks are those, that make individual firms, financial market institutions or sectors particularly vulnerable to shocks and they include both financial sources and operational sources. Examples of financial sources are maturity mismatch, liquidity mismatch, and leverage, which expose the counterpart to losses. Operational sources refer to: (i) governance or process control issues, which can lead to a disruption in the provision of financial services or critical infrastructures; (ii) cyber risks, which can damage the protection of data and the integrity of systems, causing financial losses for institutions; (iii) legal and regulatory risks, which can negatively affect the confidence in the system leading to reputational issues.

Macro-financial risks refer to weaknesses, which could amplify shocks to the financial system and consequently impair the financial stability. Potential risks include: (i) contagion, which is the possibility, that a distress suffered by a single financial institution or sector could influence other institutions or sectors in the financial market, causing a decrease in confidence in those

institutions or sectors; (ii) procyclicality, which refers to the natural tendency of financial variable to fluctuate around a trend during the economic cycle (Landau, 2009) and which can threaten financial stability, when market participants' actions exacerbate the degree and impact of fluctuations in economic growth and market prices over longer terms; (iii) excess volatility, arising when the financial system overreacts to news causing solvency or liquidity problems, which can impair the functioning of asset and credit markets, especially in case of homogeneity of business models; (iv) systemic importance: entities that are considered too important and "too big to fail" may lead to moral hazard, because they generally operate outside the current regulatory perimeter and they never take on bank-like risks (maturity transformation and leverage). In addition, they may compromise the competition with other service providers, since they are considered systemically important for the financial industry (Wilkins, 2016).

1.3.4 Implications of FinTech credit on financial stability

In this paper, we define as FinTech credit all credit activities facilitated by electronic online platforms, which match borrowers and savers directly and process a large amounts of customer information (BIS, 2017).

Since FinTech credit activity plays an important role and has generated significant interest in financial markets, the FSB also analyses the effects of FinTech credit on financial stability. The FinTech credit activity has grown fast over the last years, even if it follows different paths across different jurisdictions (Claessens *et al.*, 2018). China is the largest market (considering data referred to 2016) followed by United States and United Kingdom at a distance. After the rapid growth in 2013-2016, the evolution of FinTech credit suffered a slowdown in many major jurisdictions; even though FinTech credit markets have experienced a rapid expansion in recent years, their size remains small relative to credit provided by traditional financial intermediaries (BIS,2017). The actual small size of FinTech credit limits its direct influence on financial stability; however, if this sector were supposed to increase, it would bring both benefits and risks for the financial stability (Merler, 2017).

The most important advantage of FinTech credit is the improvement in financial inclusion, which allows investors to obtain alternative products and borrowers with limited access to bank-intermediated credit to receive the necessary funding. FinTech may also reduce transaction costs, including search costs and costs incurred during loan origination and maintenance processes, thanks to the digitalisation of lending process and the introduction of new lending technologies. The decrease in transaction costs could lead to lower lending costs and better risk-adjusted returns for investors; however, it is fundamental to assess whether FinTech lenders are able to transform lower lending costs in advantages for their borrowers in

terms of lower prices (Jagtiani and Lemieux, 2017). Indeed, Philippon (2017) found, that the unit cost of financial intermediation has declined only marginally after the 2008 crisis despite the significant evolution of FinTech.

The creation of innovative lending platforms may also encourage the diversification of credit sources in the economy, as they provide alternative solutions, that are more suitable for smaller firms and final consumers. The greater diversity in credit provision can benefit the traditional banking sector in specific circumstances, where FinTech credit platforms act as “spare tyre” for lending in the economy. In fact, FinTech offers new options and solutions, through which credit can flow to other parts of the economy, if traditional lending is not available. In this sense, FinTech credit increases the efficiency of incumbents (Merler, 2017) and in some jurisdictions, governments use FinTech credit platforms to stimulate credit markets after a banking crisis (BIS, 2017).

At the same time, many advantages of FinTech are linked to potential risks. FinTech increases accessibility to credit for many categories of customers, but with the threat of a deterioration in lending standards. Sahay *et al.* (2015) identified a bell-shaped relationship between credit inclusion and banks’ stability. In countries with weaker bank supervision the negative effect of greater credit access on bank buffers is more pronounced, while in countries with high levels of supervisory quality, credit inclusion is positively associated with higher bank buffers. So, the authors concluded that the impact of a broadening credit access on bank stability depends on the quality of the supervision, and they underlined the need for strong supervision to improve financial inclusion through credit.

FinTech credit may also lead to more procyclical credit provision like a reduction in lending conditions during an economic upswing and a pullback in credit in case of financial distress. A significant pullback of FinTech credit generates a systemic risk concerning the availability of substitute forms of credit, either through other online lending platforms or traditional financial intermediaries. Considering the small size of FinTech credit in most of countries, it is difficult for borrowers to find alternative FinTech credit platforms quickly and for this reason barriers to existing platforms offering different types of lending are not high.

Traditional financial intermediaries rarely supply credit to certain borrowers, such as very small or self-employed businesses. Therefore, it is unlikely that FinTech lending will be promptly replaced from solutions outside the FinTech credit industry.

Moreover, FinTech lending companies are more prone to help investors with herd behaviour and more volatile credit risk appetite, even if FinTech lending platforms may be more

exposed than banks to some micro-financial risks due to their greater use of untested and digital processes.

Financial stability could also be undermined by the securitisation of FinTech credit obligations into large pools. This process allows borrowers to obtain funding from different classes of institutional investors and FinTech investments to be actively traded; however, an increased use of securitisation may cause some financial stability risks. Firstly, this process rises the connection between FinTech platforms, traditional banks and capital markets.

Therefore, the continuous expansion of FinTech credit market can generate new channels, through which risks in the FinTech credit sector are transmitted to the wider financial system and vice versa.

Secondly, securitisations of FinTech credit obligations can bring to greater opacity in the overall market due to the bundling and tranching of loans obligations. Indeed, many FinTech credit activities have emerged outside the regulatory perimeter with consequent difficulties for authorities in monitoring and managing.

1.4 Regulation of FinTech

One of the main issues concerning FinTech evolution is connected to the regulation of this recent phenomenon. The 2008 global financial crisis induced regulators to strengthen the existing rules and to introduce new requirements especially in the financial and banking sectors, favouring the evolution of FinTech activities and companies.

FinTech generally emerges and operates outside the regulatory perimeter and the non-traditional products and services offered by FinTech companies may not observe the traditional financial regulation (Arner *et al.*, 2016). For this reason, it becomes more difficult for regulators to monitor and evaluate FinTech activities.

1.4.1 Difficulties in regulating FinTech

Regulators' objectives about financial industry are: financial stability, prudential regulation, conduct and fairness, competition and market development (Arner *et al.*, 2016). Before elaborating a suitable regulation, supervisors need to analyse the benefits and the applicability of a technology. The introduction of a new technology, as FinTech, does not always imply that it will be widely adopted and so that it will be subject to new rules. Since FinTech emerging players are growing fast and they are threatening traditional incumbents, regulators need to intervene by adjusting their methods and rules to best support FinTech.

Considering the significant changes in financial and banking sectors over the last decades, there are two main risks that regulators need to avoid (Darolles, 2016). First, regulators should

prevent overprotecting incumbents creating high entry barriers for newcomers. Indeed, an excessive regulation can stifle financial innovation and competition. Regulators also need to favour new FinTech players with a less rigid regulation than incumbents. With respect to traditional financial players, newcomers are generally not constrained by severe requirements and rules introduced after the 2008 global financial crisis, even if this may cause the lack of information protection and so issues of security. Regulators' decisions have both a direct and an indirect influence on the competition between incumbents and new players in the financial market; the main goal of the regulatory framework is to guarantee parity for all financial agents and at the same time to promote an innovative, competitive and secure financial market. Regulation should guarantee equal treatment and competition among all players for the soundness of the financial industry. Moreover rule-setters also need to focus on the incentives offered to market agents and how these can influence the behaviour and the decisions of players. Darolles (2016) suggested creating a harmonised set of rules and avoiding different regulations for different categories of players, since this would break up the financial market and interfere with the emergence of new players and with the evolution of financial innovation.

FinTech innovation brings both benefits and challenges for the financial market, but its interests are not always in line with the long-term goals of regulators (Philippon, 2017). FinTech companies generally enter the market where their activities can be profitable, although there are many sectors where the incumbents' presence is deep-seated and so entry is difficult. In these cases, the aim of the regulation is to actively encourage entry and to guarantee level playing field among traditional and new financial players. Nevertheless, in real markets the argument of level playing field, elaborated by Darolles (2016) as a fundamental goal for regulators, does not apply due to main biases of the financial sector. The principle of level playing field is not coherent when incumbents are "too-big-to fail" and it applies only when newcomers carry out the same activities of traditional players but with more efficiency or at lower costs (Philippon,2017).

For regulators it is a challenge to find a right regulation framework for new FinTech activities, as the financial industry includes both incumbents and newcomers and it should be dynamic fitting to continuous changes in the size and activity of businesses (Arner *et al.*, 2016). For FinTech start-ups regulation may be too expensive (compliance costs, licence applications) and incompatible with their lean business models. For emerging new players, it would be better to apply a principle-based regulatory regime which includes more flexible compliance obligations with respect to a rule-based regime. Both regimes have advantages and disadvantages for FinTech companies. A principle-based regime guarantees more flexibility especially for early-stage firms, but at the same time it creates uncertainty in terms of compliance and limitations

in terms of scalability for a more mature business. A rule-based regime clearly defines rules and processes giving right incentives to the supervised entity, but it leads to higher compliance costs and greater complexity. A suitable option for FinTech start-ups might be a combination of both regimes since the principle-based system allows companies to be more flexible and dynamic, while the rule-based one makes FinTechs more attractive to investors and creates a barrier to entry for subsequent new competitors.

Regulators face a difficult task in finding a balance between incumbents' interests and the need to control the emergence of new financial players (Darolles, 2016). On the one hand, authorities tend to impose stricter and tighter rules on existing players, since they know their businesses and goals. On the other hand, they tend to be more lenient with market entrants, which conduct new activities and provide new services, whose risks are still not fully understood. A right regulation should permit incumbents to survive, favour financial innovation and promote a healthy competition and to reach these goals some authors suggest principles and guidelines for rules-setters. Darolles (2016) argued that regulation should encourage healthy competition among players, whether they implement new technologies or offer traditional solutions, and remove all obstacles to growth for new entrants. Moreover, the regulation framework should not make any difference among players, but cover all them simultaneously, regardless of their characteristics or activities (principle of level playing field). Lastly, the main aim of regulators should be the protection of users of the financial system, which can continuously cause new and unexpected risks.

As FinTech involves risks and challenges, regulators need to focus on the downsides of this phenomenon, defending users of financial services and the stability of the financial system. As discussed above, one of the main risks of FinTech is the increase in cyber-attacks due to the greater use of online services, online platforms and technologies. For regulators the main obstacle is the lack of historical cases and data about cyber-risks and so they do not know how to evaluate and regulate these risks. The only solution for authorities is to identify plausible attack scenarios and test their consequences on FinTech businesses; regulators need to become experts of this field to fulfil their role. Another risk, that regulators need to face, is the outsourcing of some tasks within financial transactions. If traditional players decide to collaborate with FinTech players, they generally offload some traditional activities or tasks onto external service providers, especially in the case of jobs with a high technological content. In this way, traditional financial players reduce cost pressures and FinTech companies are more efficient, since they are better able to use new technologies. The issue is that the transaction is split between traditional regulated financial players and FinTech companies that are not necessarily subject to specific requirements and this causes a breach in the supervision system.

Lastly, authorities need to focus and supervise the use of Big Data Analytics that might bring to negative consequence for users of financial services (Nicoletti, 2017). Regulators should guarantee that data collection do not damage the privacy of users and that personal information about customers is not used as a discriminatory tool.

1.4.2 The rise of RegTech

Since the FinTech process has introduced significant changes in the financial industry, authorities were induced to combine the traditional objectives of financial stability and consumer protection with the goals of growth and financial innovation (Arner *et al.*, 2017). The outcome is a process of regulatory innovation, which includes technology (“RegTech”) and changes to existing regulatory frameworks such as the introduction of regulatory sandboxes. RegTech is the contraction of “regulation technology” and it indicates a system of new technological applications (e.g. artificial intelligence, machine learning and distributed ledgers) used to comply with a stricter and more complex regulation of the financial industry (Allen and Berg, 2018). RegTech offers a continuous monitoring capacity providing close to real-time insights and it seeks to identify problems in advance rather than take measures after the fact (Arner *et al.*, 2016).

The emergence of RegTech is attributable to: (i) the complex, fragmented and ever-evolving post-crisis financial regulatory regime which cause higher compliance and supervision costs for the regulators and the supervised entities; (ii) technological advances, which can improve data management and analysis such as new cryptographic technology, blockchain, robotics and Application Programming Interfaces (APIs) (IIF, 2016); (iii) the need of financial institutions to reduce compliance costs and (iv) the goal of supervisors to strengthen competition and guarantee financial stability and market integrity.

RegTech covers three complementary groups of participants. Firstly, financial players who apply new technologies to meet new requirements and standards, arising from post-crisis regulations. Secondly, regulators who face the rapid emergence of FinTech companies and technologies and so need to use RegTech to conform with new challenges and tasks. As mentioned above, regulators have a double goal: they need to protect users of financial services and the financial stability without hindering financial development and innovation. Lastly, policy-makers and regulators who need to create the necessary infrastructure to meet changes in the financial system and to support their new regulation. This implies an increasing use of and reliance on RegTech which allows financial institutions to comply with rules and authorities to understand innovative products and complex transactions.

Like FinTech, RegTech offers both opportunities and risks. The application of new technologies to regulatory frameworks allows to reduce compliance costs, to shorten bureaucratic procedures and to provide more flexibility and dynamism to FinTech companies. However, RegTech often requires significant investments due to the use of new instruments and procedures. Moreover, although RegTech contributes to increasing the efficiency of regulatory compliance, this does not necessarily imply a reduction in the overall burden of regulation, since compliance is only a small part of the red tape burden (Allen and Berg, 2018). Lastly, there is still uncertainty in the market about the usefulness and success of these new technologies, that can be used to reduce the complexity of rules, but whose future evolution and development might be impeded by regulations.

Another novelty in the regulation of FinTech is represented by regulatory sandboxes, that enable innovative financial players to check the feasibility of their new financial products, services and business models within a “test environment” with the exemption from regulatory obligations (Fáykiss *et al.*, 2018). Sandboxes allow start-ups and incumbents to conduct the test under real market circumstances for a specific time and involving a limited number of real customers.

Companies that are admitted to regulatory sandboxes need to follow a specific procedure to satisfy certain conditions for getting into the test. Firstly, the innovative product or service presented by the entity should have an element of novelty for the consumers and clients; secondly, the entity should meet the requirements of market entry. If the test has a positive result, then the innovation can enter the market.

Regulatory sandboxes are set up by authorities to promote competition and efficiencies through innovation and to improve the relationship between supervisors and financial services providers (Jenik and Lauer, 2017). Arner *et al.* (2016) underlined that the main market objectives for sandboxes are to reduce time-to-market at a potentially lower costs (FinTech start-ups can operate without complete licensing obligations), provide better access to finance and foster more innovative products.

Until now (at the end of 2017), the framework of regulatory sandbox is not widely applied yet. The first country introducing this innovation was United Kingdom in 2015, followed by about ten countries in Asia and Middle East. In Europe, only the Netherlands and Switzerland are adopting specific and dedicated regulatory sandboxes, even if at the European Union level more initiatives are evolving and focusing on FinTech challenges.

2. Implications of FinTech for banks and banking systems

In the first chapter of this work, we described the main activities, benefits and risks of FinTech phenomenon and FinTech companies. Our analysis shows that traditional banks are particularly threatened by FinTech which may cause the disaggregation of banks' value chain (Boot, 2017). FinTech start-ups mainly focus on retail banking, lending, and payment systems (McKinsey & Co., 2016) and they have developed new technologies and instruments, such as peer-to-peer lending platforms, online crowdfunding markets, robo-advisors and machine learning tools, which allow to understand and satisfy customers' needs for tailored, cheaper and easier to use financial solutions. P2P lending platforms provide credits without bank intermediation matching borrowers and lenders directly, when customers and firms invest in small businesses (SMEs or younger businesses). These platforms reduce intermediation costs and evaluate the credit risk of borrowers applying algorithms and big data analytics and using non-conventional information about customers (Vives, 2017).

Payments are an important area of FinTech characterized by significant development, even if banks still maintain their leader position (Boot, 2017). Traditional payment systems may be disrupted by digital currencies such as Bitcoin (Vives, 2017). Digital currencies are generated using blockchain technology where transactions can be verified with blocks of records without any intermediary or banks' intermediary function. These systems facilitate the introduction of many potential cost-saving innovations and they allow to generate new currencies without the backing of government or a trustworthy go-between. Blockchain technology is considered as one of the biggest disruptions in the financial industry since it increases transparency in transactions and provides mechanisms which protect customers' privacy (Bussmann, 2017).

Lastly, traditional functions of banks may also be hampered by robo-advisors and machine learning tools which provide investment advice and avoid some of the usual conflicts of interest between customers and human advisors. Robo-advice is a FinTech innovation which is challenging the traditional financial advisory services (Kaya, 2017). Robo-advice offers online investment guidance and portfolio management services based on algorithms and models to find optimal investment strategies for clients. Robo-advisors are fully automated online platforms that provide customers with digital finance advice and portfolio allocation.

Furthermore, FinTech companies represent the major competitors of traditional banks because they do not have to comply with severe regulations as opposed to traditional incumbents who

must deal with stricter requirements (Bussmann, 2017). So, FinTechs operate with more agility and they face lower compliance costs, and this enables them to offer cheaper and faster financial products. With respect to newcomers, traditional banks are still trapped in a lot of red tape, even if they strive to invest heavily in technology and use it more than in the past to compete with new entrants and survive in the new financial industry.

Technological innovations have a double effect on traditional banks: on the one hand incumbents adopt new technologies to cut costs, improve the quality of their products and be more attentive to customers' needs; on the other hand, innovation reduces traditional barriers to entry in the credit and financial services markets, increasing the competition with FinTech companies which offer technology-intensive and low-cost solutions (Panetta, 2018).

Although FinTech start-ups are growing fast and they undermine traditional financial institutions, they also represent an opportunity for incumbents and mainly for banks to revolutionize their business models and to offer more specific value propositions.

Indeed, FinTechs and banks can benefit from a collaboration or partnership because both have valuable assets and capabilities to share (Juengerkes, 2016). FinTechs are tech-driven, apply innovative technologies, are not bound to legacy systems, and provide personalised financial solutions. Banks have a larger customer base, offer regulated products and services, and add their industry expertise and know how.

There are several motives that induce banks and FinTechs to create an alliance (Klus *et al.*, 2018). Collaborating with an incumbent financial player allows FinTech companies to enlarge their customer base, increase their financial knowledge, improve trust and credibility and obtain access to a banking license which in some cases would be too expensive for a start-up alone. On the other hand, bank might outsource some activities to their partners, gain a rapid innovation thanks to FinTechs' technological advances and secure a competitive advantage since FinTech firms develop innovative ways to provide financial services.

Although the 2008 financial crisis undermined consumers' confidence in the banking industry and FinTech companies threaten the functions and activities of the banking system, banks are still considered a safe place for people investment and money (Boot, 2017).

In conclusion, traditional banks adopt new technologies and innovations to compete with fintech newcomers and to preserve financial stability despite the limits imposed by the severe regulation. FinTech start-ups may be a threat to the banking system, since (i) they offer tailored financial services that meet customers preferences and needs; (ii) they provide more flexible and dynamic financial solutions thanks to the lighter regulation; (iii) they operate in the same market of traditional banks, also reaching customers and businesses underserved by incumbents and (iv) they have taken over functions and activities previously assigned only to banks.

2.1 New FinTech instruments for the banking sector

Although FinTech exacerbates competition in the financial market, it can also provide instruments and methods to banks to manage high costs and regulatory and market pressures which came up after the 2008 financial crisis (Bussmann, 2017).

