BBVA Research

Big Data Analysis

The FinTech Universe through the Eyes of the Media and Social Networks*

Data Science Community

Abstract

FinTech is gaining momentum in financial services due to the important role of technology in reshaping the Financial System. In order to identify the dynamics created by the FinTech ecosystem, we analyse data from the media and social networks. Our analysis shows several stylised facts related to the FinTech phenomenon. (i) There is a more positive perception of FinTech than overall Financial Services, (ii) although FinTech is related to a wide range of businesses and social topics, regulation and economics have been at the centre of the conversation since 2015, (iii) blockchain, the technology behind cryptocurrencies, is at the centre of the conversation with Insurtech, general banking services and payments as the most outstanding activities, and (iv) the public tends to identify FinTech companies with startups, rather than traditional financial system actors (i.e. banks). These findings are in line with other reports on this topic, confirming the great potential and complementarity of social networks and media information for getting a real-time picture of topics that are currently evolving and impacting economy.

1. Introduction

The Fourth Industrial Revolution, brought about by internet and data, affects the whole economy and is generating a new framework in the field of industrial organisation. Companies operate in an increasingly dynamic and competitive environment, where the digitization and automation of production processes and business models are becoming highly important. The pressure on markups is high and efficiency gains are indispensable for firm's survival. At the same time, demand for tailored and high-quality goods and services is on the rise. The financial industry, an important piece for economic growth, has not been the exception to this new trend.

After the last great financial collapse in 2008, the financial system has suffered an important transformation all over the world, not only to commit to the new regulatory and supervisory requirements but also in terms of its structure. For instance, in Europe, the number of bank branches has declined by 20% and the number of banks by 25%, between 2008 and 2018. However, in the same period, between 5,000 and 12,000 new FinTech companies (depending on the definition) have entered the European financial system.[1] This partly reflects a new scenario, with stronger competition and tight margins for the industry and the increasing use of digital banking by consumers.[2] As a consequence, productive processes have dramatically changed as well as consumption patterns.

Under the previous circumstances, the acronym FIN (finance) TECH (technology) emerged. FinTech is defined as "finance enabled by new technologies, covering the whole range of financial services, products and infrastructure" (European Parliament, 2017).[3] In short, FinTech brings all together, the new business models, processes, products, services and applications that emerge around the financial services industry and are digitally available for the client in a more efficient way.

The term FinTech has often been associated with startups, while traditional financial institutions are relatively big consolidated companies. However, the frontier between the two is increasingly blurred. The latter are continuously incorporating new technologies into services and productive processes, while the former are growing in size and profitability (Nonninger and Tesfaye, 2018). In addition, most of the incumbent financial services providers are undertaking massive business transformations, to improve client experience and become more efficient, by taking advantage of tech-savvy startups through investing, acquisitions or collaborations with them. Well-established companies in other sectors, such as BigTechs or Telcos, are increasingly playing an important role in the FinTech universe as well by offering a wide range of financial services (i.e. payments, investment, B2B services, etc). All these firms together are reshaping the financial system.[4] Understanding these new dynamics is essential to analyse the role of the financial sector in the economy and to assess its contribution to economic growth, welfare and financial stability, among others.

This report aims to contribute to the understanding of the new financial system framework by offering an alternative approach based on empirical evidence from media and social media data sources. The rapid evolution of the technological change makes real-time information a valuable asset to understand the new dynamics of the financial sector. In addition, diversity of information is important for getting a comprehensive framework of analysis. Our study offers a text-based quantitative approach to explore the FinTech ecosystem from 2015 to 2018-with a special focus in 2018-by applying Big Data techniques to information from the media (GDELT) and social networks (Twitter). We present a comprehensive view of the intensity and the sentiment of the dialogue when it comes to FinTech. Moreover, we identify the main trends, topics, events and technologies associated with the FinTech phenomenon. We also use these data sources to identify countries, organisations and firms that play an important role in the FinTech universe.

