

Trabajo Fin de Grado

What is the impact of Fintech on the banking system?

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Que este Trabajo Fin de Grado que presento para su evaluación y defensa es original, y que todas las fuentes utilizadas para su realización han sido debidamente citadas en el mismo.

Málaga, a 6 de junio de 2019

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SPANISH TITLE

¿Cuál es el impacto del sector Fintech en el sistema bancario?

ABSTRACT

Since the outbreak of the banking crisis in 2008, the irruption of Fintech companies as potential competitors of traditional banking is signifying a revolution within the financial sector. For this reason, analysing their impact on the economy is one of the trends in this recent field of research. However, due to the lack of access to data from these companies, most of the articles are theoretical. In this sense, the main contribution of this work is to provide an empirical analysis which measures the impact generated by the Fintech sector in Europe, thanks to an extensive database extracted manually, comprising more than 2000 companies and funding rounds from 38 countries. To this end, a descriptive analysis of the European sector has been carried out, where the United Kingdom is clearly positioned as the leader, especially from 2015 onwards. Finally, an econometric analysis has also performed, including the top six countries with the highest number of fintechs, showing that the Fintech sector has a positive impact on the efficiency and competition of the banking system while increasing the instability of it.

KEY WORDS

Fintech, Europe, efficiency, competition, stability.

RESUMEN

Desde el estallido de la crisis bancaria en 2008, la irrupción de las empresas Fintech como competencia potencial de la banca tradicional está suponiendo una revolución dentro del sector financiero. Por este motivo, analizar cuál es su impacto dentro de la economía está siendo una de las tendencias dentro de este reciente campo de investigación. No obstante, debido a la falta de acceso a datos, la mayoría de los artículos realizados son a nivel teórico. En este sentido, la principal contribución de este trabajo es aportar un análisis empírico donde se mida el impacto generado por el sector Fintech en Europa, gracias a una extensa base de datos extraída manualmente, que comprende más de 2000 empresas y rondas de financiación de 38 países. Para ello, se ha realizado un análisis descriptivo del sector europeo, donde Reino Unido se posiciona claramente como líder, sobre todo a partir de 2015. Por último, también se ha realizado un análisis econométrico, incluyendo los 6 países con mayor número de empresas fintech, donde se demuestra que el sector Fintech tiene un impacto positivo sobre la eficiencia y sobre la competencia del sistema bancario, a la vez que aumenta su inestabilidad.

PALABRAS CLAVE

Fintech, Europa, eficiencia, competencia, estabilidad.

1. INTRODUCTION

After the 2008 economic crisis, the world-wide accepted image of stability and solvency of the European banking industry was severely harmed. Consequently, a long process of changes and transformations was undertaken in the European Union policymakers, regulators, and bankers in order to safeguard the stability of the system. Low-interest rates and expansionary monetary policies, lower profitability, a large amount of merger and acquisitions and higher capital and liquidity requirements set by the Basel III accord, where some of the measures carried out in order to guarantee the solvency of each national banking system. Nevertheless, they were not sufficient to stop the bleeding caused by the high macroeconomic uncertainty and, finally, traditional banking ended up failing to regain all the confidence lost by European consumers.

It is in this context, accompanied by the emergence of new technologies (e.g., Big Data, Artificial Intelligence or Blockchain) on the global scene, where we find the advent of the Fintech movement, a new wave of “financial technology” start-ups that have mushroomed since 2008, offering original and transparent services at a lower cost and with easy-to-use mobile platforms (Chishti & Barberis, 2016). Two main characteristics define their functioning. First, they are specialised in those segments of the financial value chain which require higher technology usage and second, they are assuming the role of non-regulated banks, as their business models are outside the scope of the regulatory constraints established in the Basel III accord.

As a result, the banking sector is configured as a game board in which three different players are tackling for the same market niche: Traditional banking (regulated banks), Fintech startups (non-regulated banks), and Big Tech companies. This last player, also named by the acronym GAFAM-BAT (MEDICI, 2018), refers to eight of the largest global technology firms (Google, Apple, Facebook, Amazon, Microsoft, Baidu, Alibaba, and Tencent), which are indirectly providing financial services to their clients and that are supposed to gain more and more relative importance during the following years. (de la Mano & Padilla, 2019; Frost, Gambacorta, Huang, Shin, & Zbinden, 2019; Zetzsche, Buckley, Arner, & Barberis, 2017a).

In this scenario, the analysis of the consumer’s behaviour and preferences has turned into an issue of enormous relevance for the financial industry nowadays, particularly because of the irruption of the millennial generation on stage. This generation, considered as the first digital natives of history, has normalised the use of smartphones or any digital gadget for day-by-day tasks, including the access to online banking services, which leaves us an unprecedented and more sophisticated banking reality.

Turning our attention to the existing literature about Fintech, it can be broadly divided into three different strands of literature regarding the methodology used: a first strand that attends to explain descriptively the concept of Fintech, its classification and the main opportunities and threats they will be facing in the future. The second one, mainly composed by those papers which argue that as a consequence of the different treatment regulated and non-regulated entities are receiving, alternative regulatory and anti-trust policies should be considered in order to preserve a level playing field. Finally, the third strand, much more undeveloped than the previous two, that seeks to measure the quantitative impact of Fintech in a concrete sector of the economy.

This lack of empirical investigation can be explained due to the difficulties found by researchers to measure the scope of action of Fintech business models and, above all, because of the limited access to quantitative data. As many Fintech companies are still not supervised by any national or supranational financial institutions, the primary sources of information relied on private consulting platforms, such as CB Insights or Crunchbase.

The goal of this thesis is to contribute to the scarce empirical literature on Fintech and to develop an in-depth overview of the FinTech sector in Europe. The first step for addressing such goal will be to collect a comprehensive database of the FinTech sector in Europe and to develop a descriptive analysis of the sector in Europe. Additionally, the aim is to empirically test the impact that the Fintech sector has on the banking industry in terms of competence and stability.

The present research contains a literature review of the Fintech in Section 2, while Section 3 presents the dataset sources. Section 4 includes the descriptive analysis. Section 5 presents the hypothesis and the econometric analysis and Section 6 concludes.

2. LITERATURE REVIEW

Fintech is a concept that, although for most of the population and media seems to be recent, began to be used in the literature almost 50 years ago. Bettinger (1972), through a short publication, was the first to introduce the term, aiming to develop some models in order to solve day-to-day financial problems faced by the bank Manufacturers Hanover. Nevertheless, we could even look further back in time to find the first financial services that have incorporated any sort of technology on it. Arner et al. (2016) identified three different stages regarding the relationship between Finance and Technology (Fintech 1.0, starting at 1866 and ending in 1967; Fintech 2.0, from 1967 to 2008; and Fintech 3.0, from 2008 until today), and concluded that it is not digital finance what is new, but the increase in the innovation speed what defines the current success of financial technology.

Moving on to the 21st century, we find a higher consensus about when the modern Fintech movement has begun. Chishti & Barberis (2016) point out that its born and boom started during the 2007 financial crisis, after the considerable drop in confidence on banks. Since then, a plethora of startups have emerged and started to develop mobile apps, software, and algorithmic systems to provide a revolutionary and more satisfying banking experience to consumers.

After the above summary regarding the Fintech's time horizon, we will turn our attention to the first strand of literature we mentioned in the introduction, which covers all those theoretical papers which attempted to define, using a clear-cut language, the concept and typology of services Fintech includes. Despite that the growth of Fintech start-ups is located one decade ago, authors have not arrived at a consensus yet about the meaning of Fintech. Zavolokina, Dolata, & Schwabe (2016) were one of the first authors to more systematically delving into the FinTech industry. Indeed, the researchers assimilate FinTech as a living organism with a flexible and fluctuating nature, rather than a stable idea that is transparent and clearly understood by academia and the media. Besides that, other authors provide a more straightforward definition of the concept. Herein, Schueffel (2016), after applying semantic analysis to more than 200 articles related to the topic, states that FinTech is a new financial industry which applies technology in order to improve financial activities. In contrast, Bernal Alonso & Santacruz Cano (2016) defines it as a mere disintegration of banking services, as each FinTech company usually focus and specialise on one single banking segment.