We first seek to understand which FinTech innovations are more adopted and known by users, which are not only final customers, but also banks and other financial institution. For this purpose, we refer to a study which analyses the FinTech adoption in Australia, Canada, Hong Kong, Singapore, the U.K., and the U.S. in 2015 (Gulamhuseinwala *et al.*, 2015). The FinTech adoption is measured through the EY FinTech Adoption Index, considering four main categories: savings and investments, money transfers and payments, borrowing, and insurance. Money transfer and payments (online foreign exchange, non-banks to transfer money) have the highest adoption rate (17.6%) followed by savings and investments (peer-to-peer platforms, equity or rewards crowdfunding, online investment advice), insurance and borrowing (fintech lending, online marketplace).

Focusing on the relationship between FinTech and the traditional banks, the most disruptive innovations for the banking sector have emerged in payments, lending and crowd-based financing, as reported by McKinsey & Co. (2016). Since the aim of this work is to analyse the implication of FinTech for the banking system, we decide to examine the main innovations in these sectors, and we analyse whether they bring concrete benefits to banks or weaken their long-hand position.

2.1.1 Payment systems

Traditional payment systems involve many agents, instruments, institutions, and processes which generally imply high costs and great complexity. Changes, technological advances and innovations have always characterized payment systems aiming at improving the nature of processes in the customers' interest (Gomber *et al.*, 2018).

The current payments landscape is threatened by the entry of nonbank digital players, the modernization of payments infrastructures, the reduction in cross-border payments inefficiencies and the digitization of retail banking transactions (McKinsey & Co., 2015). Non-bank digital players are entering the payment system increasing competition for banks, taking away important customer relationships and reducing margins on domestic transactions while favouring electronic payments instead of cash and checks. Banks also need to conform to new products, digital channels and technologies introduced by nonbank players to compete effectively with them and meet evolving customer needs. The entry of non-bank players affects

not only the domestic payments system but also cross-border payments. Until now, banks have done little to solve the inefficiencies of cross-border payments which remain expensive for customers. FinTech instruments and players try to solve the limits of cross-border payments such as lack of transparency and tracking and slow processing time moving from C2C to B2B cross-border payments systems. Another solution to reduce costs and speed up cross-border payments is the use of blockchain-based cryptocurrencies, such as Bitcoin, even if the price volatility of DLT-based instruments and the lack of trust in them could weaken their positive influence on the payment system (Gomber *et al.*, 2018).

Finally, the digital revolution in consumer payments and retail banking is expanding with important changes in transaction banking; as customers and individuals are getting used to faster and cheaper payments on the retail side, they will look for similar services in transaction banking for their companies.

FinTech innovations in the payments sector especially concern cashless solutions (mobile payments, integrated billing and streamlined payments) and non-traditional payment schemes (cryptocurrencies, peer-to-peer transfers and mobile money) (WEF, 2015). Cashless solutions guarantee simplicity, interoperability and value-added services. Firstly, they facilitate customers' transactions allowing them to make payments in a single tap. Secondly, most of innovative solutions are not limited to a single payment method, but they allow customers to manage and use a variety of credit cards, debit cards and bank accounts for payment. Lastly, many innovative solutions also offer value-added services and functionalities in addition to payments enabling financial institutions to create closer customers relationships and deliver additional value.

As the traditional payment systems are built on automated clearing houses and intermediary banks, they cannot enable rapid and inexpensive money transfers especially between countries. For this reason, decentralised and non-traditional payments systems provide alternatives to streamline the intermediating processes. Decentralised systems allow users to move money between them and they typically rely on cryptography rather than a central authority as in traditional systems (Ali *et al.*, 2014). The payments take place through a distributed ledger technology (DLT) or blockchain in the form of cryptocurrencies. So, decentralised solutions are capable of near real-time settlements, reduce transaction costs and ensure superior transparency and traceability of transactions.

Non-traditional payments systems such as mobile money and P2P transfer are based on a trusted non-financial third party to transfer value across users and geographies, even in underbanked regions (WEF, 2015). Mobile money is a network that enables payments across users via a mobile device without requiring a bank account or a well establish financial infrastructure;

thanks to its features, mobile money leverages mobile communications to reach unbanked and underbanked individuals in developing and emerging countries (Bussmann, 2017). The P2P transfer directly links the local accounts of both sender and recipient satisfying users' needs for speed, payer control, security and universality (Bradford and Keeton, 2012). In non-bank P2P payment methods both the payer and the payee need to have an account with the intermediary to make and receive the payment. Furthermore, both parties need to indicate a source from which the intermediary account and payments can be funded, generally a bank account or a payment card. Most of the time, the payment is cleared and settled through a book transfer from the intermediary account of the payer to the one of the payee, as on Amazon and PayPal platforms.

Non-traditional payments schemes enable very rapid and highly transparency transactions to both senders and recipients and they favour financial inclusion since they do not impose specific financial requirements to users.

WEF (2015) concluded that most payment innovations do not completely disrupt the existing payment processes, but they can act as real competitors of banks since they focus on front-end processes to improve customers' experience and better satisfy their needs. Furthermore, one of the main targets of FinTech has always been to exceed two of the greatest limitations of the traditional payments: payment speed and service availability (BIS, 2016). Innovative payment methods seek to guarantee the transmission of the payment and the availability of funds to the payee in real time or near-real time reducing the delays in the clearing and settlement of payments.

Lastly, FinTech innovations in the payments system ensure transparent and automatic processes for customers and thanks to the use of mobile devices and like they have more opportunities to gather data and information about customers' preferences and attitudes; innovations with these advantages can threaten traditional payment schemes, especially credit cards (Bussmann, 2017).

2.1.2 Deposit and lending functions in the fintech world

Deposit and lending are other fundamental services provided by traditional retail banks that are facing a strong competition from FinTech innovations and companies (Bussmann, 2017). The primary functions of a commercial bank are accepting deposits and granting loans and advances to individuals and businesses at a higher rate of interest than allowed by banks on deposit accounts. Retail banks receive savings from their account holders and provide an interest on the savings in return. Then they use the saved funds to originate loans to borrowers and they receive a different interest rate in return (WEF, 2015). Banks determine the availability of loans and

the interest rates analysing the borrowers' risk profiles using credit scores and consequently they identify risk-averse or risk-seeking savers and low-risk or high-risk borrowers. Borrowers are served depending on each bank's risk appetite which is generally related to the size and the scale of the bank even if banks are potentially more prone to serve low-risk borrowers and to accept deposits from risk-averse savers.

Although deposit and lending are two traditional functions of incumbent banks, FinTech innovations have reached this sector and they are gaining in popularity over the last decade. Loans issued by FinTech players represent one third of unsecured consumer loans volume in the US in 2016 and they are expected to grow at a 20% yearly rate over the next five years. The rapid development and success of alternative lending solutions have important consequences on the consumer lending market and especially on retail banking (Vallee and Zeng, 2018).

Therefore, we first try to understand what is FinTech lending, how new players operate and what implications they will have for the banking industry. The FinTech lending sector differs from traditional banking environment since it does not imply buildings, tellers and branches, but at the same time it enables money flows from savers to borrowers as traditional commercial banks do (Odinet, 2017). In the traditional banking lending, banks act as intermediaries between depositors and borrowers. Indeed, they lend money deposited by savers at the bank to borrowers and then they pay interests to customers on their deposits in return. Fintech lenders, instead, match directly borrowers and savers, and they do not lend money themselves, rather, funds are provided by investors or by partner-banks.

After the pre-screening of loan applications by lending platforms, investors screen listed borrowers directly to decide whether or not to finance the loans (Vallee and Zeng, 2018). The role of investors in fintech lending represents a radical change in the lending market since they conduct activities and functions that are traditionally performed by banks. In addition, the authors argued that informationally sophisticated investors improve lending outcomes by screening listed loans using information provided by the platform, while less sophisticated investors do not screen investing in an average loan passively if they can break even, or not investing at all. As a result, sophisticated investors outperform less sophisticated ones increasing the volume of loans financed on the lending platforms. However, the active role of investors in lending platforms generally leads to an endogenous adverse selection problem which can impair the loans volume through both a price effect and a quantity effect. On the price side, as sophisticated investors are better able to identify and finance good loans, less sophisticated investors may face an average loan with a lower quality. Hence, less sophisticated investors may need a lower loan price to break even, causing a lower prevailing loan price on the platform and a lower amount of loan applications in the first place. On the quantity side, in

case of a too severe adverse selection, less sophisticated investors may not break even and exit the market, leading to lower loans volume. To solve the adverse selection problem and maximize loans volume, FinTech lending platforms focus on the pre-screening intensity and on the information provision to investors. If the platform pre-screening cost is initially high, the platform will choose a low pre-screening intensity but provides more information to lenders. This strategy encourages the participation of sophisticated investors, increasing the volume of loans financed by them even if less sophisticated investors do not take part. If instead the pre-screening cost is low, platforms choose a high pre-screening intensity so that less sophisticated investors are willing to invest. Platforms simultaneously provide less information to mitigate the adverse selection problem caused by more sophisticated investors. Summing up, in this theoretical model a platform pre-screens a pool of loan applications, lists some loans on the platform, and provides some information to investors to facilitate their screening and investing decisions. Since unsophisticated investors do not screen, they are always uninformed about individual loans' quality while sophisticated investors, paying a cost for information, become informed and identify good loans. Therefore, sophisticated investors finance only good loans and outperform uninformed and unsophisticated investors which suffer the adverse selection imposed on them.

Given the role of investors in FinTech lending platforms, FinTech lenders do not bear any credit risk and therefore, they do not need to hold any capital reserves like traditional banks (Odinet, 2017). As a result, FinTech lenders can establish lower interest rates on their products and this feature attracts borrowers to choose fintech lending platforms instead of traditional financial institutions. New lenders also differ from banks in terms of income and methods of underwriting. Unlike retail banks, the income of FinTech players comes from commissions and fees that receive from the origination of loans or from their distribution. Lastly, besides traditional methods of underwriting (for example FICO scores), FinTech lenders apply mathematical and machine learning processes to define the creditworthiness of potential borrowers.

FinTech lenders generally act as “direct funding lenders” or as “intermediary lenders” (Odinet, 2017). In the first case, FinTech lenders (also called “balance-sheet lenders”) are online companies that originate loans internally and provide them directly to borrowers. These lenders keep the loans on their books until the debt is retired, and they generally obtain financial funds to make the loans from outside investors or from their own borrowed capital. FinTech lenders are intermediary lenders when they create a collaboration with a third-party financial institution. In this business model, the financial institution makes the loans to the borrowers, but all underwriting and processing of the application is done by the fintech lender which generally

acquires the loan after its origination. With this strategy, the FinTech lenders do not bear any credit risk because they purchase the loans directly from the partner-originating banks and they do so with investors' capital. Therefore, it is the investors who bear the risk that the online borrowers could default, given their participation in the fintech platforms.

Another important aspect in the analysis of FinTech lending is understanding why this phenomenon has come up over the last decade and what factors drove its successful development. When after the 2008 financial crisis traditional lenders pulled back on providing credit access, especially to consumers, FinTech lenders began to successfully operate in the financial industry filling the lending gap (Odinet, 2017). As already discussed for the FinTech phenomenon, the global financial crisis caused a reduction in customers' trust towards banks and an increase in safety measures around loans (e.g. higher capital requirements) decided by regulators and supervisory authorities. The result was a tightening of loan requirements by banks while the loss of confidence led to a lending gap with a considerable portion of individuals and businesses with higher risk profiles unserved by financial institutions (WEF,2015). The increase in regulatory measures caused two major shifts in the financial market (Odinet, 2017). First, new rules made "the cost of doing business" for many financial institutions more expensive. Second, incumbents were forced to "reprice" their financial products and services against higher underwriting and compliance costs. As the cost of credit increased, many consumers and small businesses decided to turn to new players to access capital. FinTech lenders were able to fill the credit gap using technological advances and machine learning to reduce costs, speed up and automate loan processes and reach underserved consumers and SMEs. Additionally, they can satisfy borrowers that traditional banks generally find too risky. Indeed, commercial banks take risks themselves and they focus only on low-risk consumers while alternative lenders provide an online marketplace where lenders can choose the desired portfolio. Most providers, such as online and P2P lending platforms, match directly funds of borrowers and savers; further, fintech lenders rely solely on investors while commercial banks need to use their customers' deposits and funds from asset-backed securities to make loans (Odinet, 2017). For these reasons, fintech players can ensure flexible, fast, low-cost and customer-oriented alternatives (WEF, 2015).

The World Economic Forum (2015) also analysed the potential role of FinTech lenders with respect to traditional banks. The first potential scenario is the disintermediation of financial agents where alternative lending platforms successfully replace traditional banks in matching risk-averse savers and low-risk borrowers. The consequence is a loss of incumbents' market share to alternative lending platforms since, offering lower interest rates and more streamlined processes, new entrants also attract and retain low-risk borrowers. As traditional banks are still

trapped by legacy processes, obsolete technologies and strict capital requirements, they cannot adapt quickly enough, and the intensified competition of alternative lenders will generate pressure on the spread earned between interests paid to savers and received from borrowers, leading to an erosion of banks' margins and deposits.

In the second potential scenario alternative lending platforms act complementing traditional intermediaries. As FinTech lenders are unable to build sufficient customer awareness and trust, especially in low-risk lending segment, they create partnerships with existing banks where alternative lenders and banks cater to different classes of investors and borrowers. Traditional financial institutions continue to operate with low-risk market guiding high-risk individuals, who do not meet minimum lending requirements, to fintech lenders. Thanks to the collaboration between banks and FinTech players, customers fulfil their financing needs and gain access to savings and lending products that best suit their preferences. Furthermore, traditional incumbents also reach and serve high-risk customers without losing other business lines and taking high risks. However, the profile of customers served by banks could become increasingly homogenised given the possibility of savers and borrowers to switch to alternative lending platforms.

In the third potential scenario, traditional banks react quickly to the competition of alternative lending players revolutionizing their technologies and processes or directly acquiring FinTech lenders. With these strategies traditional banks develop alternative adjudication methods and capabilities, more streamlined lending processes and greater efficiency offering lower interest rates and catering to more borrowers who traditionally are underserved. The results are significant improvement in customer experience, greater availability of loans and investment opportunities, improved profitability and reduced leakage during lending application process. Nevertheless, banks will need to diversify their savings and lending products from the traditional one-size-fits-all approach to serve various customers' needs and to face the competition against diverse fintech lenders.

Summing up, the authors (WEF, 2015) identified two likely implications that are common to all potential scenarios. Firstly, the choice of savers to turn to FinTech lending platforms as short and medium-term investment vehicles could cause an erosion in traditional deposits and investment products offered by banks and financial institutions leading to some balance sheet shrinkage and a negative impact on capital ratio. Secondly, it could become more difficult for banks to measure customers' creditworthiness on a consistent basis since clients' savings and credit portfolios could be distributed over many alternative platforms that use different reporting standards and methods.

2.1.3 Does Peer-to-Peer lending really threaten commercial banks?

Peer-to-peer (henceforth “P2P”) lending is the most successful FinTech lending model in the consumer credit market (Balyuk, 2018). The term P2P describes the relationship between two parties without the need for a central intermediary (Milne and Parboteeah, 2016) and indeed, the peculiarity of this innovation is the direct matching of borrowers and lenders through online lending platforms. In P2P lending borrowers access the online platform, request loans online, and they provide information about their current financial situation, like income or open credit lines (Bachmann et al., 2011).

Individual and institutional investors can choose to invest independently, within investment groups, or algorithmically (Morse, 2015). Lenders generally do not fund entire loans, but rather they may diversify across borrowers who get financed only if investors’ bids reach a threshold. If the bids reach the threshold, the loan closes at an interest rate assigned to the borrower by the lending platforms according to his risk-scoring.

P2P lending platforms are affected by information asymmetry which causes a principal-agent problem between investors and borrowers. As in all FinTech lending models, borrowers’ loans are financed by platform’ investors who need to assess borrowers’ creditworthiness. Lenders want therefore to get as much valid information about the borrower as possible, but, on the other hand, borrowers may hide some of their characteristics in order to get the loan and a low interest rate. To overcome the information asymmetry, P2P platforms force borrowers to provide information about their current financial situation. Investors receive an overview of borrowers’ financial characteristics such as credit ratings, detailed information on income and monthly expenses, house ownership or the debt to income ratio. After defining borrowers’ creditworthiness, P2P lenders go on with the screening and pricing process (Balyuk, 2018). Investors screen borrowers using their proprietary algorithms and additional local and macroeconomic information that is not available to banks. Although P2P lending started with unsophisticated investors as lenders, the considerable growth of this innovation attracted institutional investors who have insights into credit market conditions and characteristics thanks to their strategic position. Lastly, P2P lending platforms use fully automated algorithms to price and underwrite loans significantly reducing screening costs for investors. The automation of the entire application, verification and funding process enables P2P lenders to screen small loans that are generally rejected by banks because of their low profitability.

Milne and Parboteeah (2016) focused on the competitive advantages of P2P lending platforms over traditional commercial banks. P2P platforms offer better rates of return on deposits and lower fees for borrowers than traditional banks. The automation of the entire process, the lack of any intermediary, and the focused nature of their activities guarantee low administrative and

overhead costs for setting up P2P platforms. In addition, since investors bear all the risks of the process (first, the borrowers' default), they are compensated with much higher rates of return. Secondly, P2P lending platforms provide greater access to credit, especially to some categories of borrowers that are generally refused by traditional banks. Borrowers who do not meet the more stringent criteria that banks place on loans can find alternative lenders who are willing to take on a greater risk providing additional lending services.

Another reason for the growth of P2P lending is linked to the direct matching of borrowers and savers. Thanks to this feature, P2P lending offers a form of finance that generates more social benefits and externalities. Customers, in this case borrowers, are the hearth of P2P lending activities, while banks and other financial intermediaries focus more on their market power and profits without an adequate regard to the interests of their clients.

Lastly, an important advantage of P2P lending is technological innovation which allows to improve the quality and speed of services to both borrowers and lenders. The authors argued that the majority of banks' budget goes towards maintaining existing system rather than creating innovative new ones. Furthermore, retail banks tend to have large, legacy systems that cannot be easily replaced because of the obsolete infrastructure built around them.

Analysing how P2P lending impacts the credit provided by banks, Balyuk (2018) argued that FinTech lenders influence the fundamentals in the consumer credit market by improving information between borrowers and investors. Furthermore, the author found out that banks tend to increase access to credit for consumers who receive loans from P2P lending platforms since alternative lenders guarantee a greater accuracy in processing customers' information and screening loans applications. Therefore, FinTech innovations in the lending sector can bring benefits reducing imperfections and frictions in the consumer credit market, and consequently they generate information spillovers to banks which are more prone to enlarge their customer base also including underserved borrowers.

Although FinTech lenders take away part of banks' customers offering low interest rates and providing more tailored financial solutions, Milne and Parboteeah (2016) asserted that the development of P2P platforms will not lead to the end of the banking system. P2P platforms and FinTech lenders in general conduct activities traditionally assigned exclusively to commercial banks, attract both lenders and borrowers with better rates, and ensure faster, automatic and transparent processes, but they lack one core banking activity: liquidity provision. According to the authors, the principal activity of a commercial bank is liquidity provision rather than intermediation. Banks ensure their deposit customers the possibility to draw deposits on demand either by withdrawing cash or by using bank payment instruments and their borrowers the flexibility in their use of loan facilities. Customers are willing to receive

lower interest rates of return on deposits or higher costs of borrowing in return for the liquidity services provided by retail banks. Milne and Parboteeah (2016) underlined that P2P lenders are at a disadvantage compared to banks in providing such liquidity services, as they do not have access to money market funding or to central bank liquidity. For this reason, P2P and FinTech lenders should be considered as complementary agents not in a direct competition with retail banks which are expected to set up their own P2P platforms or collaborate with existing ones. Thanks to FinTech innovations, banks can improve the availability of credit to customers who generally do not meet the requirements for conventional bank lending, increasing the stability and the efficiency of banks and of the banking system as a whole.