1: Hardie, S. and Gee, D. (2019) FinTech Disruptors 2019. http://FinTechdisruptors.org/wp-content/uploads/2018/12/FD2019.pdf
2: More than half of EU individuals used internet banking in 2017, up from 29% in 2008.
3: Draft report on FinTech: the influence of technology on the future of the financial sector (2016/2243 (INI). Committee on Economic and Monetary Affairs. European Parliament. 27 Jan 2017.
4: There are many studies in the literature that point out the role of FinTech in the new financial world (Galvin et. al., 2018; Nonninger and Tesfaye, 2018; Hardie and Gee, 2019; Zang et. al., 2018 among others). Most of these papers are qualitative and focus on identifying new trends and technologies shaping finance. Zang et. al. (2018) is the only exception. They analyse the development of the online alternative finance industry (i.e. peer to peer lending, crowdfunding, etc) in the UK by using survey and web-scraping data for 77 platforms, representing 95% of the online alternative finance market.

2. How is the perception and coverage of FinTech?

This section illustrates how countries, institutions, societies and governments stand on FinTech related topics and gives a comprehensive view of the main related topics in the FinTech ecosystem. In addition, we identify the most active countries in the FinTech dialogue. We take advantage of representativeness and time span covered by media information (i.e. GDELT database[5]) to measure the extent of FinTech coverage and its perception in the media across the world and over time, through Big Data techniques using Natural Language Processing (NLP) and Sentiment Analysis.

Media coverage is calculated as the relative ratio of news related to FinTech or Finance (respectively) over the total number of news per day.[6] Sentiment metrics are based on the identification of words with a positive and negative connotation. We construct a net-tone variable based on the balance between the percentage of all words in an article having a positive and negative emotional connotation.[7] Media coverage could be interpreted as a measure of popularity of a topic (i.e. FinTech or Finance) while sentiment could be considered equivalent to the degree of trust or support for such topics.

2.1 What stands out in the new financial scenario and how?

We explore the intensity and tone of information related to FinTech vs. finance to find out if the source of information used for the analysis offers differences in these two metrics.

Firstly, we compare the evolution of sentiment and coverage for news related with FinTech and Finance separately. Figure 2.1.1 shows that the media coverage of FinTech increases over time and it is catching up with that of Finance, which remains stable over time. It is sensitive since Finance is a mature field that is usually covered by the media while the interest on FinTech is growing in the media and, therefore, in society and markets.

Regarding perception, it is very positive and slightly decreasing for FinTech, while negative and decreasing more for Finance. As a result we observe a persistently increasing gap between the perception for both topics (Figure 2.1.2). The reasons may be the fact that Financial Services are nowadays widely available for the public, who already has a formed opinion of them, and the negative reputation of traditional finance after the Great Recession. Conversely, users are less familiar with FinTech solutions and perceptions are based more on expectations than facts, since FinTech solutions are usually considered as easing access to cheaper and more convenient finance and no so many widespread negative experiences have arisen yet.

Moreover, desegregating the composition of sentiment, we observe in Figure 2.1.3 that articles related to Finance have a higher emotional connotation, that is, they have a high proportion of both positive and negative words, with a dominance of the negative ones. In the case of FinTech, net sentiment is more positive due to a smaller presence of negative words and a similar level of positive words.