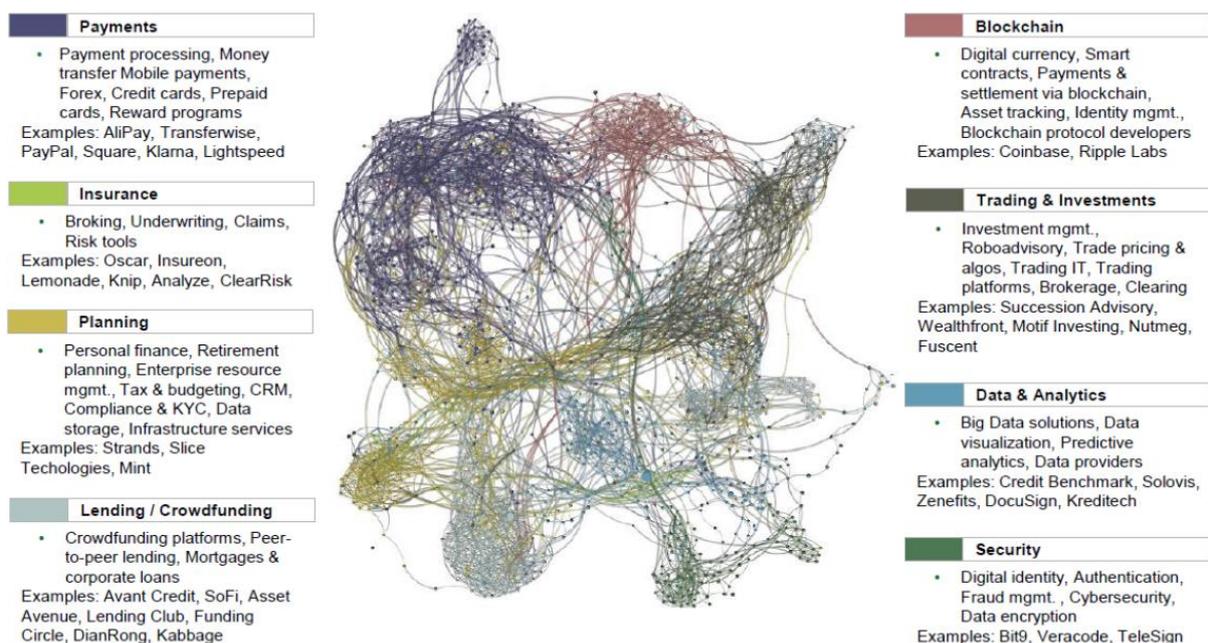
However, one of the most used definition is promulgated by the Financial Stability Board and recognized by the European Banking Authority, which contemplate FinTech as technologically enabled innovation in financial services that could result

in new business models, applications, processes or products with an associated material effect on financial markets and institutions and the provision on financial services. (Bank For International Settlements (BIS), 2018; Buchak, Matvos, Piskorski, & Seru, 2018; Carney, 2017; Committee on the Global Financial System (CGFS) & Financial Stability Board (FSB), 2017; European Banking Authority, 2018; Navaretti, Calzolari, Mansilla-Fernandez, & Pozzolo, 2018; Schindler, 2017).

In addition to the literal definition of the word, many of those authors have also provided an arrangement of the main verticals (or activities) that must be contained within the typology of Fintech's business models. In this respect, it is worth to mention the classification proposed by the Spanish Fintech and Insurtech Association (AEFI) in the White Book on Fintech Regulation in Spain, in which up to twelve different verticals are specified: Robo-advisors & management, personal finance, alternative financing, crowdfunding & crowdlending, currency & transactional services, payments, financial infrastructure, cryptocurrencies & blockchain, InsurTech, online identification of clients, neobanks & challenger banks, and marketplaces & aggregators. (AEFI, 2017)

Nonetheless, for descriptive purposes, it is common to unify all the verticals into a shorter classification, by merging the ones with similar features. In this regard, it is relevant the classification recognised by the International Organization of Securities Commissions, in which the Fintech landscape is mapped across eight different categories: payments, insurance, financial planning, lending & crowdfunding, blockchain, trading & investments, data & analytics, and cybersecurity. (Figure 2.1)

Figure 2.1. Global FinTech landscape



Source: IOSCO (2017).

A last stage of the first strand of the literature comprises all those articles and consulting reports that comprehend an explanation of the key aspects determining the success of Fintech startups (Anagnostopoulos, 2018; Claessens, Frost, Turner, & Zhu, 2018; Frost et al., 2019; Navaretti et al., 2018; Schindler, 2017) and a descriptive breakdown of the leading current opportunities and threats, as well as expected future trends and forecasts the FinTech sector is facing (Capgemini, LinkedIn, & Efma, 2018; CB Insights, 2019; EY, 2017; Finnovating, 2018; KPMG, 2019; MEDICI, 2018; PWC, 2017; World Economic Forum, 2017).

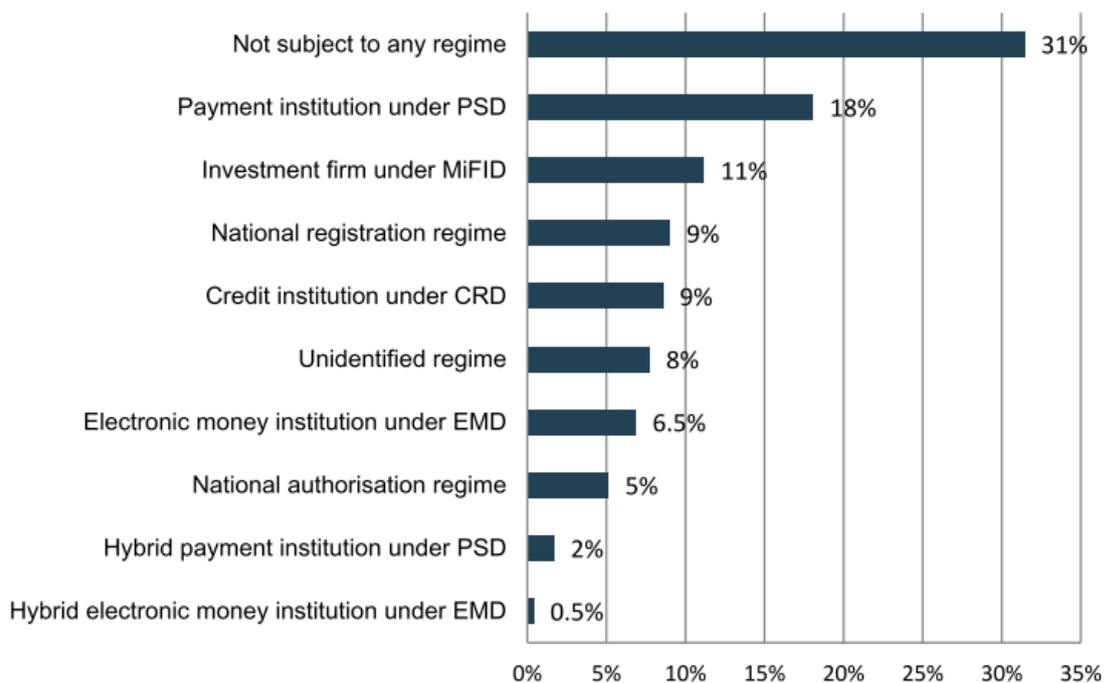
In this vein, Anagnostopoulos (2018) claims that the factors and trending enablers of change for which FinTech is reshaping the banking industry status quo are: Mutating demographics and high internet and mobile penetration, shifting expectations towards a customer-centric business model, healthier cost-efficacy indicators of FinTech startups, niche concentration, cybersecurity, changes in banking and financial compliance between 2008 and 2013, diversification and funds disintermediation and, regulation as a source of disruption.

From another standpoint, in Financial Stability Board (2019), the researchers distinguish between supply and demand to describe the drivers that are swaying the financial market structure. Within the factors contained in the supply side, they encompass the usage of application programming interfaces (APIs), shifts in consumer behaviour driven by smartphones and technological developments like cloud computing or distributed ledger technology (DLT). In terms of financial regulation, licensing requirements and competition aspects in regulation such as the Payment Services Directive (PSD2) are the leading aspects. On the demand side, the principal components are the veering consumer preferences and unmet customer demand.

Concerning the second strand of the literature, there is an extensive list of articles examining the role of national governments and supranational institutions, evaluating if the best solution for consumers' welfare is cooperation or competition between Fintech startups and incumbent banks, and suggesting which should be the best policy measures to apply. For instance, Philippon (2016) makes an analysis of the financial services regulation based on the dichotomy between a top-down regulation of traditional banks and a bottom-up regulation of new disruptors, and argues that within the current politically-influenced regulatory status, there are still many large financial firms enjoying too-big-to-fail subsidies and oligopolistic rents, which impede the accomplishment of a significant structural change. Therefore, an alternative approach to financial regulation should be implemented, seeking to contain incumbents and thwarting future regulatory arbitrage, without enforcing a top-down structural revolution.