2.1.4 Crowdfunding: a new source of funding

Crowdfunding is considered by McKinsey & Co. (2016) as another FinTech innovation which may cause disruption in the traditional banking system, albeit to a lesser extent with respect to innovative payments systems and fintech lending. Crowdfunding emerged as an alternative way for entrepreneurial ventures to secure funds without the need for venture capital or other traditional forms of investment (Mollick, 2013). Crowdfunding derives from the combination of micro-finance and crowdsourcing, even if it represents a unique category of fundraising, facilitated by the growth of Internet. Crowdfunding is defined as an open call essentially through the Internet which allows entrepreneurs to obtain necessary fundings, either in the form of donations or in exchange for some forms of reward or voting rights (Belleflamme *et al.*, 2013). In other words, crowdfunding is the collection of funds through a web platform from a large group of backers to fund a project or a start-up (Wilson and Testoni, 2014). Thanks to the use of web platforms and the consequent reduction in transaction costs, it is possible to collect a small amount from a large pool of funders, and this can result in considerable amounts of capital. Second, the use of the Internet makes it possible to directly link funders with individuals or organizations looking for funding without the need for active intermediaries.

Crowdfunding differs from other funding methods because of the relationship between funders and founders which varies by context and the nature of the funding effort (Mollick, 2013). In case of art or human projects funders act as philanthropists who do not receive any direct return for their donations. The second model is the lending model in which entrepreneurs obtain funds in the form of loans. In return for their contributions, funders receive fixed periodic income and repayment of the original principal investment (Wilson and Testoni, 2014). Entrepreneurs using lending model seek passive investors because they are simply interested in raising money and not using the crowd as customers (Onnée and Renault, 2016). The third approach is called reward-based crowdfunding in which funders receive a non-financial reward for backing a

project. Funders get some privileges for example allowing them access to products realized by funded projects at an earlier date, better price, or with some other special benefits. Finally, the equity crowdfunding treats funders as investors, giving them stakes or other consideration in return for their fundings. In equity crowdfunding contributors receive securities which allow them to get a portion of the profits and vote at general meetings (Onnée and Renault, 2016). Using this model, the crowdfunding platform gives investors the possibility to finance projects already listed by experts and become shareholders of the funded company.

Crowdfunding can be an alternative or a complement to traditional financial circuits (Onnée and Renault, 2016). Indeed, through crowdfunding an individual or an organization can avoid having to turn to traditional banks, which tend to be reluctant to grant loans to some categories of customers. In addition, start-ups and small businesses may run into difficulties in attracting external finance during their initial stage through both bank loans and equity capital (Belleflamme *et al.*, 2013). Therefore, many projects and ventures remain unfunded due to a lack of sufficient value promised to financial investors or due to difficulties in convincing them. Crowdfunding has emerged as a new source of finance which helps firms raise funds from large audiences rather than from a small group of specialized lenders. The concept of crowdfunding is using the crowd to obtain ideas, feedback, and solutions to develop corporate activities. Many entrepreneurs just need small amounts of capital to start a one-time project which is generally financed by friends and family. However, crowdfunding is also a useful source for entrepreneurial seed capital enabling entrepreneurs to obtain the initial money necessary for the establishment of their business (Mollick, 2013).

Besides fundraising, crowdfunding permits to test the good or service proposed by the project as a sort of pre-selling to potential clients (Onnée and Renault, 2016). The projects are presented on the crowdfunding platform and this is a way for the entrepreneur to promote his projects and to benefit from the platform's viral potential. In addition, creators are invited to share their projects via social networks, directly involving the community which becomes a driving force of the project. Lastly, project developers can improve their credibility to traditional financiers (traditional banks and venture capitalists) through successful crowdfunding campaigns.

The four models of crowdfunding (donation model, lending model, reward-based model and equity crowdfunding) differ in terms of complexity and level of uncertainty (Wilson and Testoni, 2014). The donation model is the simplest one because the only risk is that the project does not achieve its goal, even if the funder of the project does not expect any material or financial return from his investment. Although equity crowdfunding is the smallest category of the entire crowdfunding in terms of volume, it is the most complex.

We focus on equity crowdfunding characteristics and risks because it seems to be the most disruptive innovation for the financial and banking sectors.

In equity crowdfunding the investor buys a share in the company, but he also needs to estimate its value. Further, the level of uncertainty is very high since this model is based on the entrepreneur's ability to create equity value in the company, which is very difficult to assess. Equity crowdfunding is receiving greater attention from policymakers and academics since it is a precious source of funds especially for start-ups which generally have limited access to finance and often do not command assets to be used as guarantees for bank loans. Young and small firms can obtain equity funding from three traditional sources: founders, family and friends; angel investors; and venture capitalists. The role of angel investors and venture capitalists has increased substantially over the last decade because after the financial crisis banks have become more reluctant to finance start-ups due to their greater riskiness and lack of collateral. Equity crowdfunding has the same objectives of business angels and venture capitalists, but it departs from these models because transactions are intermediated by an online platform. Wilson and Testoni (2014) described the key characteristics of equity crowdfunding with respect to angel investors and venture capitalists. Firstly, equity crowdfunding mostly operates in the financing segment covered by angel investors, although authorities introduced upper limits to the capital that can be raised from non-qualified investors, as the crowd. Secondly, as angel investors, the financial return is not the only reason for an investment in equity crowdfunding. In crowdfunding investors also finance start-ups for social and emotional benefits besides the will to help start-ups initiate a successful business, exploit tax reliefs and achieve meaningful financial returns. In addition, the investment spectrum of equity crowdfunding is typically broader than angel investors and venture capitalists since investment motives of the large public tend to be quite heterogenous. Although equity crowdfunding has become a valuable alternative source of funds for start-ups, and it is increasing in terms of volume, it is not risk-free. Indeed, the characteristics of crowdfunding can make investments in young firms even riskier, and they can exacerbate the information asymmetry problems common to seed and early-stage financing. While business angels and venture capitalists perform due diligence to evaluate the firm, crowdinvestors have less incentive to perform it since this process can be costly, and crowdfunding investments are generally small. Moreover, crowdfunders likely lack the expertise and skill to adequately perform due diligence. This happens because the large audience often includes non-professional investors, who do not have the knowledge or capabilities to evaluate a company. Finally, the company valuation conducted by crowdinvestors may be affected by biases and herding behaviour (Agrawal *et al.*, 2013). The authors argued that the propensity of individual funders to invest in a project increases with

accumulated capital potentially leading to herding because the investment decision of a funder may be affected by those of the other investors. Furthermore, the authors asserted that funders and entrepreneurs are typically initially overoptimistic about potential outcomes.

Regarding investments, equity crowdfunding is often based on standardised contracts provided by the platform. However, investments into start-ups generally require customised contracts in order to align the interests of the entrepreneurs to those of the funder. Business angels and venture capitalists tend to invest in a portfolio of companies to diversify their risk. This strategy might be replicated by equity crowdfunders considering that they are exposed to a variety of projects. However, non-professional investors, as the crowd is, could not understand the strategic importance of the diversification and therefore, they could potentially concentrate all their investments in a single project or company.

Finally, equity crowdfunding tends to exacerbate the information asymmetry problems that typically characterize early-stage firms. Indeed, entrepreneurs always have more information than investors about their projects or ventures (Agrawal *et al.*, 2013). In equity crowdfunding the informational asymmetry increases due to the geographical distance between funders and entrepreneurs. So, it is particularly difficult for funders to perform due diligence in person, assess the true ability of the entrepreneur or the underlying quality of the project. The consequence is a market failure in the form of adverse selection. Indeed, if funders discount the value of the projects on the platform as a result, high-quality venture will not raise funds on the platform because they cannot get a “fair” price for their equity in that platform. The risk is that adverse selection increases the cost of capital to the point where only low-quality venture will choose crowdfunding, while high-quality ventures will continue to turn to business angels and venture capitalists.

Crowdfunding business model also has some limits in post-investment support and monitoring. Business angels and venture capitalist provide not only fundings to start-ups, but they are also directly involved in increasing the value of the company, while the support provided by crowdinvestors is generally less valuable. The crowd makes small investments, and it has less incentive to provide active support to the company due to the lower return for their investment (Agrawal *et al.*, 2013). Moreover, the information asymmetry, typical of early-stage financing, also characterises the post-investment phase limiting the monitoring activity of the crowd.

The monitoring activity is particularly important in investments that take 5-10 years or more to produce a return (Wilson and Testoni, 2014). Equity investments may succeed or fail, and therefore it is necessary to elaborate a positive exit strategy for the investors. The exit of investors can be through an IPO or a M&A, but in equity crowdfunding the path to a positive exit can be longer and even less likely.

In conclusion, the lack of pre-investment screening and due diligence, weaker investment contracts and poorer post-investment support and monitoring can make equity crowdfunding transaction significantly riskier than business angels and venture capitalists ones.

After describing the characteristics and the risks of equity crowdfunding, we try to understand whether these innovations really affect the banking system. Crowdfunding, as other FinTech innovations, has the potential to replace significant parts of the banking system.

Blaseg and Koetter (2015) analysed the relationship between crowdfunding and banks to verify when ventures and entrepreneurs are more willing to turn to crowdfunding rather than to traditional bank loans. The authors underlined that the financial crisis of 2008 increased the difficulties that young and small firms face in raising external finance. As a result, the volume of equity financing from venture capitalists decreased significantly and credit supply tightened. Early stage financing is typically characterised by greater riskiness, information asymmetries and high relative transaction costs. Crowdfunding established itself as a valid alternative for younger ventures since it ensures lower transaction costs thanks to the use of web platforms. The authors analysed whether and how the credit shock transmitted by banks made young ventures and entrepreneurs more inclined to seek crowdfunding as alternative source of external finance. Focusing on a large group of young venture in Germany, Blaseg and Koetter (2015) found out that the relationship of a young venture with a bailed-out bank increases the probability that the venture uses crowdfunding. Moreover, after the financial crisis banks were forced to handle their lending more restrictively due to more severe rules. Therefore, ventures that cannot demonstrate their creditworthiness remain unfinanced and they decide to turn to equity crowdfunding instead of bank financing. Young and small firms are more likely to use crowdfunding also when they have few tangible assets. Tangible assets allow to reduce the financial loss for investors in case of bankruptcy and the information asymmetries costs if ventures pledge their assets as collateral.

Summing up, crowdfunding is a valuable alternative source of funding mainly for young ventures and small entrepreneurs, especially when their banks are affected by credit crunch. Crowdfunding, as FinTech lending, is a potential threat to commercial banks because it can reach some categories of customers who are generally underserved by traditional financial institutions. Banks are adapting crowdfunding platforms' business models to meet small loan applications with transparent and customised products. However, crowdfunding innovation is not risk-free, and the real issue is whether crowdfunding will be able to overcome its main limits: lack of expertise and knowledge to perform due diligence, information asymmetry problems, lack of adequate monitoring and successful exit for investors. Despite some successful equity crowdfunding cases, the crowdfunding industry still lacks "a sufficient track

record to assess its ability to create value for both investors and entrepreneurs” (Wilson and Testoni, 2014).

For these reasons, most of young ventures are still more prone to apply to traditional banks, business angels or venture capitalists who provide knowledge of the market, expertise and financial capabilities. Lastly, there is a huge disparity in size between the crowdfunding and traditional banking industries, and this means that crowdfunding is not currently considered as a realistic alternative to banks.

2.2 Banks' performance and profitability

In the previous paragraph we focused on three FinTech innovations which McKinsey & Co. (2016) described as the most concrete threats to the banking system. We analysed innovative payment system, FinTech lending agents and platforms, and equity crowdfunding in relation to traditional commercial banks' activities and functions. From the analysis it emerged that FinTech innovations threaten the banking system since they have the potential to overcome some limits and disadvantages of traditional incumbents. Innovative payments systems guarantee faster, cheaper and more transparent processes to their customers improving their experience and better satisfying their evolving needs. FinTech lending companies and platforms reach categories of borrowers (high-risk borrowers such as SMEs and individuals) who are generally underserved by traditional banks. In addition, alternative lending ensures lower transaction and compliance costs thanks the direct matching between investors and borrowers and the lighter regulation. Lastly, equity crowdfunding, in particular, emerges as a valid and valuable alternative source of external finance for young ventures and start-ups. With respect to innovative payments systems and FinTech lending, crowdfunding is characterized by a small volume in the financial industry, but it allows small projects and ventures to get funding. As FinTech lending, crowdfunding satisfies customers' and firms' funding applications which are typically rejected by commercial banks due to their greater riskiness.

These FinTech innovations threaten the banking system because they better meet customers' evolving needs and preferences, they take away clients to traditional commercial banks, and they guarantee lower costs, higher rates of return and less severe requirements. But, do FinTech innovations have tangible effects on commercial banks in terms of performance and profitability? Does the collaboration between traditional banks and fintech companies improve banks' efficiency?

Before developing a model to analyse these issues, we first need to define bank's profitability and how to measure it.

2.2.1 Banks' performance

In this work we refer to banks' performance as the ability of banks to generate sustainable profitability (ECB, 2010). Profitability is essential for a bank to maintain its ongoing activity and for investors to obtain fair returns. As any profit-seeking organization, banks need to generate profits against unexpected losses and depletion of capital base. So, the ultimate purpose of a bank is to preserve and create value for its owners, even if various stakeholders of a bank can focus on different aspects of profitability, depending on their perspectives. Depositors, for example, worry about a bank's long-term ability to look after their savings. Debt holders, instead, look at the ability of the bank to meet its obligations, while equity holders focus on profit generation to secure a future return on their current holding. Despite banks' greater complexity, their performance is still driven by earnings, efficiency, risk-taking and leverage. As mentioned above, the ultimate objective of a bank is the creation of profit and earnings, but it is also important to account their composition and volatility. Efficiency is defined by the ECB as the ability of the bank to generate revenues from a given amount of assets and to make profit from a given source of income. We will discuss bank's efficiency later in relation to a potential collaboration with FinTech players. Risk-taking refers to the adjustment of earnings for the undertaken risks to generate them. Lastly, leverage might improve bank's results in the upswing acting as a multiplier, but at the same time it might also increase the probability of a bank's failure due to rare and unexpected losses.

There is a great variety of measures to assess bank performance with differences among groups of stakeholders. The ECB (2010) splits performance measurements in three categories: traditional, economic and market-based measures.

ROE (return on equity), along with ROA (return on assets), is one of the most widely used measures of corporate financial performance adopted by analysts, consultants, financial managers, and shareholders (De Wet and Du Toit, 2006).

ROE is measured dividing the net income by the average total equity, and it can be broken up into three separate ratios following the "Dupont analysis":

$$ROE = \frac{\text{net income}}{\text{total revenue}} \times \frac{\text{total revenue}}{\text{average assets}} \times \frac{\text{average assets}}{\text{average equity}} \quad (\text{Hess and Francis, 2004}).$$

The three components measure, respectively, actual profitability, utilization of assets and the gearing of the company. For banks, it makes sense to combine the last two components into one equity capital utilization measure. In fact, unlike in industrial firms, a bank's gearing is not a particularly distinguishing factor and it is generally strongly affected by regulatory capital requirements. The two remaining sub-components of ROE could then be interpreted as operational and capital efficiency respectively. Therefore, ROE can be improved by increasing

profitability, by using assets more efficiently or by increasing financial leverage (De Wet and Du Toit, 2006).

ROE is the most popular measure of performance: (i) it directly assesses the financial return of a shareholder's investment; (ii) it is easily available for many categories of stakeholders; and (iii) it facilitates the comparison between different companies or sectors of the economy (ECB, 2010). However, this ratio has some flaws and limits as performance indicator (De Wet and Du Toit, 2006). The authors argued that the earnings of a company can be manipulated legally within the Generally Accepted Accounting Principles (GAAP) changing some accounting policies. In addition, ROE is calculated after the cost of debt, but before considering the cost of own capital. As mentioned above, ROE increases with a higher financial gearing, but if this last goes beyond a certain level, it may cause a fall in the company value and in the share price. In this case, an increase in ROE may lead to wealth destruction, which is in contrast with the principle of shareholder value creation. Higher gearing and higher asset turnover, which are not necessarily beneficial, can cause a dangerous increase in ROE.

The ECB (2010) underlined that during the 2008 financial crisis ROE failed to discriminate the best performing banks from bad ones in terms of long-term sustainability of their results. In some cases, the banks with the highest ROE were those worst hit by the crisis. Indeed, ROE is a short-term indicator which provides an overview of the banks' current health and for this reason, it cannot take into account long-term strategies, long-term damages caused by negative events, and measures with long-term impact. So, ROE is not a good indicator of banks' sustainable performance when changes derive from one-shot events which cannot be replicated in the future (e.g. extraordinary events during a crisis). ROE does not also consider long-term issues such as restructuring or improvement in capital ratios. For example, during a crisis many banks undertake actions, such as restructuring, to return generating value in the long-term. However, these strategies generally imply negative effects in terms of costs, involving further pressures on ROE and the current performance.

Moreover, ROE can be a misleading ratio since it is generally influenced by seasonal factors and it exposes banks to higher unexpected risk levels. The last criticism of ROE analysed by the ECB is that this ratio is not risk-sensitive, and it completely ignores important risk elements, such as the quality of assets, the cost of risk, the risk concentration, and the solvency situation. So, the ECB concluded that ROE is not a stand-alone performance measure, and therefore, it is necessary to develop alternative and additional performance indicators.

Other traditional indicators to measure performance are:

-(i) ROA, calculated as: $ROA = \frac{\text{net income}}{\text{average total assets}}$;

- (ii) cost to income ratio (CIR), calculated as $CIR = \frac{\text{operating expenses}}{\text{operating revenues}}$, which estimates the ability of the financial institution to generate profits from a given revenue stream;
- (iii) net interest margin, computed as $\text{net interest margin} = \frac{\text{net interest income}}{\text{assets}}$, which indicates the capacity of banks' intermediation function to generate income.

Banks' performance can also be assessed through economic measures such as EVA (economic value added) and RAROC (risk-adjusted return on capital) (ECB, 2010). These indicators assess the economic results generated by a company from its economic assets, mainly focusing on efficiency as a central element of performance. EVA is defined as the excess of adjusted earning over the opportunity cost of the capital involved:

$$EVA = \text{Adjusted earnings} - c * K$$

Where earnings are adjusted to better represent economic earnings in accordance with GAAP, c is the opportunity cost of equity, and K is the amount of equity used by the unit being measured (Kimball, 1998). From the ECB (2010) perspective, EVA considers the opportunity cost for stockholders to hold equity in a bank, measuring whether it generates an economic rate of return higher than the cost of invested capital to increase the market value of the company:

$$EVA = \text{return on invested funds} - (\text{weighted average cost of capital} * \text{invested capital}) \\ - (\text{weighted average cost of debt} * \text{net debt})$$

The value of the EVA can be improved in three ways: by increasing adjust earnings, either trough improved margins or additional sales; by reducing the equity capital used; or by reducing the cost of equity (Kimball, 1998). However, any change to improve EVA requires managers to face trade-offs among the key variables. If managers decide to expand the activity to increase earnings, such expansion will lead to greater investments and so higher equity capital. In this case, EVA will increase only if the additional earnings generated by expansion exceed the marginal cost of the additional equity capital involved. Otherwise, a company may increase its use of debt and decrease the amount (K) of equity used. But, if K decreases, the riskiness of the equity investment will increase and so c , the cost of equity, will increase. In this situation, EVA will improve only if the percentage decline in K is greater than the percentage increase in c .

Considering the flaws of ROE discussed above and the trade-offs that managers need to face using EVA, the EVA system is considered superior to more conventional performance measures. Managers of banks and companies should use performance indicators to identify the best investment decisions in terms of earnings and use of equity capital. If managers only focus on maximizing earnings and adopt ROE to value a project, they will not consider the opportunity cost of capital and therefore, they will choose a project with positive and increasing

earnings, but with an inefficient use of equity. A firm that adopt only ROE as performance indicator will tend to underinvest, grow more slowly than it should, and generate lower returns for shareholders. More popular performance measures as ROE and ROA may suggest that the bank is performing well, when in fact it may be reducing its value to its shareholders. Using EVA, firms may avoid these outcomes because managers would be induced to manage the internal trade-off between growth and the return to additional equity. Maximizing EVA, a firm would invest until the last project generated a ROE just equal to the opportunity cost of the equity capital employed. Despite the advantages of EVA in terms of incentive system and shareholder value creation, it is not the best measure of performance because projects with negative EVA will not be chosen considering the current EVA figures, even though the future annual EVA is enough to justify the investment (De Wet and Du Toit, 2006).

As discussed above, one of the main limits of ROE as performance indicator is that ROE is not risk-sensitive and so, it ignores any risk element in the banks' activity. The second economic performance measure analysed by the ECB (2010) is the risk-adjusted return on capital (RAROC) which measures the expected result over economic capital.