To shed some light into the causes of such a gap in sentiment between FinTech and Finance, Figure 2.1.4 shows the main topics associated with FinTech and Finance in the news. FinTech is related to topics such as innovation, science, information and communication technologies, research or labour market that, in general, have positive connotation. By contrast, Finance is associated with the traditional core parties of the financial system such as


5: The Global Database of Events, Language and Tone (GDELT) Project is a real-time global open database of human society according to the world's news media, reaching deep into local events, reactions and emotions of every place of the world in near-real time. It also includes a comprehensive and high-resolution catalogue of geo-referenced socio-political events from 1979 to the present. The GDELT Project monitors every accessible print, broadcast, and online news report around the globe every 15 minutes in over 100 languages. Information is processed using a vast pipeline of algorithms to identify hundreds of categories of events (from protests to appeals for peace), thousands of emotions (from anxiety to happiness), millions of narrative themes (from women's rights to clean water access), as well as locations, people, organisations, and other indicators. More information about GDELT can be found in the annex and in www.gdelt.org
6: We normalise the data in order to correct for the exponential rise in media coverage over time and the imperfect nature of computer processing of the news.
7: We identify the words according to more than 40 sentiment dictionaries included in Wordnet. Each article is translated into English from more than 65 languages. Our indicator for the tone is normalised by taking into account the total number of words included in each article. Thus, we get a score ranging from -100 (extremely negative) to +100 (extremely positive) for each piece of news, with 0 indicating neutral tone.

Central banks, institutions, capital markets, stock markets and with business and economic environment issues which, due to the fact that the financial system is identified as a key part of the economy, might trigger stronger and more tainted opinions.

Figure 2.1.1 FinTech and finance media coverage over time 2015-2018 (Mov. Avg. 30 days. Relative ratio with respect to total news)
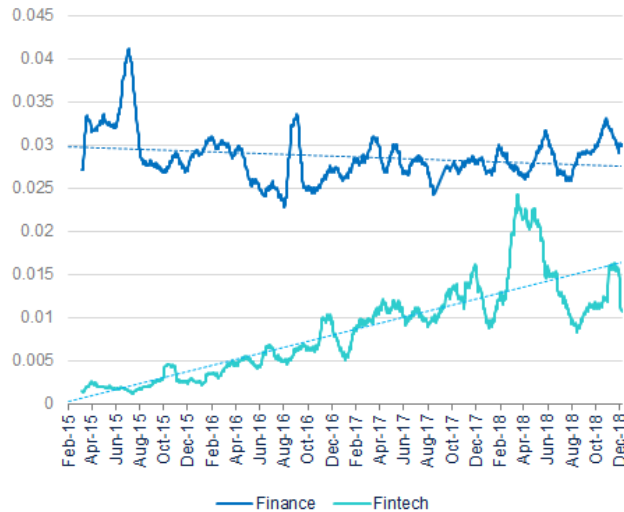
Source: BBVA Research and www.gdelt.org

Figure 2.1.2 FinTech and finance media sentiment over time 2015-2018 (Mov. Avg. 30 days)
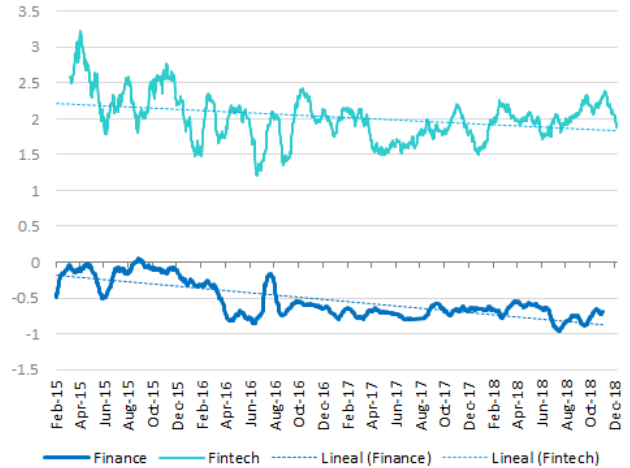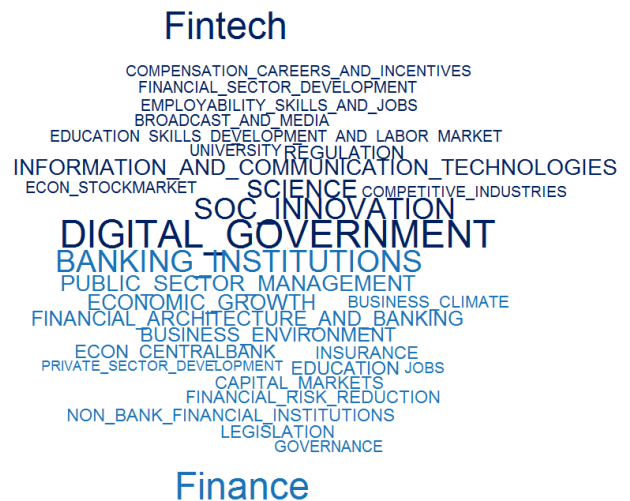