The focal justifications of this kind of articles came from the concern of many policy-makers, regulators and economists about the actual health of the banking industry (Vives, 2016) and, more concretely, because of the unequal regulatory status FinTech companies face versus incumbent banks. A prove of this fact is shown in Figure 2.2, exposing that in the European Union, almost one-third of Fintech companies were not subject to any regime, which may lead to regulatory arbitrage or uncovered consumer protection risks (EBA, 2017).

Figure 2.2. Breakdown of Fintech firms by regulatory status, 2017



Source: European Banking Authority (2017).

To prevent from the dissimilar regulatory regime, the collaboration between financial institutions and regulators, traditional banks, FinTech’s startups, and national governments is crucial. In this matter, in addition to the creation of innovation hubs and accelerators (BIS, 2018; CGFS & FSB, 2017), one of the most demanded supervisory approach has been the establishment of regulatory sandboxes (Gerlach & Rugilo, 2018; González-Páramo, 2017; Navaretti et al., 2018), which are open frameworks where companies can test their new products and services with very concrete customers, for a certain period, with a temporal authorization and in a controlled environment under the regulators supervision (Jenik & Lauer, 2017).

The first two real regulatory sandboxes that have been implemented were “Project Catalyst” in 2012 by the US’ Consumer Financial Protection Bureau (CFPB, 2016) and “Regulatory sandbox” in 2015 by the UK’s Financial Conduct Authority (FCA,

2015). Nevertheless, other authors advocate going beyond that by applying a smarter regulation such as RegTech, which allows not only massive cost savings but also brings the opportunity for regulators to take decisions almost in real time. (Buckley, Arner, Zetsche, & Weber, 2019; Zetsche, Buckley, Arner, & Barberis, 2017b)

In terms of Spain, as we remarked before, in 2017 was published the White Book on Fintech Regulation in Spain, an initiative to put in place a set of ideas and proposals for regulatory changes favoring the entrepreneurial activity of FinTech operators to improve the competitiveness of the financial industry (banking, investment services and insurance) in the interests of consumers (AEFI, 2017). In 2018, the Ministry of Economics and Business proposed the implementation of a Regulatory sandbox by law (Ministerio de Economía y Empresa, 2018), which will involve the participation of the Bank of Spain, the National Securities Market Commission, and AEFI.

Finally, considering the European Union as a whole, in 2018 the European Commission released a 23 steps Action Plan to foster a more competitive and innovative European financial sector, comprising 3 upper pillars: spurring innovative business models across Europe, boosting technological innovation in financial services and, improving security and integrity in the financial sector (European Commission, 2018).

To conclude, we outline a third strand of the literature, with much more room for progress concerning future literature, mainly composed by those empirical papers that have strained to measure the quantitative effect of one FinTech vertical in a particular financial market niche, such as mortgage lending (Buchak et al., 2018; Fuster, Plosser, Schnabl, & Vickery, 2018), crowdfunding (Cole, Cumming, & Taylor, 2019), peer-to-peer lending (de Roure, Pelizzon, & Thakor, 2018; Tang, 2019) or retail banking (Li, Spigt, & Swinkels, 2017). In this regard, as most of the studies have been carried out in the US, it opens the gate for future lines of investigation regarding different FinTech markets, such as the European Union, and its effect on the banking system. For instance, it is noteworthy to highlight the contribution of Buchak et al. (2018), in whose work analyse the impact and relationship between FinTech & shadow banks growth with the evolution of the mortgage lending sector in the US, using the data provided from the Home Mortgage Disclosure Act (HDMA). On top of that, we can also find other authors who have built up theoretical models attempting to explain and forecast the coexistence between traditional and shadow banks and to provide policy recommendations for regulators and supervisors (Chretien & Lyonnet, 2019; Martinez-Miera & Repullo, 2017).

3. DATA

In order to get access to data regarding FinTech's startups all along Europe, we have relied on the information available in Crunchbase, a digital "DaaS" platform which recollects business information about all type of companies, from small startups to the most prominent public multinationals. Indeed, their data comes from four types of sources: a venture program network, an active community of contributors, machine learning scripts that track down the top news online publications, and an in-house data team of experts (Crunchbase, 2019). Thus, our analysis will depend on a high degree on the number of FinTech's firms and funding rounds that have been captured in the CrunchBase database.

To retrieve the sample, we have worked with two different Crunchbase databases, one standing for companies (static approach) and the other for companies' founding rounds (dynamic approach). Then, we have applied three different filters: A category filter comprising companies which have been defined as "Fintech"; a geographical filter containing firms located in the European continent; and last one including those that were founded after 1993 (temporal filter). We have chosen this date because in that year the World Wide Web was publicly released by the European Organization for Nuclear Research (CERN, 1993), being it a reasonable proxy for dealing only with those FinTechs that are immersed nowadays in the Digital Revolution.

Furthermore, Crunchbase let us compiling those variables that interest us most in order to carry out the descriptive empirical analysis. Table 3.1 displays a summary of all the variables selected among the two datasets. For the variables "funding" and "money", we need to first convert all the values from their local currency to euros, which is the one we have selected for comparisons. To do that, we have included the approximate exchange rate for 13 different currencies to the euro, subtracted from XE.com platform.

Finally, with all of the above information, we were able to manually construct two different datasets, containing up to 2161 companies in the first one and 2679 funding rounds in the second, from a total of 42 different countries. For the variable "funding" and "fundingEUR", the total number of firms for which we have available information is reduced to 882 and 923, respectively for each dataset.

Table 3.1. Description of variables

VARIABLES	EXPLANATION
name	Name of the organization
location	Where the organization is headquartered (City, region, and country)
country	Country of the organization (up to 38 different countries in Europe)
category	Descriptive keywords for an Organization.
status	Operating status of an organization (Active or closed)
fdate	The date the Organization was founded.
closedate	The date when the organization is closed
rounds	Total number of funding rounds
roundate	The date that the Funding Round was publicly announced
money	Amount of money raised in Funding Round (on different currencies).
moneyEUR	Amount of money raised in euros.
fstatus	Organization's most recent funding status (<i>Early Stage Venture, IPO, Late Stage Venture, M&A, Private Equity, or Seed</i>).
funding	Total funding amount raised across all funding rounds (on different currencies)
fundingEUR	Total funding amount (in euros)
founders	Total number of founders
employees	Intervals of the total number of employees in categorical variables: "0" = N/A ; "1" = 1-10 ; "2" = 11-50 ; "3" = 51-100 ; "4" = 101-250 ; "5" = 251-500 ; "6" = 501-1000 ; "7" = 1001-5000 ; "8" = 5001-10000 ; "9" = 10000+

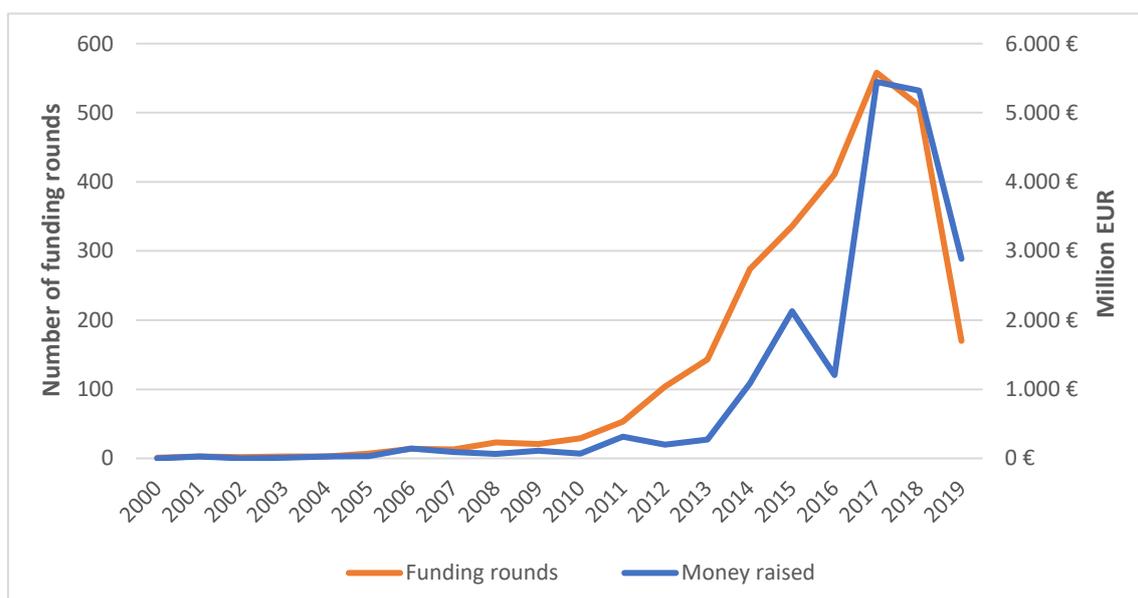
IPOstatus	The current public status of the Organization (<i>Public, Private or Delisted</i>)
articles	Number of news articles that reference the organization.
apps	Total number of apps a given publisher has consolidated between iTunes and Google Play.
downloads	Total downloads for the previous month (last 30 days) for all apps published by the company. (from Apptopia)
month_visits	Total (non-unique) visits to the website for the last month. Includes both desktop and mobile web. (from Apptopia)
average_visits	Average of monthly visits over the past six months. (from SimilarWeb)
traffic_rank	Traffic rank of site, as compared to all other sites on the web. (from SimilarWeb)
rate	The approximate rate at which a non-EUR currency will be exchanged for EUR. (<i>At 01/06/2019</i>).
currency	The 13 different currency codes that are exchanged for EUR. (<i>AUD, CAD, CHF, DKK, GBP, NOK, PLN, RUB, SEK, SGD, SKK, TRY, USD</i>).