RAROC is one of the risk-adjusted performance measures (RAPM), used in the banking industry as a guide for an efficient asset allocation, performance evaluation, and capital structure decisions in complex financial institutions (Geyfman, 2005). After the strengthening of regulatory constraint on bank total capital, one of the banks' main objective is to maximize risk-adjusted profitability. One way to reach this goal is to minimize the risk of each activity undertaken by the bank. RAPM have been developed during the last decade to compare the risk-adjusted return against an appropriate hurdle rate of the bank's cost of capital or the opportunity cost to stockholders in holding equity in the bank. RAROC measures the performance of a bank as the ratio between the risk-adjusted return of a business activity and the capital employed to finance it.

To identify successful operations and projects, performance measures need to consider the underlying level of risk associated with banks' activity, and they need to face the trade-off between growth, return and risk (Kimball, 1998). To evaluate banks' performance, RAROC approach assigns capital to business units as part of a process of assessing the risk-adjusted rate of return and the economic value added of each business unit (Zaik *et al.*, 1996). This system allows to allocate capital to individual business units and activities of banks in accordance with their anticipated economic value added (EVA) (ECB, 2010). With respect to ROE, RAROC is a more reliable measure to evaluate the performance of business units, given the focus on the underlying risk level (Zaik *et al.*, 1996). If the RAROC of a business unit is greater than the cost equity, which is the shareholders' minimum required rate of return, it means that the

business unit is creating value for shareholders. But if RAROC is below the cost of equity, the business unit is reducing shareholder value. However, the use of rates of return in RAROC, ROE or ROA does not allow to quantify how much value is being created or destroyed by an operation. For this reason, managers, who use only RAROC or any rate-of-return to measure performance, are induced to underinvest. To maximizing the shareholder value, a bank should undertake all projects that exceed the cost of capital, but if managers are rewarded exclusively on the basis of ROE or RAROC, they are more likely to refuse value increasing projects that will reduce their average return. Therefore, Zaik *et al.* (1996) suggested using the “economic profit” also called “residual income” of the activity to measure the performance and to create right investment incentives for managers.

About RAROC, the ECB (2010) underlined a similarity with EVA because both approaches link a bank’s profit with its cost of capital, even if RAROC goes further because it adjusts the value-added in relation to the capital needed. RAROC is theoretically the most relevant measure of performance since it compares economic return against risk. However, it’s difficult to calculate RAROC without having access to internal data and making strong assumptions. In addition, RAROC seems to be a more appropriate tool for activities with robust techniques for measuring risk, such as credit risk. For these reasons, academics are reluctant to consider RAROC a valid alternative tool to analyse and measure performance of business activities.

The ECB (2010) concluded the analysis of performance measures focusing on market-based indicators which characterise how capital markets value the activity of any company, compared with its estimated accounting or economic value. The most commonly market-based metrics include: (i) the price-earnings ratio (P/E), which is the ratio of the company’s financial results over its share price; (ii) the price-to-book value (P/B), which relates the market value of equity to its book value; (iii) the total shareholder return (TSR), which is the ratio of dividends and increase of the stock value over the market stock price; and (iv) the credit default swap (CDS), which expresses the cost of insuring an unsecured bond of the institution for a given time period. Summing up, ROE and ROA are the most widely used among traditional performance measures in the banking sector and many other industries. ROE is an internal performance measure of shareholder value, and it is by far the most popular indicator since it can be easily assessed, and it provides a direct valuation of the financial return of a shareholder’s investment. However, ROE has some limits and flaws: (i) it ignores any risk assessment; (ii) it is a short-term indicator which does not consider any long-term strategy or long-term issues of the company; and (iii) it can be subject to manipulation in case of lack of data.

Considering these limits, academics analysed alternative tools and indicators to measure performance of banks, in particular the so-called risk-adjusted performance measures (RAPM).

Risk has become a fundamental component in assessing banks' performance after the 2008 financial crisis and the consequent strengthening of banks capital requirements. RAROC allows banks to assign capital to individual business units according to their underlying level of risk. RAROC is theoretically considered a more reliable performance measure than ROE in terms of risk assessment, but this ratio is not out of limits and disadvantages. To assess bank performance using this ratio, it is necessary to have access to internal data and to make strong assumptions about banks' activities. Some authors (De Wet and Du Toit, 2006; EBA, 2010; Kimball, 1998) also consider EVA as performance measure, which is based on the concept of opportunity cost. Applying EVA, banks expect to obtain better decision-making by their managers since they are forced to include the opportunity cost of equity when making investment and operating decisions (Kimball, 1998). In addition, the author argues that EVA is superior to the more conventional ROE since it requires managers to face trade-off among its key variables: earnings, cost of capital and amount of equity employed. However, as any other incentive compensation system, EVA system can be manipulated by managers to maximize their compensation without necessarily increasing the profits of the company. In this case, managers juggle the EVA based system to maximize the current incentive compensation at the expenses of future reported performance.

One of the main drivers of banks' performance is efficiency together with earnings, risk-taking and leverage (ECB, 2010). Efficiency and effective utilization have always been key objectives of banks and financial institutions (Spong *et al.*, 1995). In the last few years the emphasis to banking efficiency has increased due to several recent events: increasing competition for financial services, technological and financial innovation, banking consolidation, and the increasing competition from non-bank players. All these events induced banks to focus more attention on controlling costs and providing services and products efficiently. Innovation in technology, especially in terms of improvements in communications and data processing, is also adding emphasis to efficiency. FinTech innovations give banks and other financial institutions opportunities and solutions to raise productivity and efficiency using new technological instruments. Banks can increase their efficiency automating processes and operations, introducing new financial products and services, and competing more directly with each other. Much of the banking consolidation movement is motivated by the hope of increasing efficiency. Companies generally perform acquisitions to reduce costs of internal operations, exploit potential synergies, and eliminate overlapping offices, personnel, and other duplicative resources and services. Banks can get similar advantages in case of collaborations or acquisitions of non-bank players such as FinTech companies (Darolles, 2016). FinTech players

have a strong competitive advantage thanks to technological innovation, but incumbents are trying to expand their skills and capabilities (Merler, 2017). Banks may decide to purchase financial products or services directly from FinTech players when it is too costly for them to internalize their production. Thanks to the collaboration with FinTech companies, banks can ensure cheaper and easier to use financial solutions, faster and automated processes, and they can outsource some activities to partners to be more efficient. All these trends show that efficiency needs to be a central objective of banks to operate successfully.

In the literature, we can find several definitions of efficiency: technical efficiency, allocative efficiency, economic efficiency, cost efficiency, and scale efficiency.

For the purpose of our work, we follow the definition provided by the ECB (2010). The ECB described efficiency as the ability of a bank to generate revenue from a given amount of assets and to make profit from a given source of income. Efficiency can be measured using the cost-to-income ratio (henceforth “CIR”) which expresses the capability of the institution to generate gross profits from a given revenue stream (Arnaboldi and Rossignoli, 2015). CIR is traditionally computed as non-interest expenses, excluding bad debt and tax expense, divided by the sum of net interest income and non-interest income (Hess and Francis, 2004). It measures the output of a bank in relation to its utilized input, and it shows the amount of expenses that are needed in a given time period to generate a specific amount of revenues (Burger and Moormann, 2008). CIR is recognized as the most popular ratio to measure cost efficiency since it can be easily computed, it allows a fast and easily feasible comparison of banks, it can be easily computed, and the results seem to be intuitive.

In the literature about CIR, it is commonly recognized that a high CIR is equivalent to low productivity and low efficiency and vice-versa (Hussain, 2014). Hess and Francis (2004) showed that there is an inverse relationship between the CIR and the bank profitability. Ghosh *et al.* (2003) found out that a negative relation between efficiency and the CIR exists, and this means that more efficient banks (with lower CIRs) generate higher profits. Therefore, it seems to exist a negative correlation between CIR and efficiency and a positive relationship between efficiency and profitability.

Although banks focus on the reduction of CIR as proxy for cost efficiency, CIR has some limitations in assessing efficiency (Beccalli *et al.*, 2006). Osborne (1995) found no clear correlation between the CIR and the ROE of a sample of banks. Bekier and Nickless (1998) found important differences regarding cost efficiencies among countries which adopt different payment systems. Countries where cheques are widely used for non-cash payments (USA,

Canada, Australia, and the UK) tend to have more costly banking systems than European countries which rely more on electronic transaction methods.

Moreover, using financial ratios to measure efficiency has some disadvantages with respect to parametric and non-parametric approaches (Stochastic Frontier Approach and Data Envelopment Analysis) because financial ratios tend to ignore the input price and the output mix (Berger and Humphrey, 1992). A closer analysis of CIR calculation shows that price components (interest rates, commission fees and factor costs) influence the determination of earnings and expenses and so they alter the ability of CIR to measure efficiency (Burger and Moormann, 2008). Earnings are based on sales quantities and assessed on prices, while administrative costs are determined looking at the cost of production factors. The consideration of prices on the earning side can be problematic for the measurement of efficiency which detects the level of a bank's production and settlement capability. Therefore, prices elements should not be included in the measurement of productivity.

Lastly, banks that operate in different countries may be characterised by different interest rates and commission fees. Since these elements are part of the CIR, banks situated in countries with higher interest margins *ceteris paribus* appear to be more efficient and productive than others. Considering the limitations of the CIR, academics have developed parametric and non-parametric methods which estimates the operating efficiency (Beccalli *et al.*, 2006). Operating efficiency occurs when a company is cost minimising (using less inputs for the same level of outputs) or profit maximising (producing more outputs for the same amount of inputs). This concept of efficiency is proxied by a frontier index known as X-efficiency (defined as the ratio of the minimum costs that have been expended to produce a given output bundle to the actual expenses) which is used to measure bank performance and is considered a better indicator compared to traditional accounting ratios (Berger and Humphrey, 1992).

Summing up, efficiency has become one of the main objectives of banks and bankers, especially after the 2008 financial crisis and the consequent strengthening of bank capital requirements. A bank, as any other organization, should be able to generate profits with an efficient use of its inputs and resources. The focus on efficiency is also increased due to the greater competition from nonbank players such as FinTech companies that operate in the banking sector. The competition from FinTech players induces banks to adopt new technologies, to develop new automated processes and new financial services.

We presented a simple but comprehensive definition of efficiency provided by ECB: efficiency is the bank's ability to generate revenue from a given amount of assets and to make profit from a given source of income. Regarding efficiency measurement, we described different approaches from the traditional cost to income ratio to the more precise DEA and SFA methods.

Since in our work we will analyse the correlation between FinTech innovations and banks' efficiency focusing on the cost dimension of FinTech instruments adopted by banks, we believe it is opportune to apply the cost-to-income approach.

3. Impact of FinTechs acquisitions on banks' performance

In the previous chapters we analysed the FinTech phenomenon and the emergence of FinTech start-ups (henceforth "FinTechs") which provide innovative financial solutions and services. FinTech is a complex phenomenon threatening the banking industry and the traditional financial institutions. It includes both technological innovations (distributed ledger technology, artificial intelligence, robo-advisory, and Application Programming Interfaces or APIs), and FinTechs which provide new financial services based on FinTech innovations. Over the past 5 to 10 years customers significantly changed their view of financial services companies and their needs (KMPG, 2017). Customers expect more innovative, faster, and efficient financial services. However, traditional banks have failed to provide these services because of stringent regulatory requirements and inflexible, slow-to-adapt legacy core banking systems (Schwab and Guibaud, 2016).

In the current era of digitalization and automation, financial institutions should be able to quickly respond to their customers' needs with customized and easier to use financial products. Therefore, financial institutions and banks feel the pressure to both modernize their infrastructure and respond to changing customers' demands and expectations. The banking industry is facing a fierce competition from FinTechs from a variety of fronts. FinTechs are able to better satisfy customers' needs adopting a variety of technologies to increase the accessibility and speed of their services (Capgemini,2018). The elaboration of advanced data analytics and the greater attention on customer data allow FinTechs to offer tailored services and products adopting a more customer-focused approach in contrast with traditional banks. FinTech innovations guarantee their clients more transparency and dependability through digital, automated and more efficient processes. Moreover, the emergence of FinTechs led to the introduction of new business models such as P2P lending which may have a significant impact on lending and retailing sectors. With respect to traditional banks FinTech have no legacy infrastructure and so, they can keep costs down and offer lower-priced solutions (such as robo-advisors). Finally, through innovation and low-cost financial solutions, FinTechs can reach and satisfy customers who are generally unserved or underserved by the traditional financial industry. All these elements represent FinTechs' strengths and sources of competitive advantage with respect to banks and other financial institutions which should invest more time and attention on evolving customers' needs and technological advances.

3.1 Collaboration between banks and FinTechs

Collaborations and relationships between FinTechs and incumbents can be win-win situations for both entities considering the complementarity of their features and competitive advantages (Capgemini, 2018). FinTechs offer agility, focus on customer experience, and lack of legacy systems while banks bring infrastructure, brand name and customer trust, and their ability to deal with regulation. Although FinTech are closer to customers' needs introducing innovative products, they face challenges in scaling-up and establishing financially viable business models. Despite the growth and the great number of FinTechs, only few FinTech companies and products have reached a significant scale. FinTechs' weaknesses come from the lack of customer trust and brand name since it takes time for FinTechs to attract customers which reposed trust in traditional financial institutions. Unlike banks and other financial institutions, FinTechs do not have well-established distribution infrastructures, and this may prevent them from reaching a broad customer base. Even though FinTechs have a leaner and low-cost structure thanks to the absence of legacy systems, regulatory and supervisory bodies across the worlds are introducing protocols and regulations for Fintechs. This decision comes from the continuous expansion of FinTechs in the financial industry, even if many of them do not have the expertise in handling complex regulation and mandates. FinTechs need also to face issues about financing and capital. Indeed, they heavily rely on venture capital funding based on the uniqueness of their businesses. If FinTechs' new ideas do not generate interest, this can compromise the financing of firm's operations and activities. Finally, for FinTechs it is difficult to reach economies of scale without collaborating with incumbents. Although FinTechs offer low-cost financial solutions, they can profit only with economies of scale which may allow them to attract and gain new customers. As mentioned above, collaboration can be a profitable solution for both FinTechs and traditional financial institutions since FinTechs challenges are often natural strengths of incumbents and vice versa.

Although FinTechs are real competitors for different players of the financial industry (banks, insurances, financial institutions), they especially threat traditional banks. Indeed, FinTechs have partly taken over functions and activities previously reserved for incumbents, e.g., in payments, lending and investing (Eickhoff *et al.*,2017). They began to provide financial services which are similar to those provided by traditional banks but are not subject to the same degree of regulatory pressure in terms of licences, capital and rules. For this reason, we will focus our analysis on the relationship between banks and FinTechs.

The emergence of new competitors as FinTechs altered the composition of the banking industry, and it induced banks to elaborate FinTech strategies to maintain their role in the financial sector.

In addition, the development of new technologies and the shifts in customers' needs increased the interest of banks in FinTech innovations and companies.

Banks can adopt different strategies to curb the potential threat from FinTechs (Ernst & Young, 2017). Banks may decide to invest their own capital in FinTechs as in-house venture capital, independent venture capital funds or investments on their own balance sheet. Investments in FinTechs allow banks to gain early access to innovative solutions, resolve the lack of in-house talent and innovative culture, and reduce the time-to-market. Banks can also enter in different types of arrangements with FinTechs: utilizing products or platforms developed by FinTechs (for example in the case of robo-advice), creating partnerships or collaboration as a whole network, establishing joint ventures or co-creating new services (a bank partner with a FinTech to launch a new digital marketplace). Creating partnerships or collaborations with FinTechs is one of the most common strategy in the banking industry given its innumerable advantages in terms of speed, cost and acquisition of new customers (KPMG,2017). Through the creation of alliances, FinTechs' products and services can reach the large customer base of banks and at the same time, banks can help FinTechs address regulatory requirements and gain access to new customer segments (Klus *et al.*, 2018).

Instead of investing in FinTechs, banks could accelerate their in-house development of FinTech products and services. When a bank decides to build FinTech innovations, they can define the scope of their initiatives and design tailor-made products or services (KPMG,2017). However, few financial institutions adopt this strategy because they do not have time, resources, capabilities and agility to develop FinTech innovations efficiently and effectively. Indeed, to create in-house innovations, internal capabilities, technical competencies and cultural disposition to embrace change are required. For banks, the building strategy represents a challenge also because the strict regulation and the complexity of their businesses have historically slow down their innovation process (Ernst & Young, 2017).

Another model of engagement with FinTechs is represented by mergers and acquisitions (M&As). Banks may directly acquire FinTechs increasing their digital footprint and reducing costs for the development of new technologies. Acquiring FinTechs may be an effective way to avoid the development process by directly gaining access to FinTech capabilities. Even though M&A transactions between banks and FinTechs are a very recent phenomenon in the banking industry, they can lead to important benefits for both players. Banks would have direct access to talent and innovative culture, reach new markets and speed up processes and products delivery to final customers. Since FinTechs adopt new technologies, offer alternative innovative financial solutions and reach underserved customers, banks would also have the possibility to enlarge their product and market differentiation. With respect to collaborations, M&As

operations are more complex because they imply a complete integration between two entities with different culture, capabilities and knowledge.

Banks could also create a relationship of white-labelling with FinTechs or other technologies companies. In this situation, FinTechs develop and realize the financial products or services, which are then brand and sell by banks. Applying this strategy, banks have access to innovative products without bearing the cost for their realization, and they can test value and fill potential product/service gaps. However, banks have less control than developing the products internally, they need to integrate this innovative structure within their business and to share revenue (KPMG,2017). In some cases, FinTechs sell their products only under their partner bank's brand (Bömer and Maxin, 2018). Analysing a sample of FinTech in the German industry, the authors found out that all FinTech that apply white-label approach cooperate with many different banks. Therefore, FinTechs are only technology services providers, and they distribute their technology to banks to increase profits and number of users. White-labelling is convenient for banks because they can offer innovative financial solutions to their customers without the need to build or develop the necessary legacy systems. With this type of collaboration, it emerges a new hybrid model for banks so called BankTech (Schwab and Guibaud, 2016). In this model banks would put at FinTech companies' disposal their core banking infrastructure and sometimes their banking licence while indirectly reaching new customers which were unserved in the past (for example young people, the unbanked, SMEs or digital natives). Although FinTechs provide innovative financial solutions through a more customer-centric experience, some of them need banks' support, knowledge and expertise to operate. In the relationship bank-FinTechs banks will not only lend FinTechs with their backbone infrastructure to operate, but also rely on them to serve their existing clients better.

Finally, banks are leading or participating in a number of accelerators, incubators and training programmes to get access to technologies and talent without taking any significant stake in the FinTechs. On the other side, FinTechs gain easy access to resources, data, funding, space and networking opportunities to test their prototypes. This is the case of joint FinTech programs or lead FinTech programs.

To conclude the analysis, the report of KPMG (2017) shows that collaboration is the preferred engagement strategy when banks need to interact with FinTechs to drive financial innovation. However, although banks still hesitate, acquisitions of FinTechs are an emerging phenomenon in the banking industry. CB Insights (2018) identifies and analyses 20 Fintechs acquisitions by banks in the period 2014-2018. Most of these acquisitions occurred after September 2017, and this confirms that such type of deals is very recent and that banks are changing their behaviour towards FinTechs. Banks involved in these acquisitions are especially European (BBVA, BNP

Paribas, Credit Suisse) and US (Goldman Sachs, JP Morgan Chase & Co., Capital One, Ally, First Republic Bank, Silicon Valley Bank, and KeyCorp) banks. In table 1 we recap the acquisitions of FinTechs performed during the period 2014-2018.

Table 3: Acquisitions of FinTechs performed by banks between 2014 and 2018

Bidder	Target	FinTech sector	Date	Transaction
BBVA	Simple	Digital Banking	2014	Cross-border
	Madiva Soluciones	Real Estate	2014	Domestic
	Holvi	Digital Banking	2016	Cross-border
	Openpay	Alternative Payments	2016	Cross-border
Goldman Sachs	Honest Dollar	Wealth Tech	2016	Domestic
	Finaceit	Lending & Credit	2017	Cross-border
	Final	Lending & Credit	2018	Domestic
	Clarity Money	Personal Finance	2018	Domestic
BNP Paribas	Compte Nickel	Digital Banking	2017	Domestic
	Gambit Financial Solutions	Wealth Tech	2017	Cross-border
Capital One	Level Money	Personal Finance	2015	Domestic
	Paribus	Personal Finance	2016	Domestic
JP Morgan Chase & Co.	WePay	Alternative Payments	2017	Domestic
	MCX	Alternative Payments	2017	Domestic
Ally	TradeKing	Capital Markets Tech	2016	Domestic
Credit Suisse	TradePlus24	Lending & Credit	2017	Domestic
First Republic Bank	Gradifi Inc.	Lending & Credit	2016	Domestic
Silicon Valley Bank	Standard Treasury	Capital Markets Tech	2015	Domestic
TD Bank	Layer 6	Artificial Intelligence	2018	Domestic

Sources: CB Insights (2018); CrunchBase

From this analysis, we can see that all acquisitions occurred in Europe and in the US, with the only exception of TD Bank which operates in Canada. Although European and American banks reduced their investments in fintech in 2017 with respect to 2016, they are finally picking up FinTech acquisitions (CB Insights, 2018).

As mentioned in the previous chapter, the aim of our work is to investigate the impacts of FinTechs on banks' performance. To conduct this analysis, we will consider the acquisition of

FinTech companies performed by a bank to analyse the strategy behind the deal and the impact of acquisitions on the performance of the acquiring bank.

3.2 BBVA and FinTechs acquisitions

From the analysis of FinTechs acquisitions by banks, it emerged that Banco Bilbao Vizcaya Argentaria (henceforth “BBVA”) is the most active bidder within the European banking industry. For this reason, we decide to focus on FinTechs acquisitions performed by BBVA in order to understand the motives and the strategy behind the deals and to investigate the consequences and effects on the performance of the bank. Before analysing the acquisitions performed by BBVA, we will briefly illustrate its history, sources of competitive advantage and business strategies.

3.2.1 The BBVA Group

BBVA is a customer-centric global financial services group founded in 1857 as an issuance and discount bank by the Board of Commerce. During the economic development of the 1960s in Spain, Banco de Bilbao expanded its business, acquiring other banks and creating a financial group. In the meanwhile, Banco de Vizcaya continued to grow and established itself as a modern bank within an important financial group. After increasing their size and presence in the Spanish banking industry during the 1980s, Banco de Bilbao and Banco de Vizcaya agreed to a merger creating the new BBV. In the meanwhile, Corporación Bancaria de España, created as a state-owned enterprise and credit institution with the status of a bank, merged with other Spanish public banks under the brand of Argentaria.

In 1999 BBV announced its merger with Argentaria, a brand born in 1988 representing a group of banks and official credit institutions. The deal between BBV and Argentaria allowed the two banks to reach a strong, large financial structure, an ample diversification of business and risks, and therefore, greater potential for increasing its profits. BBVA offers its customers an extensive distribution network, a wider range of products, new channels and a strong international presence. The integrations process between BBV and Argentaria received a major boost with the adoption of a single BBVA brand in January 2000, favouring the creation of an image base on its own unique identity. One of the main peculiarities of BBVA is its international presence. Indeed, the Group has a strong leadership position in the Spanish market, it is the largest financial institution in Mexico, and it has leading franchises in South America and in the South of the US.

The 2008 financial crisis posed new challenges for the financial industry which faced an increase in regulatory pressure. Stricter regulatory requirements along with low interest rates

and activities slowdowns caused a negative impact on profitability of the banking industry around the world. In addition, the financial industry is facing the competition from new specialized players (FinTechs, Tech giants) which base their business models on better customer experience and lower operating costs. The emergence of new entrants was also favoured by the development of new technologies (AI, Blockchain, Big Data, Biometrics, Data processing, and Cloud) characterized by automated data analysis, algorithms, and process automation. BBVA Group was able to transform its strategy and value proposition in accordance with the new challenges posed by the financial industry. Considering the customer-centric approach adopted by new players and the shift in customers' needs, BBVA Group elaborated a new value proposition based on its customers' real needs in order to strengthen the relationship with them. Firstly, BBVA wants to help its customers make the best financial decisions through a clear and transparent offering of financial products and services. Moreover, the offering of financial services must be easy and convenient giving customers the possibility of accessing the services and using their preferred channels (digital or traditional channels). Finally, the Group wants to provide relevant help and advice so that customers can make their best financial decisions. With this aim, BBVA offers its clients daily financial support, innovative and personalized products and services.

Customer experience is the first purpose and strategic priority for the Group even if digitization and innovations are essential to guarantee a better customer experience and to become the leaders in customer satisfaction. Digitization has become the driver of BBVA's transformation since it is an essential element for boosting digital channels and developing innovative products. To accomplish its transformation and maintain the competitive advantage, the Group is actively participating in the disruption of the financial industry caused by the market entry of FinTechs and other Tech giants. For this purpose, BBVA elaborated the New Digital Business (NDB) unit and strengthened its position in the FinTech ecosystem investing in FinTech innovations and start-ups. Besides a better customer experience and a greater digitization, the Group aims at reaching an optimal capital allocation to improve business profitability and sustainability, and efficiency leadership considering the low-profitability environment for the financial industry.

3.2.2 BBVA's strategies in the FinTech sector

Since our work focuses on FinTechs acquisitions performed by banks, we will concentrate on BBVA's digitization strategies and results.

As mentioned above, BBVA created the NDB unit in 2015 to keep abreast of the digital disruption of the financial industry caused by the FinTech phenomenon. The unit operates as

an independent entity between the bank and the acquired companies, and it handle all transactions and deals elaborated by BBVA towards the FinTech ecosystem.

The mission of the new unit consists of four pillars: Build, Acquire, Invest, and Partner. The aim of “build” is to recruit experienced entrepreneurs and develop, finance and incubate their FinTech ventures at one of the venture creation centres (Madrid, San Francisco, London) of the Group. With this purpose, BBVA created internal ventures with Denizen, CoVault, Muno, and Azlo.

Incubated out of BBVA’s NDB unit in San Francisco, Denzen allows customers to receive money in one country and pay it out in another immediately, avoiding international transfer fees and eliminating currency exchange fees. In this way, Denzen significantly reduces time and costs of international banking. CoVault specialises in delivering super secure digital identity and security solutions for both consumers and businesses. Supported by BBVA through NDB unit, CoVault launches a new mobile app aimed at simplifying the process of storing, sharing, and verifying online identities. This solution uses key encryption linked to the biometric signature on the user’s device, allowing the user to digitally protect his sensitive information from being accessed without his authorization. Muno is a start-up which launched a new health insurance for freelancers to suit their needs and solve their challenging issues. Finally, Azlo is the first digital banking platforms offering free business accounts with unlimited payments to anyone in the US or Mexico, and including bill pay, mobile check deposit and basic digital invoicing in the baseline product. The aim of Azlo is to increase the availability of both domestic and cross-border banking services for both customers and businesses. Incubating and financing these FinTech ventures allow BBVA to gain competitive advantage in digital and open banking guaranteeing their customers process transparency, faster and cheaper financial solutions, and protection of personal data and information.

Another mission of the new NDB unit is to invest in FinTech ventures and companies like Propel Venture Partners and Atom bank. Propel Venture Partners is an independent venture capital firm which provides opportunities at the intersection of technology and finance. As reported on the website of BBVA, the Group invested in two vehicles focused on financial technology, which Propel manages as a third party.

Atom is the UK’s first bank exclusively built for smartphones and tablets without traditional physical branches. Through the mobile app, customers can carry out all transactions and create their own personalised brand. In March 2018 BBVA announced an additional investment in the UK digital bank to increase its stake. The Group invested a further £85.4m (€96m approx) increasing its ownership in the challenger bank to around 39%. This move shows BBVA’s confidence in the business strategy of Atom and brings the total invested so far, including this

latest tranche, to £167m (€189m). The new capital invested by BBVA in Atom allows the digital bank to continue its impressive growth in the UK and offer new products and services. After Atom Bank, BBVA announced an investment in solarisBank, a German banking platform, following its participation in a Series B funding round. The deal is perfectly in line with the digital transformation process of the Group, and it allows BBVA to reinforce its presence in the digital banking sector. solarisBank, the first banking platform with a full banking license, enables companies to offer their own financial products from solarisBank and also those of third-party providers.

The NDB unit also aims at creating partnerships with FinTechs and other technological innovators. BBVA is working with R3, the consortium for financial innovation, in the development of a blockchain-based identity management system for the digitization of the documentation process of trade finance.

In June 2017 BBVA signed an agreement with Ant Financial Services to allow Chinese tourists to pay in Spanish stores using Alipay which is the largest online and mobile payment and marketing platform. The Group will integrate Alipay into the bank's Smartpay services which turn smartphones into a payment method.

BBVA also created collaborations with Prosper, specialized in consumer lending, and Ripple, a blockchain network that allows the first real-life implementation of an international money transfer using its new DLT.

Finally, a key point in BBVA's FinTech strategy is represented by the acquisition of innovative FinTech companies and technological disrupters. As mentioned above, BBVA is the most active European bank in the acquisition of FinTechs. The first FinTech company acquired by the Group was Simple in February 2014, followed by Madiva in December 2014, Holvi and Openpay respectively in March and December 2016. Acquisitions of FinTechs play a key role in the digitalization and transformation strategy elaborated by the Group.

The first BBVA's acquisition involved Simple, a US-based online banking start-up. Founded in 2009 in Portland, Simple organized its commercial launch only in 2012. The company offers customers traditional banking services but in an innovative and smarter way. Customers receive a white card (Simple Visa® card) that can be used as a debit card, and they can take advantage of features like direct deposit and money transfers. At the moment of the deal, Simple served about 100,000 customers across the US, a fivefold increase since the end of 2012.

The deal was concluded by the US-based BBVA Compass Bancshares, Inc. (a subsidiary of BBVA) for a value of \$117m. After the acquisition, Simple continued to operate separately under the same brand and with the same approach to customer experience. With the help of BBVA, Simple developed new products and services, and it was able to expand beyond the US

and enter new markets, considering the international presence of BBVA. Moreover, by joining with the Spanish bank, it could jointly gain complete end-to-end ownership of the customer experience, from the offer to the realization and the sell of financial solutions. In this way, both companies increased their degree of flexibility and control on new innovations. The acquisition of Simple helped BBVA to operate a geographical expansion in the US, where it operates even now through Compass subsidiary. Indeed, at the time of the acquisition the Spanish group had a relatively small presence and influence in the USA. Moreover, for BBVA purchasing Simple gave it access to about 100,000 new customers in the US and to new technologies that will help BBVA attract more. The deal between BBVA and Simple was a sort of revolution within the banking industry since banks and FinTechs operate with different business models, customer approaches and strategies. Indeed, Simple, as FinTech company, was characterized by a very low-cost business model, no physical branches and customer-centric approach which enabled BBVA to improve its customers' experience and satisfaction.

In December 2014 BBVA acquired Madiva Soluciones, a Spanish start-up providing services based on big data and cloud computing. Its services simplify existing transactions and create new business opportunities by processing unstructured data and high volumes of information available on Internet. BBVA recognized a great potential in the big data sector, and the purchase of Madiva allowed the Group to strengthen its capabilities in this sector and to improve the offering for its clients. After the acquisition, Madiva continued to operate as an independent company, serving not only its original customer but also BBVA's clients. For this reason, the acquisition was a successful deal for Madiva because it allowed the small Spanish start-up to enlarge its customer base and to collaborate with an international banking group which is still now betting on the development of FinTechs. The acquisition turned out to be very successful for both BBVA and the Spanish start-up itself. Indeed, in August 2018 the Group and Madiva launched BBVA Valora, which became BBVA's flagship product with 150,000 queries a month from users providing advice and guidance on home purchase. Madiva played a key role in the elaboration of BBVA Valora since it developed an algorithm that helped identify customers with high purchasing power and limited relationship with BBVA. Madiva's knowledge about big data and cloud computing was essential to provide customers a personalised and efficient tool.

In line with the transformation strategy, BBVA continued the process of acquisitions in the FinTech sector, purchasing Holvi and Openpay in 2016. In March 2016 BBVA announced the strategic acquisition of the Finnish Holvi. Founded in 2011, Holvi provides entrepreneurs, small and medium-sized businesses with a range of financial services as well as traditional banking through its online platform. The Finnish company offers tools to both collect money and to

manage personal finances. Moreover, the online platform includes an online sales platform, an invoicing facility and a cashflow tracker. Holvi was created with the view to meeting needs and requirements of small entrepreneurs and businesses. Through the latest innovations in FinTech, it was able to realize an all-in-one banking service that streamlines the most complicated and time-consuming financial processes. Finally, Holvi is the world's first financial service operating with its own Payment Institution License, regulated by the Financial Supervisory Authority of Finland (FIN-FSA). After the deal Holvi continued to operate as a stand-alone entity, but with an important flow of knowledge, ideas and support with BBVA. Both companies are united by the same vision about the benefit of technology and innovation for the customer. From BBVA's perspective, the acquisition enabled it to further develop a new digital approach to small business banking, while for Holvi the purchase gave it the necessary room to grow, and the scale and expertise to consolidate that growth.

At present (2019) BBVA's last acquisition in the FinTech ecosystem is Openpay, occurred in December 2016. Openpay is a Mexican payment service provider (PSP) which facilitates e-commerce for large businesses and SMEs, a critical customer segment for traditional banks. It was founded in 2013 with the aim of building a "one-stop shop" for e-commerce, providing a real time online platform which allows users to make card, cash and loyalty-points payments and interbank transfers. Thanks to Openpay, a business can start processing different types of payments and bank transfers through a single integration, reducing its operating costs. Openpay operates in Mexico through Paynet, its own global network of more than 15,000 (in 2018) associated points-of-sale. Through Paynet, Openpay enables cash payments for online purchases, and it manages more than one million transactions a month. The online platform also uses advanced tools to prevent fraud and protect customers' accounts. Indeed, it analysed each transaction in real time with its anti-fraud system to prevent fraudulent charges, and it has the PCI-DDS certification (an international security standard in the handling of payment data) for handling and storing card private information. The acquisition did not imply any operating changes or changes in fees for existing Openpay customers. They continued operating as usually but enjoying an additional level of reassurance since they are now backed by a more stable and stronger company. The transaction with Openpay was conducted by BBVA Bancomer, the business unit of BBVA operating in Mexico. Through the acquisition BBVA Bancomer increased its range of online payments solutions, while Openpay strengthened its commercial role by collaborating with Mexico's largest bank. The synergies between the bank and the start-up improved the commercial capacities of both companies, complemented their catalogue of products for retail clients and allowed them to strengthen their payment solutions. Since Openpay is even now one of the principal innovators in Latin America in payments, its

acquisition also represented an important step forward for Mexican banking. In this way, it opened to the new financial players that are able to satisfy users' needs in a more agile fashion. Moreover, e-commerce is on the rise around the world- and in Mexico in particular- driven by tremendous growth in digital payments. The acquisition of Openpay perfectly falls in BBVA's strategy of digitalization, and it reinforces one of the bank's strategic priorities: offering a better customer experience, in line with new customers' needs. This transaction enabled the Group to remain at the cutting edge of payments systems, bringing numerous benefits also for customers. Along with the acquisitions performed in the previous years, the purchase of Openpay showed BBVA's commitment to digital transformation in order to revolutionize the banking industry in accordance with FinTech innovations.

Analysing all the acquisitions performed by BBVA until now, it emerges the attention of the Spanish Group towards technological innovations brought by FinTech in the financial industry. BBVA has always declared that digital transformation is one of the priorities of its strategy, and it seeks to achieve this goal investing, incubating and acquiring FinTech ventures and companies. In the context of FinTechs acquisitions, BBVA can be considered as an early adopter of these innovations, following the "diffusion of innovation" theory elaborated by Rogers. Indeed, considering the sample of FinTechs transactions mentioned in Table 1, BBVA performed the first acquisition of a FinTech company in the history of the banking industry, and it is also the most active European banks in the purchase of new players.

All the acquisitions of FinTechs performed by the Group are united by its commitment to digital transformation to improve customer experience and offer better financial solutions. Technological innovation has become an essential source of value and competitive advantage for companies. Indeed, many authors (Uhlenbruck *et al.*, 2006; King *et al.*, 2008; Makri *et al.*, 2012) argued that companies turn to acquisitions as an alternative strategy for obtaining the knowledge necessary to create innovations. This is the strategy adopted by BBVA in the acquisitions of FinTechs. Given technological advances and shifts in customers' needs, BBVA understood the key role of digital innovation in the banking industry. Indeed, the acquisitions of FinTechs allowed BBVA to obtain and integrate knowledge and capabilities from acquiring firms to better meet customers' requirements and to face the fierce competition from new technological players. Through these transactions, BBVA also gained access to growing sectors of FinTech such as digital banking, online payments solutions, big data and cloud computing. BBVA can now offer its clients cheaper (FinTechs generally apply lower charges, fees and interest rates) and faster traditional banking services, guaranteeing them more transparency of processes and more security of personal information.

Except for Madiva Soluciones, the other three acquisitions performed by BBVA are cross-border transactions toward the US, Finland and Mexico.

In accordance with academic literature, there are several reasons that can induce companies to perform cross-border acquisitions rather than domestic transactions (Datta, 2018). Analysing the cross-border acquisitions performed by BBVA, we refer only to some motives such as growth, synergies, increase in market power and market entry, and access to inputs and technology. Expansion and growth through M&As are less time consuming and more cost effective than internally developing the necessary production capability and capacity. Indeed, the realization of new facilities and infrastructures requires investments and so, it may be more profitable to acquire existing facilities of another company. This reason is in line with the strategy declared by BBVA even if the Spanish Group is also committed to incubating and financing FinTech ventures. Another motive is linked to the realization of potential synergies between the bidder and the target company. Combining their efforts and resources, firms can produce better results with lower operating costs. In the case of BBVA the acquisitions of FinTechs may allow the Spanish bank to realize operating synergies in terms of higher growth in new (the US, Mexico, Finland) or existing markets (Spain).

Cross-border transactions can also allow acquired company to gain access to new markets. In this case, a foreign company prefers to acquire a local firm which knows the market and has an established customer base. In the case of BBVA, cross-border acquisitions allow it to geographically expand and strengthen its presence in markets such as the US and Mexico where it had a relatively small impact. At the time of Simple acquisition, the FinTech financing activity in the US far exceeded that of every other country, as reported by Accenture. The US market was characterized by the highest rate of Fintech investments (about \$10,000m) and deals (more than 500). The trends of the US market and its attention on FinTech innovations attracted BBVA which strengthened and differentiated its original strategy by directly acquiring FinTech companies. Focusing on the acquisition of Openpay, BBVA performed the deal in a moment of tremendous growth for the Mexican FinTech sector. BBVA was and is still now one of the largest banks that dominate Mexico. The strong position of the Group in Mexico gave it the opportunity to acquire a Mexican start-up to consolidate its presence not only within the traditional banking system but also in the innovative FinTech ecosystem. Moreover, cross-border transactions also enabled BBVA to enlarge its customer base, gaining access to acquired firms' customers.

Finally, companies generally perform cross-border operations to gain access to technology and latest innovations. This perfectly reflects the commitment of BBVA to digital transformation and innovation of its business model. Indeed, BBVA acquired inputs and technologies of

FinTechs in both domestic and cross-border transactions. As mentioned above, BBVA gained access to innovations as digital banking, online payments solutions, big data and data analytics which are the most disruptive FinTech innovation for the retail banking sector.

Summing up, the acquisitions of FinTechs performed so far are based on three objectives of BBVA's strategy: accelerate the digital transformation process of the Group, integrate knowledge and capabilities about latest technological innovations, and gain access to new customers.

3.3 Effects of acquisitions on companies' performance: Literature Review

In the previous paragraph, we analysed investments, partnerships, and acquisitions of FinTechs performed by BBVA to reach a new objective: accelerate its digital transformation. We described the different initiatives of the Spanish banking group in the FinTech ecosystem. We mainly concentrated on FinTech acquisitions to understand the strategic motives of BBVA behind such operations. Now we will try to investigate the effects of such acquisitions on BBVA's performance. However, before focusing on BBVA's acquisitions, we briefly describe the main findings in academic literature about the performance of companies after M&A operations.