Source: Author elaboration with information from Crunchbase and XE.

4. DESCRIPTIVE ANALYSIS

We will start the descriptive analysis by examining the evolution experimented by the European FinTech sector from 2000 to 2019. Although some companies have been founded before the year 2000, we do not have available information for the funding rounds until then. Figure 4.1 presents the evolution of the number of funding rounds and their investment volume year by year. Notice that, as we have data only until the mid of 2019, it is reasonable to expect that their values are approximately half smaller than in 2018.

Figure 4.1 Evolution of founded FinTech companies, number of funding rounds and their volume.

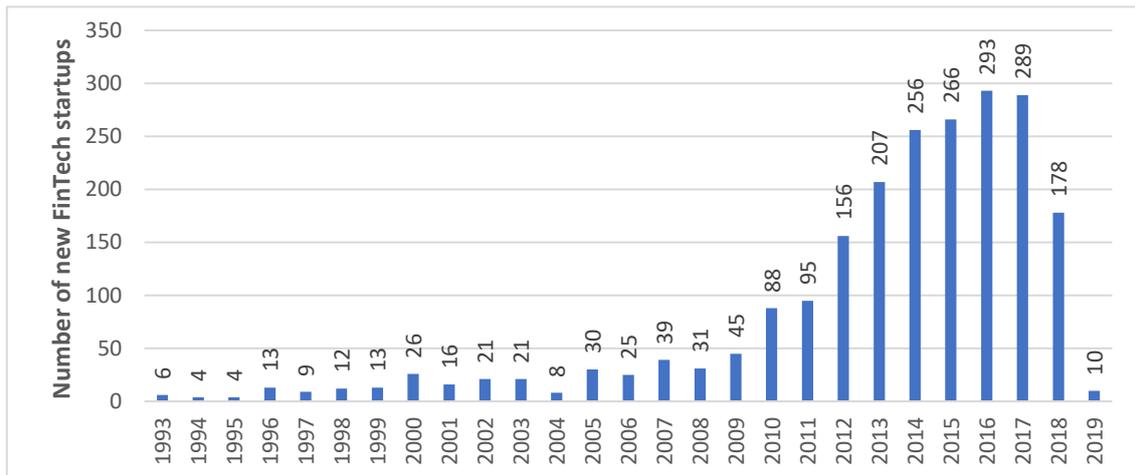


Source: Author elaboration

As Chishti & Barberis (2016) suggest, we can ensure that the arising of the first funding rounds is located in 2008, date in which the whole European banking system changed radically. Some years after, we can elucidate that the growth of both indicators started to increase exponentially until 2017, reaching more than 500 founding rounds and 5,000 million euros in volume during a single year. Events such as the creation of the first cryptocurrency (Nakamoto, 2009), the arrival of touch-screen smartphones and the execution of the Basel III accord can explain this remarkable high increase. Moreover, it is noteworthy to add also that, up to 250 and 221 founding rounds during 2017 and 2018 are related to companies headquartered in the United Kingdom, assuming an investment of more than 5.000 million of euros in both years, approximately 44% of the sector in both measures.

Following with the analysis of the evolution, figure 4.2 displays with the same reasoning than the previous that the number of new FinTech startups is increasing every year from 2008, being 2016 when the maximum is achieved, with a total of 293 companies entering into the market, comprising 42 countries of the European continent. Finally, with these three indicators (companies, number of funding rounds and their volume) we can assure that the FinTech sector has gained a relevant position within the financial services industry.

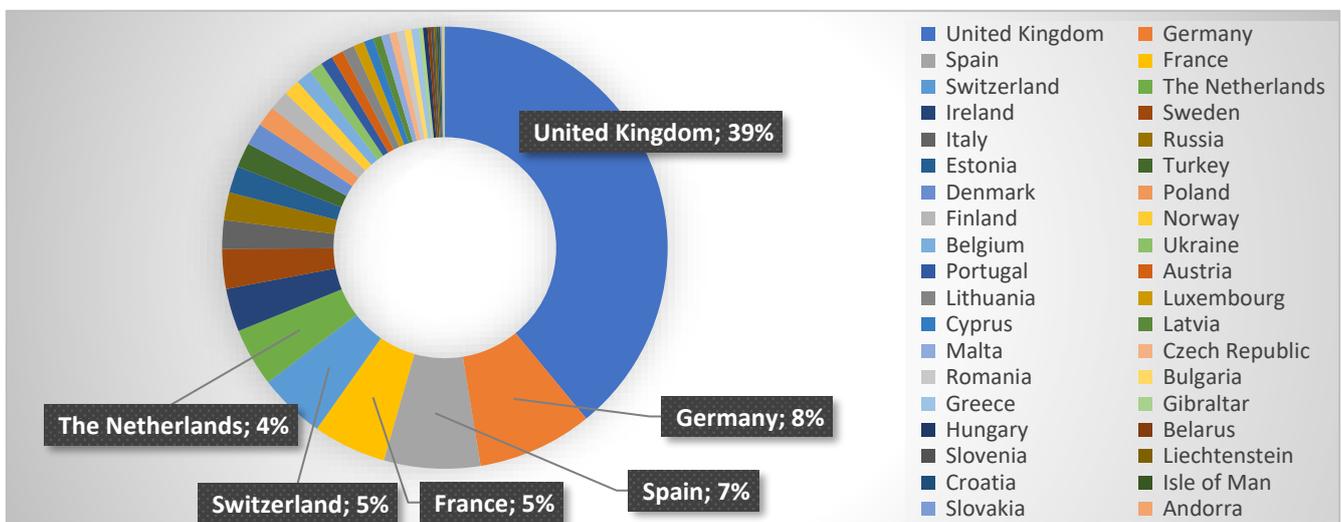
Figure 4.2 Number of founded FinTech startups each year



Source: Author elaboration

Once we have confirmed the positive trend the FinTech sector has been experimenting as a whole in Europe, we will proceed with its decomposition by geographical distribution. In this vein, figure 4.3 and 4.4 points that both the number of FinTech and the number of funding rounds & volume are very heterogeneous among countries.

Figure 4.3 Geographical distribution of FinTech's companies by country.