Many studies in the academic literature compared the accounting statements of companies before and after acquisitions to investigate whether and how they affect the firms' financial performance. There are two distinct methodologies that can be applied to study the financial effects of takeover (Rahman and Limmack, 2004; Guest *et al.*, 2012). On one side, profitability studies compare the post-acquisition performance of the acquirer with the pre-acquisition performance of the acquiring and acquired firm. On the other side, share return event studies examine the share price impact of the transaction on the acquired and acquiring firms. Since in our work we will follow the approach of profitability studies, we will describe the main findings of profitability studies in the academic literature.

Considering academic studies about M&A operations in the US, they show inconsistent result. Indeed, some authors found no or negative impacts on companies' post-acquisition performance, while others identified a positive effect of M&A operations on firms' performance and profitability. The inconsistency of profitability studies may be due to different methodologies employed and different sample selection.

Mueller (1980) reviewed a sample of studies across seven nations (Belgium, Germany, France, the Netherlands, Sweden, the UK and the US) about the effects of M&A operations on corporate performance. The author noticed no consistent pattern of either improved or deteriorated profitability after acquisitions.

Ravenscraft and Scherer (1989) compared pre-merger and post-merger profitability of 2,732 lines of business by US manufacturing companies during the period 1957-1977. Acquired companies were found to be extraordinary profitable before the acquisition, especially the smallest firms. After the merger, the profitability of acquired companies declined and so, the authors concluded that mergers have substantial negative impact on the post-acquisition profitability. Clark and Ofek (1994), Philippatos and Baird (1996) and Denis *et al.* (1997) also found that acquisitions do not lead to an improvement in firms' performance. Ghosh (2001) argued that operating performance does not improve after an acquisition. The author investigated the performance of 315 US mergers occurred between 1981 and 1995, using control firms as benchmark. Considering firms matched on performance and size as benchmark, the author found no evidence that operating performance improves following acquisitions. In addition, the results of this study indicated that cash flows (used by many authors to measure financial performance) increase significantly only in case of cash acquisitions, while they decline for stock acquisitions.

Healy *et al.* (1992) examined the post-acquisition operating performance of merged firms using a sample of the 50 largest mergers in the US between 1979 and 1983. Unlike Ravenscraft and Scherer (1989), measuring companies' performance through operating cash flow returns, the authors found that combined firms have significant improvements in cash flow. These increase in cash flow result from improvements in asset productivity relative to firms' industries. However, this study has been criticized for using industry median firms as benchmark.

Switzer (1996) continued the Healy *et al.* (1992) study to analyse performance changes of a larger sample of 324 takeovers in the US during the period 1967-1987. The results indicated that the performance of the merged companies typically improved after the transaction considering a substantially larger sample and time period with respect to Healy *et al.* (1992).

Ramaswamy and Waegelein (2003) examined the financial performance of target and acquiring firms using a sample of US companies during the period 1975-1990. The study followed the methodology of Healy *et al.* (1992), adopting industry-adjusted cash flow returns on market value of assets as performance criteria. Comparing the pre-merger and a five-year post-merger period, the authors observed a significant improvement in post-acquisition performance. In addition, the results indicated that post-merger performance is negatively associated with relative target size and positively correlated with long-term incentive compensation plans.

Looking at the UK, Dickerson *et al.* (1997) investigated the impact of acquisitions on company performance using a sample of 613 mergers between 1948-1977. The results indicated that acquisitions have a detrimental impact of company performance comparing the ROA of

acquiring and non-acquiring firms. Moreover, the authors underlined that company growth through acquisitions yields a lower rate of return than growth through internal investment.

Manson *et al.* (2000) further investigated a sample of 44 acquisitions in the UK between 1985 and 1985 following the methodology adopted by Healy *et al.* (1992). The authors found out evidence of both operating and non-operating gains from takeovers in UK. However, these results are sensitive to how operating performance and associated gains are measured.

Powell and Stark (2005) analysed a sample of takeovers completed in the UK over the period 1985 to 1993 using several benchmarks and operating performance measures. The authors found that acquisition result in modest improvements in operating performance, even if these results strongly depend on the methodology adopted for the analysis. Indeed, using a procedure in which benchmark firms are selected on the basis of several pre-takeover characteristics, the authors found a slight increase in post-acquisition performance for acquiring firm. Using the methodology developed by Healy *et al.* (1992), in which post-takeover performance is regressed on a combined target and acquirer pre-acquisition performance, the results indicated larger improvements in post-acquisition operating performance.

Cosh *et al.* (2006) analysed the performance of 363 takeovers in the UK completed in the period 1985-1996. Measuring the takeover performance as changes in companies' operating performance, the results indicated that takeovers have a positive but not always significant impact on profitability, and negative impact on short and long run returns.

From the studies in the UK analysed before, it emerged that most of them showed a positive correlation between M&A operations and companies' post-merger performance.

We can also find inconsistent results in studies that consider other countries in Europe and in the rest of the world.

In a review paper, Bruner (2002) analysed a sample of 15 studies from 1971 to 2001 analysing the post-acquisition financial performance of firms. The author reported that four studies evidenced a negative performance after the acquisition, three studies indicated a positive impact of the acquisition on the performance, and eight studies showed non-significant changes between the pre-merger and the post-merger firms' performance.

The methodology of cash flow developed by Healy *et al.* (1992) was also adopted by Sharma and Hao (2002). The study investigated the improvement in post-acquisition operating efficiency of a sample of manufacturing firms during 1986-1991 in Australia. Unlike Healy *et al.* (1992), the authors used matched sample based on assets size and industry to control for industry and economic factors. However, the results showed that corporate acquisitions do not lead to significant improvements in post-acquisition operating performance.

Gugler *et al.* (2003) analysed the effects of mergers around the world (the US, the UK, Continental Europe, Australia, Canada, and New Zealand) by using a large panel of data over the past 15 years. The authors examined the effects of the mergers by comparing profitability and sales of the merging firms with control groups of non-merging firms. They observed that takeovers produced no significant decline in companies' performance.

Rahman and Limmack (2004) examined the financial performance of a sample of Malaysian companies involved in acquisitions in the period 1988-1992. The aim of the study was to investigate whether takeovers in Malaysia lead to an improvement in corporate operating performance analysing companies' operating cash flow performance. The results suggested that acquisition performed by Malaysian companies led to improvements in the long run operating cash flow performance. Such improvements came from both increases in return on sales and in asset turnover.

Ooghe *et al.* (2006) analysed the impact of acquisitions on a sample of 143 privately held companies in Belgium between 1992 and 1994. Specifically, this study examined the financial performance of the acquiring firm after the acquisition, using statistical analysis of industry-adjusted variables. The results indicated that after the transaction the profitability, the solvency and the liquidity of most of the combined companies decline.

Mantravadi and Reddi (2008) examined the post-merger performance of acquiring firms from different industries in India. The authors adopted a sample of mergers in India between 1991 and 2003, and they compared some pre-merger and post-merger financial ratios to investigate the impacts of M&A operations on the performance of acquiring firms. The authors found that mergers have a slightly positive impact on firms' profitability in the banking and financial industry, while other sectors showed a marginal negative impact on operating performance.

Kumar (2009) examined the post-merger operating performance of acquiring companies involved in M&A operations between 1999 and 2002 in India. The author compared the pre-merger and post-merger performance of companies using accounting data to investigate merger related gains to the acquiring firms. He found that post-merger profitability, asset turnover and solvency of the acquiring firms, on average, show no improvement when compared with pre-merger values. Therefore, he concluded that mergers usually do not improve the acquirer's financial performance.

Finally, Rani *et al.* (2013) investigated the impact of M&A transactions on corporate performance, comparing the performance of companies before and after the transaction. The results pertaining to operating cash flow ratios showed that there is an improvement in performance of the acquiring firms in the post-acquisition period. The authors conducted the same analysis applying the Du Pont model, and they showed that M&A operations lead to

improvements in the long-term operating profit margin of the acquiring firms. They concluded that increases in cash flows after the transaction are generated primarily due to the better operating margins. As for the US and the UK studies mentioned above, findings related to Indian M&A operations show opposite conclusion by different authors.

From our analysis, it emerged that the academic literature is divided about the relationship between M&A operations and their impact on companies' post-merger performance. The findings of different authors have not converged to a conclusion whether M&A operations are creating or destroying value for the companies involved. We found inconsistent results in studies conducted in the US, the UK and in other countries. Different findings may be due to different methodologies, different samples of M&A operations, and economic characteristics of different countries. The prevailing theory in the literature is that M&A operations have no or negative impact on the post-merger performance of both acquired and acquiring firms.

3.4 Methodology

Objective

In our work we analyse profitability and efficiency of the acquiring firm (BBVA) before and after the four acquisitions (Simple, Madiva Soluciones, Holvi and Openpay) to investigate whether the transactions have an impact on the post-acquisition performance of the acquirer. To investigate the effect of acquisitions on performance, we analyse ROE, ROA and CIR of the acquiring company before and after the transactions.

Research methodology

Most of the authors in the academic literature conducted empirical analysis to investigate the impacts of M&A operations on companies' performance. They developed statistical models which compared the pre-merger and post-merger performance of both acquiring and acquired firms to assess whether the transaction creates benefits for both entities. In our dissertation we conduct a quantitative analysis focusing only on the financial performance of the acquiring company (BBVA). We do not examine acquired firms' performance since it is difficult to find financial statements and data of small FinTech start-ups.

To realize our analysis, we use secondary data from the financial statements of BBVA in relation to the years of the transactions (2014 and 2016).

Research Hypothesis: to test the objective mentioned above, we formulate the following general hypothesis:

H₀: BBVA's acquisitions have no impact on the post-transaction performance of the acquiring company.

H₁: BBVA's acquisitions have impact on the post-transaction performance of the acquiring company.

We adopt the methodology of comparing pre-merger and post-merger performance (in terms of profitability and efficiency) of the acquiring firm using the following financial ratios:

-Return on equity (ROE)

-Return on asset (ROA)

-Cost-to-Income ratio (CIR)

In chapter 2, we also mentioned Net Interest Margin (NIM) as a traditional indicator to measure the financial performance of banks. However, in the financial statements of BBVA we found only annual data of NIM and not quarterly data as for the other financial ratios. Using annual data, the two acquisitions performed in 2014 would present the same values of pre-acquisition and post-acquisition NIM. The same issue would also occur for the two acquisitions in 2016. Reducing the number of observations from 4 to 2 may cause a further decrease in the significance of the results. For this reason, we exclude NIM from our analysis.

The acquisitions of our sample occurred in February 2014, December 2014, March 2016 and December 2016. Therefore, we decide to examine quarterly financial ratios of BBVA to investigate the potential effects of the operations on the post-acquisition performance of the Spanish Group. Many authors (Healy *et al.*, 1992; Manson *et al.*, 2000; Ghosh, 2001; Rahman and Limmack, 2004) suggest investigating the effects of M&As on corporate performance considering two or more years before and after the transactions. A sufficient long period is needed to investigate and understand the impact of an acquisition since efficiency and operating performance improve over a long-time horizon and not within short periods. However, we cannot adopt this time interval especially for the latest two acquisitions (occurred in 2016) due to the lack of financial data after 2017. So, we examine financial ratios' changes in the short-term, i.e. one year before and one year after the acquisitions.

Since the acquisitions of Simple and Madiva Soluciones occurred in the same year (2014) but in different months (February and December), we consider the financial ratios of BBVA at the date of the acquisition. The same is valid for the two acquisitions occurred in 2016 (March and December). The quarter of each acquisition is denoted as $t=0$, while one-year before and after are indicated as $t=-1$ and $t=+1$ respectively.

Tables from 2 to 5 represent the financial ratios of BBVA for each transaction.

Table 2: BBVA's financial ratios for the acquisition of Simple

Financial ratios	-1	0	+1
ROE	16.2	5.5	9
ROA	1.25	0.51	0.73
CIR	50.4	51.7	49.9

Table 3: BBVA's financial for the acquisition of Madiva Soluciones

Financial ratios	-1	0	+1
ROE	5	5.6	5.3
ROA	0.48	0.5	0.46
CIR	52.3	51.3	52

Table 4: BBVA's financial ratios for the acquisition of Holvi

Financial ratios	-1	0	+1
ROE	9	5.6	9.1
ROA	0.73	0.52	0.84
CIR	49.3	54.8	49.1

Table 5: BBVA's financial ratios for the acquisition of Openpay

Financial ratios	-1	0	+1
ROE	5.3	6.7	6.4
ROA	0.46	0.64	0.68
CIR	52	51.9	49.5

Paired t-test

Pre-acquisition and post-acquisition data are tested for normality assumption to establish whether the paired t-test can be applied. Using Shapiro-Wilk normality test, we found that data of ROE, ROA and CIR both before and after the acquisition follow a normality distribution. Indeed, the p-value is greater than the significance level ($\alpha=5\%$) for ROE, ROA, and CIR pre-

acquisition and post-acquisition values. Since the normality assumption is satisfied by all the three samples, we can apply a paired t-test to verify our hypothesis.

Following the approach adopted by Ramakrishnan (2008) and Singh (2013), we compare pre-acquisition and post-acquisition financial ratios of BBVA using paired t-test to examine if there is any statistically significant change in operating performance.

We apply the paired t-test for our analysis since each financial ratio in each transaction is tested twice (before and after the transaction). This means that the observations are paired data. A paired t-test is a parametric test, which is used to compare the means of two variables from the same group (Ramakrishnan, 2008). It determines whether the difference between the means of the two variables is significantly different from zero. In our case, the two variables are the financial ratios of the acquiring firm before and after the transaction. The paired t-test thus determines whether there is a significant difference between the means of the two periods (before and after the acquisition) for the financial ratio. If the mean difference of the two variables is significantly different from zero, it means that the acquisition has an effect (positive or negative) on the performance of the acquiring company. If the mean difference is equal to zero, we can conclude that the acquisition has no impact on the corporate performance.

For each financial ratio we conduct a paired t-test based on the following hypotheses:

-ROE

H₀: Acquisitions have no significant impact on acquiring firm's ROE

H₁: Acquisitions have significant impact on acquiring firm's ROE

-ROA

H₀: Acquisitions have no significant impact on acquiring firm's ROA

H₁: Acquisitions have significant impact on acquiring firm's ROA

-CIR

H₀: Acquisitions have no significant impact on acquiring firm's CIR

H₁: Acquisitions have significant impact on acquiring firm's CIR

We now illustrate the main steps to conduct a paired t-test. Firstly, we elaborate the hypothesis that we want to test:

H₀: $\mu_d = 0$

H₁: $\mu_d \neq 0$

where μ_d is the mean difference.

Secondly, we calculate the differences (henceforth "d_i") between pre-acquisition and post-acquisition data for each transaction. Now d_i represent our sample of data. To conduct a paired t-test we need to calculate the mean difference (\bar{D}_i), the standard deviation (S_{di}) of the

differences, and the standard error of the mean difference ($SE(\bar{D}_i)$). The mean difference is defined as the mean of the paired differences “ d_i ”. The standard error of the mean difference is computed as: $SE(\bar{D}_i) = \frac{S_d}{\sqrt{n}}$ where n is the number of differences.

Our test statistic is:

$$t = \frac{\bar{D}_i - \mu_0}{SE(\bar{D}_i)}$$

where μ_0 is equal to zero. Indeed, in our null hypothesis H_0 , we assume that there is no difference between pre-acquisition and post-acquisition financial ratios of the acquiring firm. The t-value is then compared to the p-value to decide whether to accept or reject the null hypothesis H_0 . The values of these steps are reported in Tables from 6 to 11.

Results of the paired t-test

Using software R to conduct the paired t-test, we report the outcomes for the three financial ratios in Table 6.

Table 6: Results of paired t-test for the financial ratios of the acquiring firm

Financial ratios	One-year before (mean)	One-year after (mean)	\bar{D}_i	$SE(\bar{D}_i)$	t-value	p-value (two-tailed)
ROE	8.875	7.45	1.425	1.937	0.736	0.515*
ROA	0.73	0.6825	0.0475	0.1586	0.299	0.784*
CIR	51	50.125	0.875	0.545	1.605	0.207*

*Not significant at 5% significance level

ROE

The mean difference of pre-acquisition and post-acquisition ROE is equal to 1.425, the t-value is 0.736 with a p-value (two-tailed) at 0.515. Choosing a significance level (α) equal to 5%, the p-value is greater than α . Therefore, we cannot reject H_0 which states that there the four acquisitions performed by BBVA have no significant impact on the acquiring company’s ROE. Failing to reject H_0 , we can conclude that there is no difference in pre-acquisition and post-acquisition ROE of the acquirer. Looking at the means of ROE before and after the transaction, the results show a decrease in ROE from 8.8% to 7.5%. This decrease might cause a negative effect on the performance of the acquiring firm. However, it is not statistically significant reduction since the p-value (0.515) is greater than the significance level ($\alpha=5\%$).

ROA

The table above illustrates that the mean difference of ROA is equal to 0.6825 with a t-value at 0.299 and a p-value (two-tailed) at 0.784. Fixing the significance level α at 5%, it results a p-value greater than α . Therefore, we cannot reject H_0 which states that the four acquisitions performed by the Spanish Group have no significant impact on its post-acquisition ROA. Since our test fails to reject H_0 , we can conclude that a significant difference between ROA before and after the transaction does not exist. From the table above, it emerges a decline in ROA (average) from 0.73% to 0.68%. Although this reduction might negatively affect the performance of BBVA, it is not statistically significant given p-value $> \alpha$.

CIR

The mean difference related to CIR is equal to 0.875, the t-value is 1.605 with a two-tailed p-value at 0.207. Since the p-value is greater than the significance level ($\alpha=55\%$), we cannot reject H_0 . We can conclude that there is no a significant difference between the pre-acquisition and post-acquisition CIR of the acquiring company. Therefore, it emerged that the four acquisitions performed by BBVA have no significant impact on its post-acquisition CIR. As for ROE and ROA, also post-transaction CIR reduces with respect to the value before the acquisition (from 51% to 50.12%). With a p-value greater than α , we can state that the reduction is not statistically significant for the acquiring company.

Conclusions

Considering the great development of FinTechs and the increasing interest of banks in the FinTech ecosystem, our work focuses on the relationship between FinTechs and traditional banks. Particularly, the aim of the dissertation is to assess whether acquisitions of FinTechs have a significant impact on the financial performance of acquiring banks.

We referred to performance in terms of profitability and efficiency of banks, which are measured through return on asset (ROA), return on equity (ROE) and cost-to-income ratio (CIR). To investigate this issue, we considered the four acquisitions of FinTech companies performed by the international banking group BBVA in 2014 and 2016. We choose BBVA's acquisitions since the Spanish Group is the most active European player in the FinTech ecosystem and acquirer of FinTechs.

The initial objective of our work is to test whether the four acquisitions have a significant impact on BBVA's post-acquisition ROA, ROE, and CIR, comparing pre-acquisition and post-acquisition values. From the results obtained for the financial ratios, we will infer acquisitions' global effect on the post-acquisition performance of the acquiring firm.

The financial ratios related to each acquisition are measured one year before and after the acquisition to examine their change after the transactions. Since the values of each financial ratios are measured twice (before and after the acquisition), they can be considered as paired data. Verified the normality assumptions of financial ratios' values, we conducted a paired t-test to investigate whether the acquisitions influence post-acquisition financial ratios of the acquiring firm. Three hypotheses were formulated to assess whether BBVA's acquisitions significantly affect ROA, ROE and CIR of the acquiring company. We assumed as null hypothesis (H_0) that acquisitions have no significant effect on the post-acquisition ROE, ROA and CIR, while the two-tailed alternative hypothesis (H_1) stated that a significant difference between pre-acquisition and post-acquisition financial ratios exists.

Considering the return on equity, the results reported in Table 12 indicate a p-value greater than the significance level ($\alpha=5\%$). Therefore, we cannot reject H_0 and so we can conclude that there is no significant difference between the pre-acquisition and post-acquisition ROE. Moreover, the results show a reduction in the mean ROE which declined from 8.8% to 7.5% after the acquisitions. Although this decline might indicate a negative impact of the acquisitions on the post-transaction ROE, it is not statistically significant given that p-value is greater than the significance level. Analysing this profitability ratio, we can conclude that the four acquisitions performed by BBVA do not have a significant impact on its return on equity after the transactions.

The second paired t-test is conducted to examine the impact of acquisitions on acquiring firm's return on asset. The results of the paired t-test show a p-value greater than the significance level ($\alpha=5\%$). So, we cannot reject the null hypothesis which states a no significant impact of acquisitions on acquiring company's ROA after the transactions. Failing to reject H_0 , we can state that acquisitions do not cause a significant change in the return on asset of the acquiring company. In addition, the mean of ROA reduces from 0.73% before the acquisition to 0.68% after the transaction, even though this decline is not statistically significant.

Finally, we test the effect of acquisitions on the CIR of the acquiring company. As for the profitability ratios, the results of the paired t-test highlight a p-value greater than the significant level ($\alpha=5\%$). Since we cannot reject H_0 , we conclude that acquisitions do not have a significant impact on the cost efficiency of the acquiring firm after the transactions. Indeed, the paired t-test do not show any significant difference between CIR before and after the acquisitions. The cost efficiency mean also diminishes after the transactions, from 51% to 50.12%, although this reduction cannot be considered statistically significant (p-value is greater than $\alpha=5\%$).

Considering these results, we can state that the acquisitions performed by BBVA do not have any significant impact on its post-acquisition ROE, ROA, and CIR. Therefore, we can conclude that BBVA's acquisitions do not significantly affect the performance of the acquiring firm.

The results of our work are in line with some findings of profitability studies in the academic literature. As mentioned above in the literature review, authors are divided about the impacts of M&A operations on the performance of the acquiring companies. Some authors (Healy *et al.*, 1992; Manson *et al.*, 2000; Ramaswamy and Waagelein 2003; Rahman and Limmack, 2004; Powell and Stark, 2005) argued a positive impact of acquisitions on the performance of acquiring and acquired companies. However, most of the academic studies cited in our work (Mueller, 1980; Ravenscraft and Scherer, 1989; Clark and Ofek, 1994; Philippatos and Baird, 1996; Denis *et al.*, 1997; Dickerson *et al.*, 1997, Ghosh, 2001; Kumar, 2009) found no or negative effect of M&A operations on the performance of the companies involved in the transactions. Differences may be due to different methodologies, different samples of companies and different accounting measures.

Although our findings are in line with some previous academic studies, they are not out of limitations. A first limitation of our analysis is linked to the small sample size. Indeed, we measure ROE, ROA, and CIR of BBVA only in relation to four acquisitions. Small sample size can lead to some issues in interpreting the statistical results, especially in terms of p-value. The sample size is strictly related to the confidence in the estimates, uncertainty and precision. A small sample size generally leads to lower confidence in the results, greater uncertainty and lower precision and statistical power. Indeed, the results of our analysis are not statistically

significant for all the three financial ratios. The small sample size is due to the small number of FinTech acquisitions performed by traditional banks. Acquisition of FinTechs is a very recent phenomenon in the traditional banking sector since initially banks considered FinTechs only as competitors and not as sources of competitive advantages.

In our work we focused on BBVA's FinTechs acquisitions since it is the European banks with the highest number of acquisitions in the FinTech ecosystem.

A second limitation in our analysis is the time interval adopted to measure the financial ratios of BBVA for the acquisitions. Most of the studies in the academic literature measure the financial ratios from two to five years before and after the acquisitions. Indeed, many authors argued that potential effects (positive or negative) on profitability and efficiency emerge only in the long-term. However, we adopted a short-term horizon due to the unavailability of financial data after 2017. The choice of a longer time interval would have excluded from our analysis the two acquisitions performed in March and December 2016, further reducing the sample size.

Appendix

In the following tables we report the intermediary results necessary to conduct the paired t-test.

Table 7: Pre-acquisition and post-acquisition ROE

Acquisitions	One-year pre-acquisition ROE (%)	One-year post-acquisition ROE (%)	d_i
1	16.2	9.0	7.2
2	5.0	5.3	(0.3)
3	9.0	9.1	(0.1)
4	5.3	6.4	(-1.1)
\bar{D}_i			1.425

Table 8: Results of the paired t-test for ROE

\bar{D}_i	S_{d_i}	$SE(\bar{D}_i)$	t-value	p-value
1.425	3.874	1.937	0.736	0.515

Table 9: Pre-acquisition and post-acquisition ROA

Acquisitions	One-year pre-acquisition ROA (%)	One-year post-acquisition ROA (%)	d_i
1	1.25	0.75	0.5
2	0.48	0.46	0.02
3	0.73	0.84	-0.11
4	0.46	0.68	-0.22
\bar{D}_i			0.0475

Table 40: Results of the paired t-test for ROA

\bar{D}_i	S_{d_i}	$SE(\bar{D}_i)$	t-value	p-value
0.0475	0.3172	0.1586	0.2995	0.7841*

Table 11: Pre-acquisition and post-acquisition CIR

Acquisitions	One-year pre-acquisition CIR (%)	One-year post-acquisition CIR (%)	d_i
1	50.4	49.9	0.5
2	52.3	52.0	0.3
3	49.3	49.1	0.2
4	52.0	49.5	2.5
\bar{D}_i			0.875

Table 12: Results of the paired t-test for CIR

\bar{D}_i	S_{d_i}	$SE(\bar{D}_i)$	t-value	p-value
0.875	1.090	0.545	1.605	0.207

References

- Accenture, 2015. "The Future of FinTech and Banking: Digitally disrupted or reimaged". Available at: https://www.accenture.com/acnmedia/Accenture/Conversion-Assets/DotCom/Documents/Global/PDF/Dualpub_11/Accenture-Future-Fintech-Banking.pdf
- Admati A.R., DeMarzo P.M., Hellwig M.F., Pfleiderer P., 2011. "Fallacies, Irrelevant Facts, and Myths in the Discussion of Capital Regulation: Why Bank Equity is Not Expensive". Preprints of Max Planck Institute for Research on Collective Goods, Bonn 2010/42. Available at: https://www.coll.mpg.de/pdf_dat/2010_42online.pdf
- Agrawal A.K., Catalini C., Goldfarb A., 2013. "Some Simple Economics of Crowdfunding". National Bureau of Economic Research, Working Paper 19133, Cambridge. Available at: <https://www.nber.org/papers/w16820.pdf>
- Ali R., Barrdear J., Clews R., Southgate J., 2014. "Innovations in payment technologies and the emergence of digital currencies". Bank of England, Quarterly Bulletin. Available at: <https://www.bankofengland.co.uk/-/media/boe/files/quarterly-bulletin/2014/innovations-in-payment-technologies-and-the-emergence-of-digital-currencies.pdf>
- Allen D., Berg C., 2018. "Regulation and Technological Change". Australia's Red Tape Crisis, Connor Court Publishing, Australia, Forthcoming. Available at: <https://ssrn.com/abstract=3140921>
- Allen F., Carletti E., Marquez R., 2014. "Deposits and Bank Capital Structure". Working Papers, University of Pennsylvania, Wharton School, Weiss Center.
- Arnaboldi F., Rossignoli B., 2015. "Financial Innovation in Banking". In: Beccalli E., Poli F., (eds.), 015. "Bank Risk, Governance and Regulation". Palgrave Macmillan Studies in Banking and Financial Institutions. Palgrave Macmillan, London.
- Arner D.W., Barberis J.N., Buckley R.P., 2015. "The Evolution of FinTech: A New Post-Crisis Paradigm?". [University of Hong Kong Faculty of Law Research Paper No. 2015/047 UNSW Law Research Paper No. 2016-62](#)
- Arner D.W., Barberis J.N., Buckley R.P., 2016. "FinTech, RegTech and the Reconceptualization of Financial Regulation". Northwestern Journal of International Law & Business, Forthcoming. University of Hong Kong Faculty of Law. Research Paper No. 2016/035. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2847806
- Arner D.W., Zetsche D.A., Buckley R.P., Barberis J.N., 2017. "FinTech and RegTech: Enabling Innovation While Preserving Financial Stability". Georgetown Journal of International Affairs, Volume 18, No.3, pp. 47-58. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3211708

Bachmann A., Becker A., Buerckner D., Hilker M., Kock F., Lehmann M., Tiburtius P., 2011. "Online Peer-to-Peer Lending – A Literature Review". Journal of Internet Banking and Commerce, Volume 16, No. 2. Available at: <http://www.arraydev.com/commerce/jibc/>

Balyuk T., 2018. "Financial Innovation and Borrowers: Evidence from Peer-to-Peer Lending". Rotman School of Management Working Paper No. 2802220. Available at: <https://ssrn.com/abstract=2802220>

BCBS, 2013. "Basel III: The Liquidity Coverage Ratio and liquidity risk monitoring tools". Bank for International Settlements, pp.4. Available at: <https://www.bis.org/publ/bcbs238.pdf>

BCBS, 2010a. "The Basel Committee's response to the financial crisis: report to the G20". Bank for International Settlements. Available at: <https://www.bis.org/publ/bcbs179.pdf>

BCBS, 2010b. "Basel III: A global regulatory framework for more resilient banks and banking systems". Bank for International Settlements. Available at: https://www.bis.org/publ/bcbs189_dec2010.pdf

Beccalli E., Barbara C., Girardone C., 2006. "Efficiency and Stock Performance in European Banking". Journal of Business Finance & Accounting, Volume 33, Issue 1, pp. 245-262. Available at: <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1468-5957.2006.01362.x>

Beck T., Chen T., Lin C., Song M., 2014. "Financial Innovation: The Bright and the Dark Sides". Journal of Banking & Finance, 72, November 2016, pp 28-51. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=1991216

Bekier M.M., Nickless S., 1998. "Banks Need Fewer Checks Not Fewer Branches". The McKinsey Quarterly, Volume 1, pp. 184-189.

Belleflamme P., Lamber T., Schwienbacher A., 2013. "Crowdfunding: Tapping the right crowd". Journal of Business Venturing, Volume 29, Issue 5, September 2014, pp. 585-609. Available at: <http://dx.doi.org/10.1016/j.jbusvent.2013.07.003>

Berger A.N., Humphrey D.B., 1992. "Megamergers in Banking and the Use of Cost Efficiency as an Antitrust Defence". Antitrust Bulletin, Volume 33, pp.541-600. Available at: <https://doi.org/10.1177/0003603X9203700302>

BIS, 2018. "Sound Practices. Implications of fintech developments for banks and bank supervisors". Basel Committee on Banking Supervision. Available at: <https://www.bis.org/bcbs/publ/d431.pdf>

BIS, 2017. "FinTech credit. Market structure, business models and financial stability implications". Report by a Working Group established by the Committee on the Global Financial System (CGFS) and the Financial Stability Board (FSB). Available at: https://www.bis.org/publ/cgfs_fsb1.pdf

BIS, 2016. “Faster payments – Enhancing the speed and availability of retail payments”. Committee on Payments and Market Infrastructures. Available at: <https://www.bis.org/cpmi/publ/d154.pdf>

Blaseg D., Koetter M., 2015. “Friend or Foe? Crowdfunding versus Credit when Banks are Stressed”. IWH Discussion Paper, Volume 8. Available at: <https://www.econstor.eu/bitstream/10419/117342/1/834451689.pdf>

Bömer M., Maxin H., 2018. “Why Fintechs Cooperate with Banks – Evidence from Germany”. Hannover Economic Papers, No. 637. Available at: http://diskussionspapiere.wiwi.uni-hannover.de/pdf_bib/dp-637.pdf

Boot A.W.A., 2017. “Understanding the Future of Banking Scale and Scope Economies, and Fintech”. In: A.D. Kunt, D.D.Evanoff and G.G. Kaufman, (eds.), 2016. “The Future of Large Internationally Active Banks”. World Scientific Studies in International Economics, Volume 55, pp. 431-449. Federal Reserve Bank of Kansas City, Third Quarter 2012. Available at: <https://www.kansascityfed.org/publicat/econrev/pdf/12q3Bradford-Keeton.pdf>

Bradford T., Keeton W.R., 2012. “New Person-to-Person Payment Methods: Have Checks Met Their Match?”. Federal Reserve Bank of Kansas City. Available at: <https://www.kansascityfed.org/publicat/econrev/pdf/12q3Bradford-Keeton.pdf>

Bruner R.F., 2002. “Does M&A Pay? A Survey of Evidence for the Decision-Maker”. Journal of Applied Finance, Volume 12, Issue 1, pp.48-69. Available at: <https://ssrn.com/abstract=485884>

Burger A., Moormann J., 2008. “Productivity in banks: myths and truths of the Cost Income Ratio”. Banks and Bank Systems, Volume 3, Issue 4, pp. 85-94. Available at: https://businessperspectives.org/images/pdf/applications/publishing/templates/article/assets/2374/BBS_en_2008_4_Burger.pdf

Bussmann O., 2017. “The Future of Finance: FinTech, Tech Disruption, and Orchestrating Innovation”. In: R. Francioni and R.A. Schwartz, editors, 2017. “Equity Markets in Transition. The Value Chain, Price Discovery, Regulation, and Beyond”. Cham: Springer International Publishing AG, pp. 473-486.

Capgemini, 2018. “World Fintech Report 2018”. Available at: <https://www.capgemini.com/wp-content/uploads/2018/02/world-fintech-report-wftr-2018.pdf>

CB Insights, 2018. “Global Fintech Report Q1 2018”. Available at: <https://bebeez.it/files/2018/05/Global-Fintech-Report-Q1-2018.pdf>

Claessens S., Frost J., Turner G., Zhu F., 2018. “Fintech credit markets around the world: size, drivers and policy issues”. Bank for International Settlement, Quarterly Review. Available at: https://www.bis.org/publ/qtrpdf/r_qt1809e.pdf

- Clark K., Ofek E., 1994. "Mergers as a Means of Restructuring Distressed Firms: An Empirical Investigation". *The Journal of Financial and Quantitative Analysis*, Volume 29, Issue 4, pp. 541-565. Available at: <https://www.jstor.org/stable/2331109>
- Cosh A., Guest P.M., Hugher A., 2006. "Board share ownership and takeover performance". *Journal of Business Finance & Accounting*, Volume 34, Issue 3-4, pp.459-510. Available at: <https://doi.org/10.1111/j.1468-5957.2006.00615.x>
- Cosimano T.F., Hakura S.D., 2011. "Bank Behaviour in Response to Basel III: A Cross-Country Analysis". *International Monetary Fund Paper*. Available at: <https://www.imf.org/external/pubs/ft/wp/2011/wp11119.pdf>
- Darolles S., 2016. "The rise of FinTechs and their regulations". *Banque de France, Financial Stability Review*, No. 20, April 2016, pp 85-92. Available at: https://publications.banque-france.fr/sites/default/files/medias/documents/financial-stability-review-20_2016-04.pdf
- Datta S.K.M., 2018. "Legal issues and challenges of cross-border merger and acquisition under the companies Act". *International Journal of Law*, Volume 4, Issue 2, pp. 9-14. Available at: <http://www.lawjournals.org/archives/2018/vol4/issue2/4-1-66>
- Denis D. J., Denis D.K., Sarin A., 1997. "Managerial Incentives and Corporate Diversification Strategies". *Journal of Applied Corporate Finance*, Volume 10, Issue 2. Available at: <https://doi.org/10.1111/j.1745-6622.1997.tb00137.x>
- De Wet J., Du Toit E., 2006. "Return on equity: A popular, but flawed measure of corporate financial performance". *South Africa Journal Business of Management*, Volume 38, No.1, pp.59-69, 2007. Available at: <https://ssrn.com/abstract=1656329>
- Dickerson A., Gibson H., Tsakalotos E., 1997. "The Impact of Acquisitions on Company Performance: Evidence from a Large Panel of UK firms". *Oxford Economic Papers*, Volume 49, Issue 3, pp. 344-361. Available at: <https://www.jstor.org/stable/2663598>
- EBA, 2017. "Discussion Paper on the EBA's approach to financial technology (Fintech)", EBA/DP/2017/02, 4 August. Available at: <https://www.eba.europa.eu/documents/10180/1919160/EBA+Discussion+Paper+on+Fintech+%28EBA-DP-2017-02%29.pdf>
- ECB, 2010. "Beyond ROE- How to Measure Bank Performance". Appendix to the Report on Eu Banking Structures. Available at: <https://www.ecb.europa.eu/pub/pdf/other/beyondroehowtomeasurebankperformance201009en.pdf>
- Eickhoff M., Weinrich T., Muntermann J., 2017. "What do FinTechs actually do? A Taxonomy of FinTech Business Models". *Research Paper, International Conference on Information System*, pp. 1-19. Available at:

https://www.researchgate.net/publication/320215812_What_do_FinTechs_actually_do_A_Taxonomy_of_FinTech_Business_Models/download

Ernst & Young, 2017. “Unleashing the Potential of FinTech in Banking”. Available at: [https://www.ey.com/Publication/vwLUAssets/ey-unleashing-the-potential-of-fin-tech-in-banking/\\$File/ey-unleashing-the-potential-of-fin-tech-in-banking.pdf](https://www.ey.com/Publication/vwLUAssets/ey-unleashing-the-potential-of-fin-tech-in-banking/$File/ey-unleashing-the-potential-of-fin-tech-in-banking.pdf)

Ernst & Young, 2016. “UK FinTech. On the cutting edge. An evaluation of the international FinTech sector”. Available at: <https://www.ey.com/Publication/vwLUAssets/EY-UK-FinTech-On-the-cutting-edge/%24FILE/EY-UK-FinTech-On-the-cutting-edge.pdf>

Ertan A., Loumiot M., Wittenburg-Moerman R., 2016. “Enhancing Loan Quality through Transparency: Evidence from the European Central Bank Loan Level Reporting Initiative”. *Journal of Accounting Research*, Volume 55, Issue 4, pp. 877-918. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2702126

Fáykiss P., Papp D., Sajtos P., Törös A., 2018. “Regulatory Tools to Encourage FinTech Innovations: The Innovation Hub and Regulatory Sandbox in International Practice”. *Financial and Economic Review*, Volume 17, Issue 2, pp. 43-67. Available at: <http://english.hitelintezetiszemle.hu/letoltes/fer-17-2-st2-faykiss-papp-sajtos-toros.pdf>

FSB, 2017. “Financial Stability Implications from FinTech. Supervisory and Regulatory Issues that Merit Authorities’ Attention”. 27 June. <http://www.fsb.org/2017/06/financial-stability-implications-from-fintech/>

Fujitsu, 2016. “The Fujitsu European Financial Service Survey 2016. A new pace of change”. Available at: <http://colemanparkes.com/wp-content/uploads/2016/06/Fujitsu-European-Financial-Services-Survey-2016.pdf>

Geyfman V., 2005. “Risk-adjusted Performance Measures at Bank Holding Companies with Section 20 Subsidiaries”. Working Paper No. 05-26, Research Department, Federal Reserve Bank of Philadelphia. Available at: <https://www.philadelphiafed.org/-/media/research-and-data/publications/working-papers/2005/wp05-26.pdf>

Ghosh A., 2001. “Does operating performance really improve following corporate acquisitions?”. *Journal of Corporate Finance*, Volume 7, Issue 2, pp. 151-178. Available at: [https://doi.org/10.1016/S0929-1199\(01\)00018-9](https://doi.org/10.1016/S0929-1199(01)00018-9)

Ghosh S., Nachane D.M., Narain A., Sahoo S., 2003. “Capital Requirements and Bank Behaviour: An Empirical Analysis of Indian Public Sector Banks”. *Journal of International Development*, Volume 15, Issue 2, pp. 145-156. Available at: <https://doi.org/10.1002/jid.947>

Gomber P., Kauffman R.J., Parker C., Weber B.W., 2018. “On the Fintech Revolution: Interpreting the Forces of Innovation, Disruption and Transformation in Financial Services”.