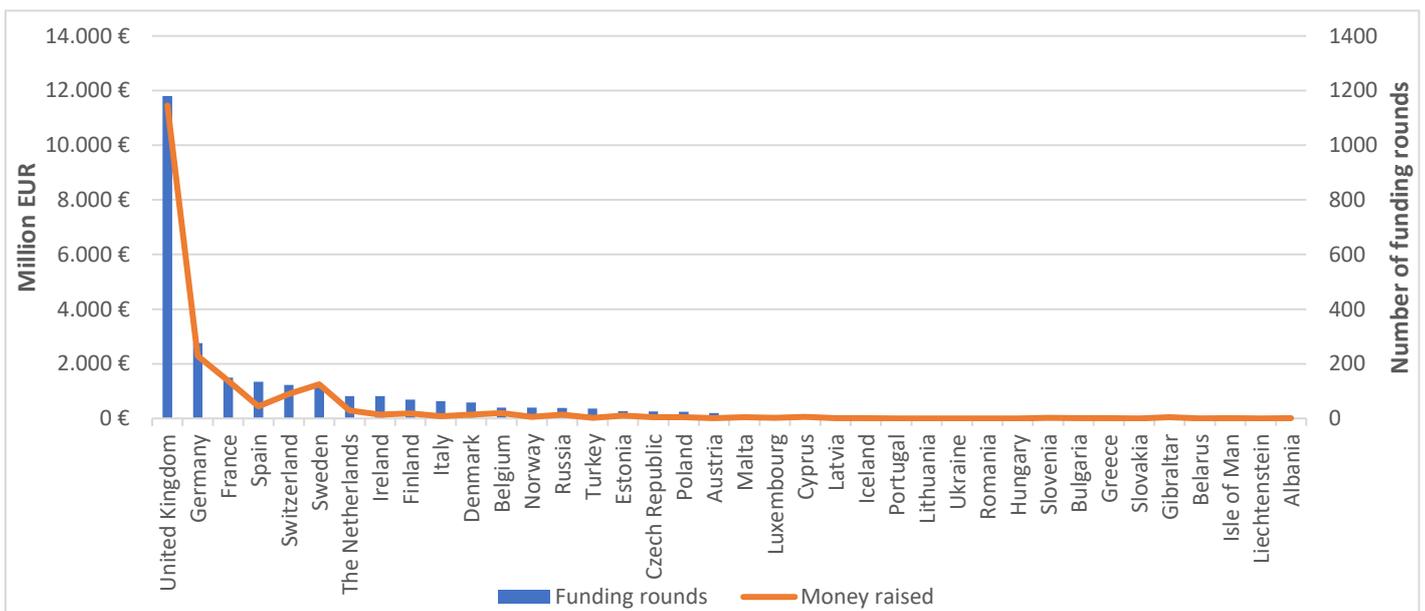


Source: Author elaboration

In this regard, we observe that the United Kingdom is the leading country in terms of the number of active entities by far, being this figure approximately five times bigger than Germany, Spain or France. As some authors and consulting groups have emphasised, the implementation of the regulatory sandbox in 2015 is one of the primary circumstances explaining their success. If we are able to confirm that the increase in the number of Fintechs and funding rounds have a positive effect on the level of competitiveness and efficiency of the British banking system, the employment of regulatory sandboxes would be a very recommendable policy for each country who wants to benefit from technological disruption and financial innovation. Besides that, it could also be a motivating topic for future research to study how the Brexit's economic and financial consequences will affect their FinTech sector.

In the same line than figure 4.3, figure 4.4 provides the geographical distribution of the number of funding rounds and volume for each country, offering even higher conclusions about the importance of the United Kingdom than before, which has assumed 59% of the total European investment by 2019.

Figure 4.4 Funding rounds and volume in terms of country.



Source: Author elaboration

However, from this graph, we can also glimpse an intriguing fact concerning the relationship between the number of funding rounds and money raised from those deals. Indeed, even though Spain occupies the third and fourth position regarding the number of companies and funding rounds, in terms of the investment perceived, this quantity is lower than in other countries with fewer rounds and companies, such as Sweden or Switzerland. To explore more deeply about this detail, table 4.1 presents the main figures of the top-eight countries sorted by the number of companies, including in the last column the ratio between funding rounds and money raised.

Table 4.1 Top-eight countries by number of FinTech companies (1993-2019)

Country	Companies	Funding Rounds	Money raised	Average funding in each round
United Kingdom	813	1180	11.454.887.060 €	9.707.531 €
Germany	177	276	2.291.801.088 €	8.303.627 €
Spain	147	134	444.436.446 €	3.316.690 €
France	111	150	1.374.081.940 €	9.160.546 €
Switzerland	105	122	899.989.793 €	7.376.966 €
Netherlands	88	82	291.930.329 €	3.560.126 €
Ireland	64	82	136.004.272 €	1.658.589 €
Sweden	60	118	1.251.100.855 €	10.602.550 €

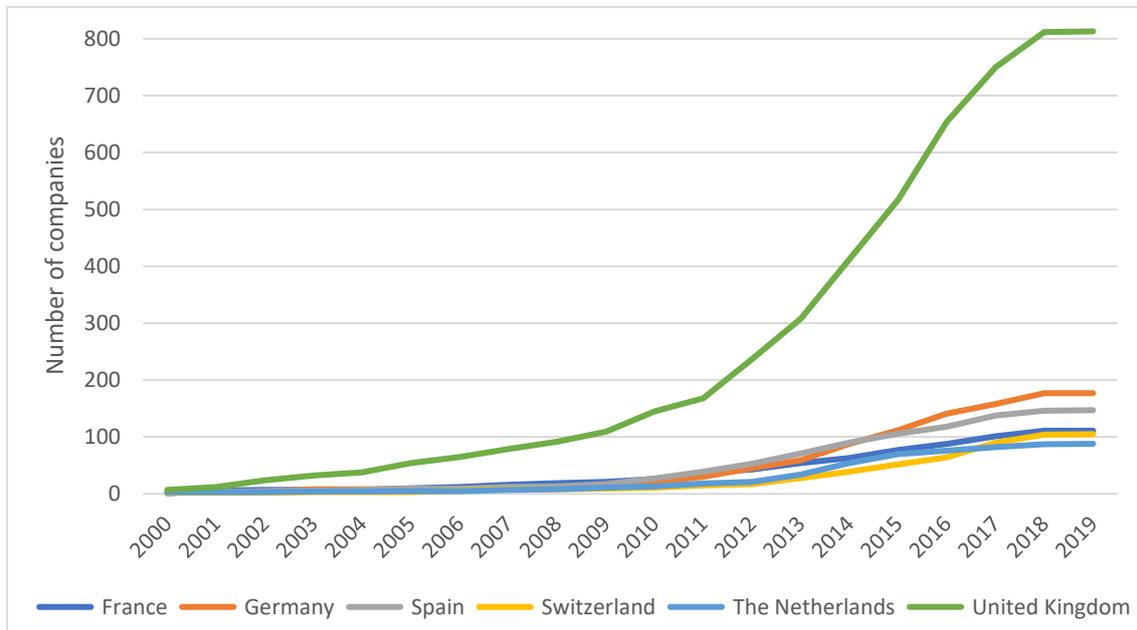
Source: Author elaboration

In addition to Spain, we can derive the same previous conclusion about the Netherlands and Ireland: the average funding they receive from investors in each funding round is significantly smaller than in Sweden, the UK, Germany or France. In fact, the mean value of the investment amount in the 2680 funding rounds considered is 7.251.423 €, being the maximum for Sweden (10.602.550 €) and Gibraltar (20.137.500 €). Another country that suffers from the same circumstance than Ireland and Spain is Italy, which has even a lower ratio (1.346.123 €) than the first. Besides that, very similar results also arise when comparing this ratio with the average funding of each startup (i.e. ratio between total funding amount and number of companies). Thus, another possible question to attach in the future is to examine why in some countries fintechs can attract higher amounts of funding than in others (i.e. why investors signalise these companies more valuable).

Finally, in order to briefly introduce the empirical analysis that we carry out in the following section, we have narrowed down the quantity of observations considered, by including only the top six countries in terms of the number of companies, which are, in order: The United Kingdom, Germany, Spain, France, Switzerland and The Netherlands. Adding a total of 1441 companies funded from 2000 to 2019, they represent 69% of total companies, 73% of the funding rounds, and 86% of the total investment of the 38 countries.