Journal of Management Information Systems, Volume 35, Issue 1, pp. 220-265. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3190052

Gomber P., Koch J.A., Siering M., 2017. “Digital Finance and FinTech: current research and future research directions”. Journal of Business Economics, July 2017, Volume 87, Issue 5, pp 537-580. Available at: <https://link.springer.com/article/10.1007/s11573-017-0852-x>

Guest P.M., Bild M., Runsten M., 2012. “The effect of takeovers on the fundamental value of acquirers”. Accounting and Business Research, Volume 40, Issue 4, pp. 333-352- Available at: <https://doi.org/10.1080/00014788.2010.9663409>

Gugler K., Mueller D.C., Yurtoglu B.B., Zulehner C., 2003. “The effects of mergers: an international comparison”. International Journal of Industrial Organization, Volume 21, Issue 5, pp. 625-653. Available at: [https://doi.org/10.1016/S0167-7187\(02\)00107-8](https://doi.org/10.1016/S0167-7187(02)00107-8)

Gulamhuseinwala I., Bull T., Lewis S., 2015. “FinTech is gaining traction and young, high-income users are the early adopters”. The Journal of Financial Perspectives: FinTech, EY Global Financial Services Institute, Volume 3, Issue 3. Available at: [https://www.ey.com/Publication/vwLUAssets/ey-fintech-is-gaining-traction-and-young-high-income-users-are-the-early-adopters/\\$FILE/ey-fintech-is-gaining-traction-and-young-high-income-users-are-the-early-adopters.pdf](https://www.ey.com/Publication/vwLUAssets/ey-fintech-is-gaining-traction-and-young-high-income-users-are-the-early-adopters/$FILE/ey-fintech-is-gaining-traction-and-young-high-income-users-are-the-early-adopters.pdf)

Haddad C., Hornuf L., 2018. “The emergence of the global fintech market: economic and technological determinants”, Small Business Economics. <https://doi.org/10.1007/s11187-018-9991-x>

Healy P.M., Palepu K.G., Rubak R.S., 1992. “Does Corporate Performance Improve after Mergers?”. Journal of Financial Economics, Volume 31, Issue 2, pp. 135-175. Available at: [https://doi.org/10.1016/0304-405X\(92\)90002-F](https://doi.org/10.1016/0304-405X(92)90002-F)

Henderson B.J., Pearson N.D., 2009. “The Dark Side of Financial Innovation”. Working paper, EFA meetings in Bergen, Norway. Available at: <http://www.efa2009.org/papers/SSRN-id1342654.pdf>

Hess K., Francis G., 2004. “Cost income ratio benchmarking in banking: a case study”. Benchmarking: An International Journey, Volume 11, Issue 3, pp. 303-319. Available at: <https://doi.org/10.1108/14635770410538772>

Hussain S., 2014. “The Assessment of Operational Efficiency of Commercial Banks in India Using Cost to Income Ratio Approach”. International Journal of Management and Business Research, Volume 4, Issue 3, Article 6, pp. 225-234. Available at: http://ijmbr.srbiau.ac.ir/article_2877_bbd3f6a3f516e33bbdae147f85236ace.pdf

Institute of International Finance, 2016. “RegTech in Financial Services: Technology Solutions for Compliance and Reporting”. Available at:

https://www.iif.com/system/files/regtech_in_financial_services_-_solutions_for_compliance_and_reporting.pdf

Jagtiani J., Lemieux C., 2017. “Fintech Lending: Financial Inclusion, Risk Pricing, and Alternative Information”. Research Department, Federal Reserve Bank of Philadelphia. Working Paper No. 17-17. Available at: <https://www.fdic.gov/bank/analytical/cfr/bank-research-conference/annual-17th/papers/14-jagtiani.pdf>

Jenik I., Lauer K., 2017. “Regulatory Sandboxes and Financial Inclusion”. CGAP Working Paper. Available at: <http://www.cgap.org/sites/default/files/researches/documents/Working-Paper-Regulatory-Sandboxes-Oct-2017.pdf>

Juengerkes B.E., 2016. “FinTechs and Banks - Collaboration is Key”. In: Christi S., Barberis J., editors, 2016. “The FinTech Book. The Financial Technology Handbook for Investors, Entrepreneurs and Visionaries”. West Sussex: John Wiley & Sons Ltd, pp. 179-182.

Kaya O., 2017. “Robo-advice. A true innovation in asset management”. Deutsche Bank AG. Available at: https://www.dbresearch.com/PROD/RPS_EN-PROD/PROD0000000000449125/Robo-advice_%E2%80%93_a_true_innovation_in_asset_management.pdf

Kerenyi A., Molnar J., 2017. “The Impact of the Fintech Phenomenon –Radical Change Occurs in the Financial Sector?”. Financial and Economic Review, Vol. 16 Issue 3., September 2017, pp. 32–50. Available at: <http://english.hitelintezetiszemle.hu/letoltes/adam-kerenyi-julia-molnar.pdf>

Kimball R.C., 1998. “Economic Profit and Performance Measurement in Banking”. New England Economic Review. Available at: <https://pdfs.semanticscholar.org/53e3/2194364307fd205b007067b0d41c8390a38c.pdf>

King D.R., Slotegraaf R.J., Kesner I., 2008. “Performance Implications of Firm Resource Interactions in the Acquisition of R&D-Intensive Firms”. Organization Science, Volume 19, Issue 2, pp. 327-340. Available at: https://kelley.iu.edu/Faculty/Marketing/rsloTEGR/publications/OS_King_Kesner_08.pdf

Klus M.F., Lohwasser T.S., Holotiuk F., Moormann J., 2018. “Strategic Alliances between Banks and Fintechs for Digital Innovation. Motives to Collaborate and Types of Interaction”. Discussion Paper of the Institute for Organisational Economics, University of Münster. Available at: <https://www.econstor.eu/bitstream/10419/180372/1/1025708199.pdf>

Klus M.F., Lohwasser T.S., Hornuf L., Schwienbacher A., 2018. “How Do Banks Interact with Fintechs? Forms of Strategic Alliance and Their Economic Impact”. CESifo Working Paper Series, No. 7170. Available at: http://www.cesifo-group.de/DocDL/cesifo1_wp7170.pdf

- KPMG, 2018. “The Pulse of FinTech 2018. Biannual global analysis of investment in fintech”. Available at: <https://assets.kpmg/content/dam/kpmg/xx/pdf/2018/07/h1-2018-pulse-of-fintech.pdf>
- KPMG, 2017. “Unleashing the potential of Fintech in banking”. Available at: [https://www.ey.com/Publication/vwLUAssets/ey-unleashing-the-potential-of-fin-tech-in-banking/\\$File/ey-unleashing-the-potential-of-fin-tech-in-banking.pdf](https://www.ey.com/Publication/vwLUAssets/ey-unleashing-the-potential-of-fin-tech-in-banking/$File/ey-unleashing-the-potential-of-fin-tech-in-banking.pdf)
- Kumar R., 2009. “Post-merger corporate performance: an Indian perspective”. Management Research News, Volume 32, Issue 2, pp.145-157. Available at: <https://doi.org/10.1108/01409170910>
- Landau J.P., 2009. “Procyclicality – what it means and what could be done”. In: Bank of Spain, 2009. “Procyclicality and the Role of Financial Regulation”, Madrid, 4/5/2009. Available at: <https://www.bis.org/review/r090805d.pdf>
- Lee I., Shin Y.J., 2017. “Fintech: Ecosystem, business models, investment decisions and challenges”. Business Horizons, Volume 61, Issue 1, pp. 35-46. Available at: <https://www.sciencedirect.com/science/article/pii/S0007681317301246>
- Lee S., 2015. “Fintech and Korea’s Financial Investment Industry”. KCMI – Capital Market Opinion. Available at: <https://www.kdevelopedia.org/resource/view/05201501210136352.do#.W-qfjdVKjIU>
- Lenz R., 2016. “Peer-to-peer Lending – Opportunities and Risks”. European Journal of Risk and Regulation, Volume 7, No. 4. Available at: <https://ssrn.com/abstract=2912164>
- Odinet C.K., 2017. “Consumer Bitcredit and Fintech Lending”. Alabama Law Review, Volume 69, Issue 781. Available at: <https://www.law.ua.edu/lawreview/files/2018/05/2-Odinet-781-858-1.pdf>
- Makri M., Hitt M.A., Jane P.J., 2012. “Complementary Technologies, Knowledge Relatedness, and Invention Outcomes in High Technology Mergers and Acquisitions”. Strategic Management Journal, Volume 31, pp. 602-628. Available at: <https://pdfs.semanticscholar.org/7f1c/ec7833336e699a4c6ed7cf6c2cc40d5c7960.pdf>
- Manson S., Powell R., Stark A.W., Thomas H.M., 2000. “Identifying the sources of gains from takeovers”. Accounting Forum, Volume 24, Issue 4, pp.319-343. Available at: <http://www.docs.fce.unsw.edu.au/banking/staff/profiles/rpowell/Papers/Paper6.pdf>
- Mantravadi P., Reddy A.V., 2008. “Post-Merger Performance of Acquiring Firms from Different Industries in India”. International Research Journal of Finance and Economics, Issue 22. Available at: <https://ssrn.com/abstract=1317757>
- McKinsey & Co., 2016. “FinTechnicolor: The New Picture in Finance”. Available at: <https://www.mckinsey.com/~media/mckinsey/industries/financial%20services/our%20insigh>

[ts/bracing%20for%20seven%20critical%20changes%20as%20fintech%20matures/fintechnic
lor-the-new-picture-in-finance.ashx](https://www.mckinsey.com/industries/financial-services/our-insights/how-the-payments-industry-is-being-disrupted)

McKinsey & Co., 2015. “Global Payments 2015: A Healthy Industry Confronts Disruption”. Available at: <https://www.mckinsey.com/industries/financial-services/our-insights/how-the-payments-industry-is-being-disrupted>

McNamara C.M., Bennett R., Metrick A., 2014. “Basel III F: Callable Commercial Paper”. Yale Program on Financial Stability, Case Study 2014-1F-V1. Available at: <https://dx.doi.org/10.2139/ssrn.2576923>

Merler S., 2017. “Fintech in Europe: challenges and opportunities”. In: Veugelers R., editor, 2017. “Remaking Europe: the new manufacturing as an engine for growth”. Bruegel Blueprint Series, Bruxelles, Volume 26, pp.198-217. Available at: http://aei.pitt.edu/90426/1/Remaking_Europe_blueprint.pdf#page=198

Mills D., Wang K., Malone B., Ravi A., Marquardt J., Chen C., Badev A., Brezinski T., Fahy L., Liao K., Kargenian V., Ellithorpe M., Ng W., Baird M., 2016. “Distributed ledger technology in payments, clearing and settlement”. Finance and Economics Discussions Series 2016-095. Washington: Board of Governors of the Federal Reserve System. Available at: <http://doi.org/10.17016/FEDS.2016.095>

Milne A., Parboteeah P., 2016. “The Business Models and Economics of Peer-to-Peer Lending”. European Credit Research Institute, Research Report, Volume 17. Available at: <https://www.ceps.eu/system/files/ECRI%20RR17%20P2P%20Lending.pdf>

Mollick E., 2013. “The dynamics of crowdfunding: An exploratory study”. Journal of Business Venturing, Volume 29, 2014, pp. 1-16. Available at: <https://doi.org/10.1016/j.jbusvent.2013.06.005>

Morse A., 2015. “Peer-to-Peer Crowdfunding: Information and the Potential Disruption in Consumer Lending”. Annual Review of Financial Economics, Volume 7, pp. 463-482. Available at: <https://www.annualreviews.org/doi/pdf/10.1146/annurev-financial-111914-041939>

Mueller D.C, 1980. “The determinants and effects of mergers: An international comparison”. 1st edition.

Nakaso H., 2016. “FinTech – Its Impacts on Finance, Economics and Central Banking”. In: Bank of Japan Joint Conference. “FinTech and the Future of Money”. Tokyo, 18/11/2016. Available at: https://www.boj.or.jp/en/announcements/press/koen_2016/data/ko161118a.pdf

Nicoletti B., 2017. “The Future of Fintech. Integrating Finance and Technology in Financial Services”. 1st ed. (s.l.): Palgrave Macmillan.

- Onnée S., Renault S., 2016. "Crowdfunding: principles, trends and issues". In: Ollejos F.X., Zhegu M., (eds.), 2016. "Research Handbook on Digital Transformations", Chapter 15.
- Osborne J., 1995. "A Case of Mistaken Identity: The Use of Expense/Revenue Ratio to Measure Bank Efficiency". *Journal of Applied Corporate Finance*, Volume 8, Issue 2, pp. 55-59. Available at: <https://doi.org/10.1111/j.1745-6622.1995.tb00287.x>
- Ooghe H., De Langhe T., Van Laere E., 2006. "Are Acquisitions Worthwhile? An Empirical Study of the Post-Acquisition Performance of Privately Held Belgian Companies". *Small Business Economics*, Volume 27, Issue 2, pp. 223-243. Available at: <https://doi:10.1007/s11187-006-0011-1>
- Ozaee A., Sohrabi S., 2017. "The role of financial technology and their effect on banking". *IUSH, QUID* 2017, Issue 1, pp.1819-1826. Available at: <https://dialnet.unirioja.es/servlet/articulo?codigo=6223079>
- Panetta F., 2018. "Fintech and banking: today and tomorrow". Harvard Law School Bicentennial, Annual Reunion of Harvard Law School Association of Europe. Available at: <https://www.bancaditalia.it/pubblicazioni/interventi-direttorio/int-dir-2018/panetta-120518.pdf>
- Philippatos G.C., Baird P.L. III, 1996. "Postmerger performance, managerial superiority and the market for corporate control". *Managerial and Decision Economics*, Volume 17, Issue 1, pp.45-55. Available at: <https://www.jstor.org/stable/i342633>
- Philippon T., 2017. "The FinTech Opportunity", BIS Working Papers, Monetary and Economic Department, No. 655, August. Available at: <https://www.bis.org/publ/work655.pdf>.
- Pinna A., Ruttenberg W., 2016. "Distributed ledger technologies in securities post-trading". European Central Bank. Occasional Paper Series No.172. Available at: <https://www.ecb.europa.eu/pub/pdf/scpops/ecbop172.en.pdf>.
- Powell R.G., Stark A.W., 2005. "Does operating performance increase post-takeover for UK takeovers? A comparison of performance measures and benchmarks". *Journal of Corporate Finance*, Volume 11, pp. 293-317. Available at: <https://doi:10.1016/j.jcorpfin.2003.06.001>
- Rahman R.A., Limmack R.J., 2004. "Corporate Acquisitions and the Operating Performance of Malaysian Companies". *Journal of Business Finance & Accounting*, Volume 31, Issue 3 & 4. Available at: <https://doi.org/10.1111/j.0306-686X.2004.00543.x>
- Ramakrishnan R., 2008. "Long-term Post-merger Performance of Firms in India". *Vikalpa: The Journal for Decision Makers*, Volume 33, Issue 2. Available at: <http://www.vikalpa.com/pdf/articles/2008/V33204-047to063.pdf>

Ramaswamy K.P., Waegelein J.F., 2003. "Firm Financial Performance Following Mergers". *Review of Quantitative Finance and Accounting*, Volume 20, Issue 2, pp. 115-126. Available at: <https://doi.org/10.1023/A:1023089924640>

Rani N., Yadav S.S., Jain P.K., 2013. "Post-M&A Operating Performance of Indian Acquiring Firms: A Du Pont Analysis". *International Journal of Economics and Finance*, Volume 5, Issue 8. Available at: <http://dx.doi.org/10.5539/ijef.v5n8p65>

Ravenscraft D.J., Scherer F.M., 1989. "The profitability of mergers". *International Journal of Industrial Organization*, Volume 7, Issue 1, pp. 101-116. Available at: [https://doi.org/10.1016/0167-7187\(89\)90048-9](https://doi.org/10.1016/0167-7187(89)90048-9)

Sahay R., Čihák M., N'Diaye P., Barajas A., Mitra S., Kyobe A., Mooi Y.N., Yousefi S.R., 2015. "Financial Inclusion: Can It Meet Multiple Macroeconomic Goals?" IMF Staff Discussion Note 15/17. Available at: <https://www.imf.org/external/pubs/ft/sdn/2015/sdn1517.pdf>

Schindler J.W., 2017. "FinTech and Financial Innovation: Drivers and Depth," *Finance and Economics Discussion Series 2017-081*. Washington: Board of Governors of the Federal Reserve System, <https://doi.org/10.17016/FEDS.2017.081>

Schwab F., Guibaud S., 2016. "The Rise of BankTech- The Beauty of a Hybrid Model". In: Christi S., Barberis J., (eds.), 2017. "The FinTech Book: The Financial Technology Handbook for Investor, Entrepreneurs and Visionaries". West Sussex: John Wiley & Sons Ltd, pp. 245-247.

Sharma D., Hao J., 2002. "The Impact of Acquisitions on Operating Performance: Some Australian Evidence". *Journal of Business Finance & Accounting*, Volume 29, Issues 1&2., pp.155-200. Available at: <https://ssrn.com/abstract=299472>

Singh K.B., 2013. "The impact of Mergers and Acquisitions on Corporate Financial Performance in India". *Indian Journal of Research in Management, Business and Social Sciences*, Volume 1, Issue 2. Available at: <http://ijrmbss.com/assets/pdf/Vol1Iss2/3.pdf>

Spinassou K., 20113. "Basel III Capital Requirements and Regulatory Power: The Impact on Bank Risk-Taking and Credit Supply". SSRN Working Paper, No.2307721, 1–27. <https://doi.org/10.2139/ssrn.2307721>

Spong K., Sullivan R.J., De Young R., 1995. "What makes a bank efficient? A look at financial characteristics and bank management and ownership structure". Federal Reserve Bank of Kansas City. Available at: <https://www.kansascityfed.org/LQeMS/kMhVd/PUBLICAT/FIP/prs95-1.pdf>

- Switzer J.A., 1996. "Evidence on real gains in corporate acquisitions". *Journal of Economics and Business*, Volume 48, Issue 5, pp. 443-460. Available at: [https://doi.org/10.1016/S0148-6195\(96\)00033-1](https://doi.org/10.1016/S0148-6195(96)00033-1)
- Uhlenbruck K., Hitt M.A., Semadeni M., 2006. "Market Value Effects of Acquisitions Involving Internet Firms: A Resource-Based Analysis". *Strategic Management Journal*, Volume 27, Issue 10, pp. 899-913. Available at: <https://www.jstor.org/stable/20142386>
- Wang D., Moini H., 2012.
- Vallee B., Zeng Y., 2018. "Marketplace Lending: A New Banking Paradigm". Working Paper 18-067, Harvard Business School. Available at: https://www.hbs.edu/faculty/Publication%20Files/18-067_1d1e7469-3a75-46a0-9520-bddbfa0b2b9.pdf
- Varga D., 2017. "Fintech, the new era of financial services". *Vezetéstudomány / Budapest Management Review*, 48 (11). pp. 22-32. Available at: http://unipub.lib.uni-corvinus.hu/3170/1/VT_2017n11p22.pdf
- Vives X., 2017. "The Impact of Fintech on Banking". In: Barba Navaretti G., Calzolari G., Pozzolo A.F. (eds.), 2017. "Fintech and Banking. Friends or Foes?". *European Economy – Banks, Regulation, and the Real Sector*, Year 3, Issue 2. Available at: https://blog.iese.edu/xvives/files/2018/02/EE_2.2017.pdf
- Wilkins C., 2016. "Fintech and the Financial Ecosystem: Evolution or Revolution?". Remarks by Carolyn Wilkins, Senior Deputy of the Bank of Canada, June 2016. Available at: <https://www.bankofcanada.ca/wp-content/uploads/2016/06/remarks-170616.pdf>
- Wilson K.E., Testoni M., 2014. "Improving the role of equity crowdfunding in Europe's capital markets". *Bruegel Policy Contribution*, No.2014/09, Bruegel, Brussels. Available at: <https://www.econstor.eu/bitstream/10419/106307/1/796323003.pdf>
- World Economic Forum (WEF), 2015. "The Future of Financial Services. How disruptive innovations are reshaping the way financial services are structured, provisioned and consumed". *Final Report*. Available at: http://www3.weforum.org/docs/WEF_The_future_of_financial_services.pdf
- Zaik E., Walter J., Kelling G., 1996. "RAROC at Bank of America: From Theory to Practice". *Journal of Applied Corporate Finance*, Volume 9, Issue 2, pp. 83-93. Available at: <https://doi.org/10.1111/j.1745-6622.1996.tb00117.x>
- Zilgalvis P., 2014. "The Need for an Innovation Principle in Regulatory Impact Assessment: The Case of Finance and Innovation in Europe". *Policy & Internet*, Volume 6, Issue 4, pp. 377-392. Available at: <https://doi.org/10.1002/1944-2866.POI374>