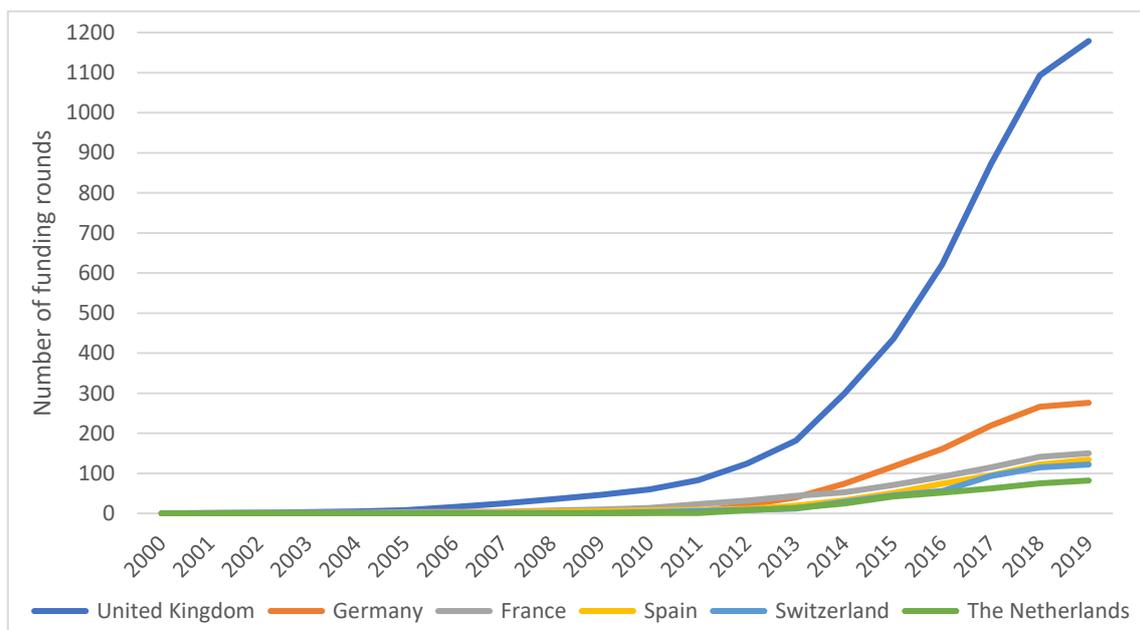
In this sense, figure 4.5, 4.6 and 4.7 reflects the evolution of those six countries with respect to the accumulated value of our three main indicators: companies, funding rounds and total funding.

Figure 4.5 Evolution of the number of companies. (top six countries)



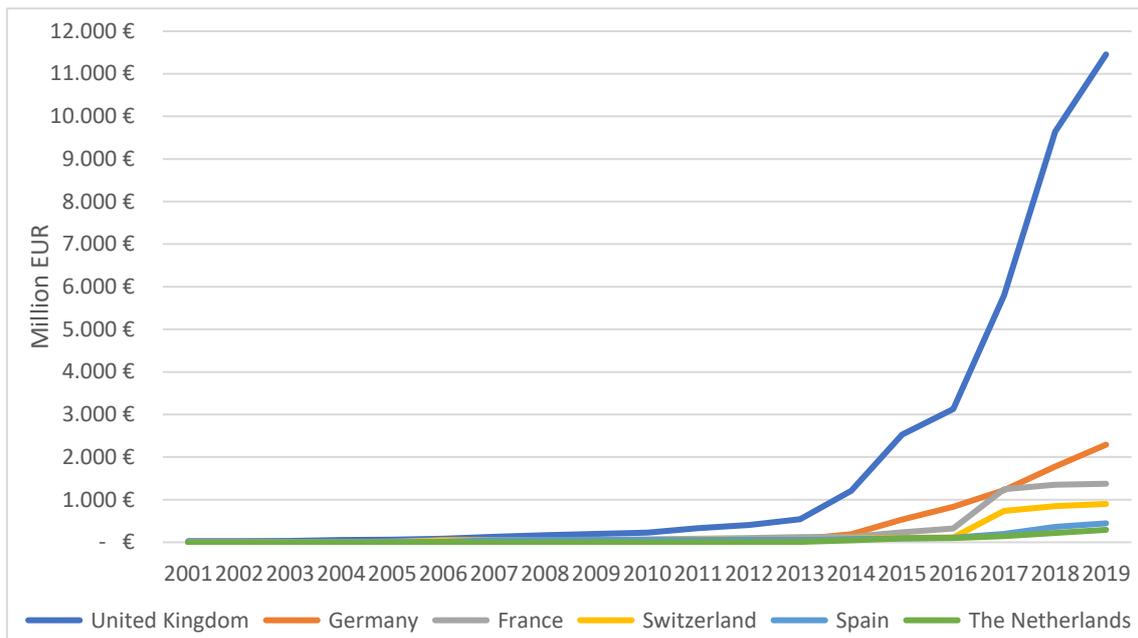
Source: Author elaboration

Figure 4.6 Evolution of the number of funding rounds (top six countries)



Source: Author elaboration

Figure 4.7 Evolution of total funding amount (top six countries)



Source: Author elaboration

5. ECONOMETRIC ANALYSIS

The massive irruption of Fintech in many countries around the world opens the question of evaluating its impact on the banking sector. Given that Fintech companies are seen as potential competitors of banking institutions in the lending and the payment sector, the interest of recent researchers has been to analyse, mostly from a theoretical point of view, because of the scarcity of available data on Fintech, the expected impact of Fintech on the banking system. On this respect, Vives (2017) presents an interesting survey about the impact of Fintech on efficiency, market structure, strategies of incumbents and entrants and financial stability.

This section aims to develop an empirical analysis in order to test from the data the real impact of Fintech in the banking sector. Using the developed database of fintechs in Europe, we estimate a structural model that allows testing whether or not its irruption affects the efficiency, competition and stability of the banking system. To address this goal, a panel data composed by the top six countries in Europe over the period 2000-2017 is used. In particular, we filter for France, Germany, Netherland, Spain, Switzerland and the UK, countries that as we have shown in the descriptive analysis, are the ones that account with the higher number of companies.

The new technology delivered by fintech startups has, without any doubt, a welfare-enhancing capability. However, as we pointed out in the literature review, regulation is needed to be developed in order to allow to absorb the promised benefits of this new technology without imperiling financial stability. In this regard, the three hypotheses that will be tested are:

H1: Fintech investment enhances bank efficiency.

One of the main impacts of financial technology over the banking sector has been in the lending and payments system. The first implication of this technological change has been to reduce costs and boost the efficiency of the banking system. Thus, it is expected that higher investment in Fintech will imply an increase in the efficiency of the banking system.

H2: Fintech investment erodes the market power of banks.

Fintech competitors are intruding on the traditional business of banks by exploiting the mistrust towards banks that millennials have developed, and it is offering digital services with which the younger generation is at ease. Thus, banks must face the impact of those new competitors by losing their part of their competitive advantages on the borrowed market and their privileges on the access to a stable customer base.

Thus, it is expected that higher investment in Fintech impact negatively in the bank market power.

H3: Fintech investment delivers benefits for customers and firms without imperiling financial stability

The penetration of fintechs will have a large and positive welfare-enhancing disruptive capability if this new technology is able to deliver the benefits for customers and firms without imperiling financial stability. If fintech startups introduce higher competition in the banking sector at expense of increased risk-taking, then the stability of the banking system will be damaged. On the other hand, it is true that the lack of regulation in the Fintech sector does not allow to keep the same level playing field between banks and fintechs and could contribute not to safeguard the financial stability.

To empirically test the above three hypotheses we resort to the estimation of the following model:

$$\text{Bank sector characteristics}_{i,t} = \alpha + \beta_1 \ln(\text{Amoney})_{i,t} + \text{Country FE} + \text{Year FE} + \varepsilon_{i,t}$$

Where Bank sector characteristics are defined considering three dimensions: bank sector efficiency, market power and stability (i.e. the corresponding to each of the hypothesis). The three indicators we have used as a proxy of those dimensions have been obtained from the Global Financial Development Database published by the World Bank in 2018. Indeed, the Bank sector efficiency has been measured using the average ratio of bank cost to income cost, a ratio that proxy the bank efficiency commonly used in the banking literature. The banking sector market power has been measured using the Lerner index (i.e. the index of competition level used in the microeconomic literature) of each banking sector. Finally, the stability has been measured using the Z-score indicator, which is a proxy of the probability of default

of the banking system and is defined as $Z - \text{Score} = \frac{ROA + \frac{EQUITY}{TOTAL ASSETS}}{\sigma_{ROA}}$.

The three banking sector characteristics are measured for each country i and for each year t , which compose our panel data. Since the goal is to test H1-H3, those banking sector characteristics have been regressed with respect the total amount of money raised in funding round in accumulated terms (“Amoney”), for each country i and each year t . Finally, given that we are using a panel data, we introduce the country fix effect and the year fix effect (i.e. Country FE and Year FE, respectively).

The results obtained from the estimation of the model corresponding to each of the three bank sector characteristics are presented in Table 5.1, 5.2 and 5.3. As the estimated models show, the data fit well to the dataset, as the goodness of fit (R^2) is very high for the three estimated models. Turning our attention to the empirical test of each of the three hypotheses the results reveals that when fintechs' money raised in funding round increases, the cost to income ratio of the bank sector decreases, being the estimated parameter, -5.78422, statistically significant (Table 5.1). Thus, regarding H1, it seems that investment in Fintech enhances bank efficiency.

Regarding H2, the empirical results are presented in Table 5.2. Since higher Lerner index means higher market power, the estimated results show that when fintechs' money raised in funding round increases, the Lerner index decreases. Where the estimated parameter, -0.01818, is statistically significant. Thus, the results point out that when the investment in Fintech increases, the competition in the banking sector increases as well.

Finally, in terms of the impact of Fintech on banking sector stability, the results show that the higher investment in Fintech erodes bank stability. Given that we are using as a proxy of bank stability the Z-Score, as higher is the Z-score, higher is the stability of the banking sector. Thus, as the estimated parameter that reveals the relationship between A_{money} and Z-Score is -0.9764 and statistically significant, it implies that when investment in Fintech increases, then the Z-score decreases, which means lower stability.

Table 5.1. Impact of fintech investment on bank efficiency

The REG Procedure						
Model: MODEL1						
Dependent Variable: EFF EFF						
Number of Observations Read					108	
Number of Observations Used					75	
Number of Observations with Missing Values					33	
Analysis of Variance						
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F	
Model	21	69237	3296.98228	24.10	<.0001	
Error	53	7251.49513	136.82066			
Corrected Total	74	76488				
Root MSE		11.69704	R-Square	0.9052		
Dependent Mean		52.27444	Adj R-Sq	0.8676		
Coeff Var		22.37621				
Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	Intercept	1	127.44484	21.17761	6.02	<.0001
LAMONEY		1	-5.78422	1.09076	-5.30	<.0001
D2		1	0.50504	5.26400	0.10	0.9239
D3		1	-16.69571	5.52370	-3.02	0.0039
D4		1	-17.64901	4.55925	-3.87	0.0003
D5		1	14.32789	4.57376	3.13	0.0028
D6		1	7.45753	4.65713	1.60	0.1153
T2		1	21.57347	11.10948	1.94	0.0575
T3		1	29.23664	10.74522	2.72	0.0088
T4		1	20.87434	10.72803	1.95	0.0570
T5		1	30.24252	9.85287	3.07	0.0034
T6		1	32.09163	7.63493	4.20	0.0001
T7		1	44.19244	7.43883	5.94	<.0001
T8		1	50.75222	7.41064	6.85	<.0001
T9		1	43.13557	6.99936	6.16	<.0001
T10		1	41.74139	6.78766	6.15	<.0001
T11		1	38.25906	6.73941	5.68	<.0001
T12		1	48.38248	6.46255	7.49	<.0001
T13		1	49.40377	6.39711	7.72	<.0001
T14		1	54.85634	6.33908	8.65	<.0001
T15		1	-13.41966	6.35398	-2.11	0.0394
T16		1	-12.24321	6.37409	-1.92	0.0601

Source: Author elaboration

Table 5.2. Impact of fintech investment on bank market power

The REG Procedure						
Model: MODEL1						
Dependent Variable: LERNER LERNER						
Number of Observations Read					108	
Number of Observations Used					75	
Number of Observations with Missing Values					33	
Analysis of Variance						
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F	
Model	19	0.93173	0.04904	7.21	<.0001	
Error	55	0.37422	0.00680			
Corrected Total	74	1.30595				
Root MSE		0.08249	R-Square	0.7135		
Dependent Mean		0.14204	Adj R-Sq	0.6145		
Coeff Var		58.07130				
Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	Intercept	1	0.35960	0.14915	2.41	0.0193
LAMONEY		1	-0.01818	0.00764	-2.38	0.0209
D2		1	-0.05790	0.03704	-1.56	0.1238
D3		1	-0.05312	0.03877	-1.37	0.1762
D4		1	0.10369	0.03210	3.23	0.0021
D5		1	-0.07126	0.03222	-2.21	0.0311
D6		1	0.16583	0.03279	5.06	<.0001
T2		1	-0.10389	0.07649	-1.36	0.1799
T3		1	-0.06646	0.07374	-0.90	0.3714
T4		1	0.00596	0.07360	0.08	0.9357
T5		1	0.17107	0.06681	2.56	0.0132
T6		1	0.17649	0.04982	3.54	0.0008
T7		1	0.14272	0.04809	2.97	0.0044
T8		1	0.09868	0.04784	2.06	0.0439
T9		1	0.12027	0.04466	2.69	0.0094
T10		1	0.09421	0.04308	2.19	0.0330
T11		1	0.09663	0.04265	2.27	0.0274
T12		1	0.10473	0.04006	2.61	0.0115
T13		1	0.13455	0.03937	3.42	0.0012
T14		1	0.14943	0.03859	3.87	0.0003

Source: Author elaboration

Table 5.3. Impact of fintech investment on bank stability

The REG Procedure						
Model: MODEL1						
Dependent Variable: ZSCORE ZSCORE						
Number of Observations Read					108	
Number of Observations Used					75	
Number of Observations with Missing Values					33	
Analysis of Variance						
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F	
Model	21	2593.07770	123.47989	12.77	<.0001	
Error	53	512.65221	9.67268			
Corrected Total	74	3105.72991				
Root MSE		3.11009	R-Square	0.8349		
Dependent Mean		13.02349	Adj R-Sq	0.7695		
Coeff Var		23.88064				
Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	Intercept	1	25.52833	5.63086	4.53	<.0001
LAMONEY		1	-0.97640	0.29002	-3.37	0.0014
D2		1	0.31750	1.39963	0.23	0.8214
D3		1	-10.92729	1.46868	-7.44	<.0001
D4		1	1.51052	1.21225	1.25	0.2182
D5		1	-4.48438	1.21611	-3.69	0.0005
D6		1	-5.44790	1.23827	-4.40	<.0001
T2		1	8.46306	2.95387	2.87	0.0060
T3		1	10.16397	2.85702	3.56	0.0008
T4		1	11.37228	2.85245	3.99	0.0002
T5		1	5.09243	2.61975	1.94	0.0572
T6		1	6.60089	2.03003	3.25	0.0020
T7		1	5.39260	1.97789	2.73	0.0087
T8		1	3.64564	1.97040	1.85	0.0699
T9		1	6.35778	1.86104	3.42	0.0012
T10		1	6.87084	1.80475	3.81	0.0004
T11		1	6.29930	1.79192	3.52	0.0009
T12		1	7.56589	1.71831	4.40	<.0001
T13		1	10.40117	1.70091	6.12	<.0001
T14		1	11.33913	1.68548	6.73	<.0001
T15		1	14.20061	1.68944	8.41	<.0001
T16		1	14.92574	1.69479	8.81	<.0001

Source: Author elaboration

Overall, the results show that fintechs impact the banking sector. Therefore, Fintech companies must be considered as new competitors in the playing field. Moreover, whereas Fintech enhances the efficiency and competition of the banking sector, it also erodes the stability of the financial system. Thus, it seems that maybe the introduction of regulation in the Fintech sector is needed in order to guarantee that they deliver their benefits to the customers and firms without imperiling the financial stability.

In order to contrast the robustness of our results, we reestimated the above three models using as independent variable the number of rounds in place of using the amount of money raised in funding round since as we have shown in the descriptive analysis both variables have a similar path. The results are presented in Tables 5.4, 5.5 and 5.6. The results show that the above results presented testing H1-H3 seem to be vindicated qualitatively.

Table 5.4. Relation of number of rounds with banking efficiency

The REG Procedure						
Model: MODEL1						
Dependent Variable: EFF EFF						
Number of Observations Read					108	
Number of Observations Used					108	
Analysis of Variance						
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F	
Model	21	65600	3123.82695	13.31	<.0001	
Error	86	20191	234.77941			
Corrected Total	107	85791				
Root MSE		15.32251	R-Square	0.7646		
Dependent Mean		56.96995	Adj R-Sq	0.7072		
Coeff Var		26.89578				
Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	Intercept	1	46.50806	4.99823	9.30	<.0001
AROUNDS	AROUNDS	1	-0.06111	0.01611	-3.79	0.0003
D2		1	8.06948	5.10951	1.58	0.1179
D3		1	-3.53326	5.11334	-0.69	0.4914
D4		1	-12.69492	5.10959	-2.48	0.0149
D5		1	9.61367	5.11137	1.88	0.0634
D6		1	1.88463	5.52036	0.34	0.7336
T2		1	20.51499	7.33981	2.80	0.0064
T3		1	22.16866	7.33886	3.02	0.0033
T4		1	23.43181	7.33839	3.19	0.0020
T5		1	13.57444	7.33556	1.85	0.0677
T6		1	15.28352	7.33001	2.09	0.0400
T7		1	25.29498	7.32549	3.45	0.0009
T8		1	30.38527	7.31889	4.15	<.0001
T9		1	24.50579	7.31209	3.35	0.0012
T10		1	24.36261	7.30234	3.34	0.0013
T11		1	20.54525	7.28770	2.82	0.0060
T12		1	26.02256	7.26285	3.58	0.0006
T13		1	26.04224	7.23865	3.60	0.0005
T14		1	29.80672	7.22345	4.13	<.0001
T15		1	-39.30420	7.26054	-5.41	<.0001
T16		1	-36.29982	7.38301	-4.92	<.0001

Source: Author elaboration

Table 5.5. Relation of number of rounds with bank market power

The REG Procedure						
Model: MODEL1						
Dependent Variable: LERNER LERNER						
Number of Observations Read		108				
Number of Observations Used		108				
Analysis of Variance						
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F	
Model	19	1.07877	0.05678	8.68	<.0001	
Error	88	0.57535	0.00654			
Corrected Total	107	1.65412				
Root MSE		0.08086	R-Square	0.6522		
Dependent Mean		0.14181	Adj R-Sq	0.5771		
Coeff Var		57.01754				
Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	Intercept	1	0.08229	0.02407	3.42	0.0010
AROUNDS	AROUNDS	1	-0.00039416	0.00008305	-4.75	<.0001
D2		1	-0.07811	0.02696	-2.90	0.0048
D3		1	0.01010	0.02698	0.37	0.7090
D4		1	0.12333	0.02696	4.57	<.0001
D5		1	-0.02505	0.02697	-0.93	0.3557
D6		1	0.18283	0.02904	6.30	<.0001
T2		1	-0.01092	0.03728	-0.29	0.7703
T3		1	-0.00109	0.03727	-0.03	0.9767
T4		1	0.02611	0.03727	0.70	0.4854
T5		1	0.10928	0.03725	2.93	0.0043
T6		1	0.11692	0.03721	3.14	0.0023
T7		1	0.07928	0.03718	2.13	0.0357
T8		1	0.02410	0.03713	0.65	0.5180
T9		1	0.05909	0.03708	1.59	0.1146
T10		1	0.05262	0.03701	1.42	0.1586
T11		1	0.05530	0.03690	1.50	0.1375
T12		1	0.05142	0.03670	1.40	0.1646
T13		1	0.08167	0.03648	2.24	0.0277
T14		1	0.09808	0.03621	2.71	0.0081

Source: Author elaboration

Table 5.6. Relation of number of rounds with bank stability

Model: MODEL1						
Dependent Variable: ZSCORE ZSCORE						
Number of Observations Read		108				
Number of Observations Used		108				
Analysis of Variance						
Source	DF	Sum of Squares	Mean Square	F Value	Pr > F	
Model	21	2597.08250	123.67060	5.57	<.0001	
Error	86	1910.38470	22.21378			
Corrected Total	107	4507.46720				
Root MSE		4.71315	R-Square	0.5762		
Dependent Mean		13.79345	Adj R-Sq	0.4727		
Coeff Var		34.16947				
Parameter Estimates						
Variable	Label	DF	Parameter Estimate	Standard Error	t Value	Pr > t
Intercept	Intercept	1	13.86354	1.53744	9.02	<.0001
AROUNDS	AROUNDS	1	-0.01354	0.00495	-2.73	0.0076
D2		1	-0.35966	1.57167	-0.23	0.8195
D3		1	-5.28860	1.57285	-3.36	0.0012
D4		1	1.84508	1.57169	1.17	0.2437
D5		1	-5.64321	1.57224	-3.59	0.0006
D6		1	-5.78435	1.69804	-3.41	0.0010
T2		1	5.86024	2.25770	2.60	0.0111
T3		1	7.10899	2.25741	3.15	0.0023
T4		1	8.88688	2.25726	3.94	0.0002
T5		1	1.25300	2.25639	0.56	0.5801
T6		1	1.72069	2.25468	0.76	0.4475
T7		1	0.90794	2.25329	0.40	0.6880
T8		1	-2.75785	2.25126	-1.23	0.2239
T9		1	0.53300	2.24917	0.24	0.8132
T10		1	1.78650	2.24617	0.80	0.4286
T11		1	1.17938	2.24167	0.53	0.6002
T12		1	1.70363	2.23403	0.76	0.4478
T13		1	4.42684	2.22658	1.99	0.0500
T14		1	5.18900	2.22191	2.34	0.0219
T15		1	8.04292	2.23332	3.60	0.0005
T16		1	9.23524	2.27099	4.07	0.0001

Source: Author elaboration

6. CONCLUSIONS

Fintech has come to stay, carrying out a revolution in the banking sector. As they are considered as potential competitors of incumbent banks, there is an increasing motivation in research for examining which is the impact in the banking system. In this regard, most of the literature analyse this topic using a theoretical approach due to the lack of access to data. This work contributes to it by developing an exhaustive empirical analysis of the Fintech sector in Europe, thanks to a large and manually extracted database comprising 2161 companies and 2679 funding rounds, from a total of 38 different countries.

First, it is analysed from a descriptive point of view what is the current situation and the evolution over time of the Fintech sector in the European continent, where the main fact is that the United Kingdom is the leading country by far in terms of the number of companies, number of funding rounds and investment perceived.

Second, an econometric analysis is performed regarding the top six countries in Europe in terms of the number of fintechs from 2000 to 2017, which aims to study the impact that fintech companies have on the efficiency, competence and stability of the banking system. In this regard, the three main conclusions extracted from the results are:

1. Investment in Fintech companies increases the efficiency of the banking sector.
2. Investment in Fintech companies increases competition in the banking sector.
3. Investment in Fintech companies increase the instability of the banking sector

From the first and the second conclusion, we can assert, from an economic point of view, that the banking sector is contestable to the fintech sector, because to compete with these new competitors, it has been able to increase its efficiency and to provide a more competitive service.

However, from the third conclusion, in the same line as the literature points out, it increases instability. Therefore, it is observed that it is necessary to introduce regulation in fintech companies so that, this increase in welfare they are generating, as a consequence of increased competition and efficiency, does not lead to a decrease in financial stability.

6. CONCLUSIONES

El movimiento Fintech ha venido para quedarse, provocando una revolución dentro del sector bancario. Consideradas como competencia potencial de la banca tradicional, existe una motivación creciente para analizar el impacto que tienen las empresas fintech en el sistema bancario. En este sentido, la mayor parte de la literatura utiliza un enfoque teórico, debido a la falta de acceso a datos. Este trabajo contribuye a ello mediante el desarrollo de un exhaustivo análisis empírico del sector Fintech en Europa, gracias a una amplia base de datos extraída manualmente que incluye 2161 empresas y 2679 rondas de financiación, de un total de 38 países diferentes.

En primer lugar, se analiza desde un punto de vista descriptivo cuál es la situación actual y la evolución del sector Fintech en Europa, dónde se observa que el Reino Unido es el líder con diferencia en cuanto a número de empresas, número de rondas de financiación e inversiones recibida.

En segundo lugar, se realiza un análisis econométrico de los seis primeros países de Europa en cuanto al número de fintechs de 2000 a 2017, que tiene por objeto estudiar el impacto que tienen las empresas fintech en la eficiencia, competencia y estabilidad del sistema bancario. Al respecto, las tres conclusiones principales son:

1. La inversión en empresas Fintech aumenta la eficiencia del sector bancario.
2. La inversión en las empresas Fintech aumenta la competencia en el sector bancario.
3. La inversión en las empresas Fintech aumenta la inestabilidad del sector bancario.

Desde el punto de vista económico, a partir de la primera y la segunda conclusión, podemos afirmar que el sector bancario ha sido capaz de adaptarse para aumentar su eficiencia y prestar un servicio más competitivo.

Sin embargo, a partir de la tercera conclusión, en la misma línea de lo que la literatura señala, aumenta la inestabilidad del sistema. Por lo tanto, se observa como necesaria la introducción de medidas de regulación en las empresas fintech para que este aumento del bienestar que están generando, como consecuencia del aumento de la competencia y la eficiencia, no conduzca a una disminución de la estabilidad financiera.

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