Source: BBVA Research and www.gdelt.org

Figure 2.1.3 Proportion of positive and negative words in the media over time (Mov. Avg. 30 days)
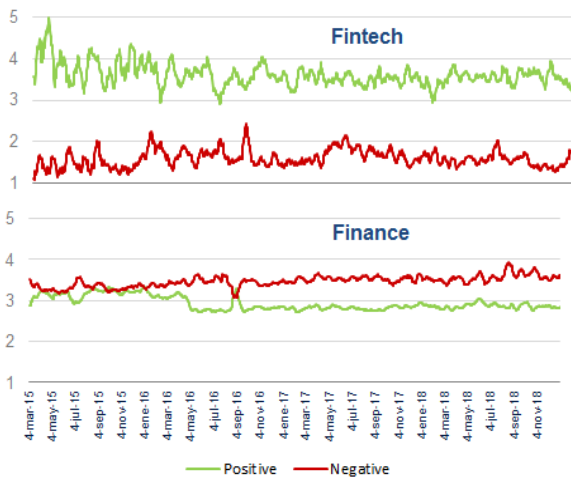
Source: BBVA Research and www.gdelt.org

Figure 2.1.4 Most related topics with FinTech and finance in the media in 2018

Source: BBVA Research and www.gdelt.org

Secondly, we analyse whether sentiment and coverage of FinTech changes when data from social networks is considered. Figures 2.1.5 and 2.1.6 represent coverage and tone, respectively, for FinTech in 2018 by using information from the media (GDELT) and social media (Twitter). We observe that similar trends emerge between the two series, both in terms of coverage and sentiment. Some peaks in coverage stands out in the Twitter data, in mid April, coinciding with many FinTech conferences all over the world (Los Angeles, Tokyo, Sydney, UK) that triggered a broadening debate on this issue in social networks (i.e. Twitter). In mid November, the words of the IMF president Christine Lagarde in the FinTech Festival, held in Singapore, generated an overwhelming echo in both media and social media (Figure 2.1.5). In this case, Lagarde's speech in favour of digital currencies was more intensely commented in media than social media as it was the first time that an international financial authority made such a positive claim regarding digital currencies. [8] These findings point out that, for the case of FinTech, the media reacts more when the news have a broader and more consolidated impact on society, while social networks reflect more intensely on specific events of high interest. When it comes to sentiment, no significant differences emerge but there are periods when sentiment is remarkable and opposite such as at the end of January, in June, August and at the end of November. The reasons for those differences may lie in the topics that were at the centre of the conversation at that time: the sharp decline in bitcoin price in January and probably also in June could have been received with more anguish by the media than by individuals; Artificial Intelligence (AI) in August as it usually causes more reaction on those individuals that feel their position at risk with the adoption of this technology; and cryptocurrencies in November, after Ms Lagarde showed interest, could have raised fears of regulation on this asset that are felt by some individuals as an alternative to the formal financial system.

Overall, our findings point that individuals and media still perceiving FinTech and finance differently, even though, in reality, both tend to be engage in the same value proposition (i.e. provision of financial services through technology means) and resulting firms are hybrids of the two concepts.

Figure 2.1.5 Media and social media coverage evolution of FinTech over time
(In standard deviations. Mov. Avg. 15 days)
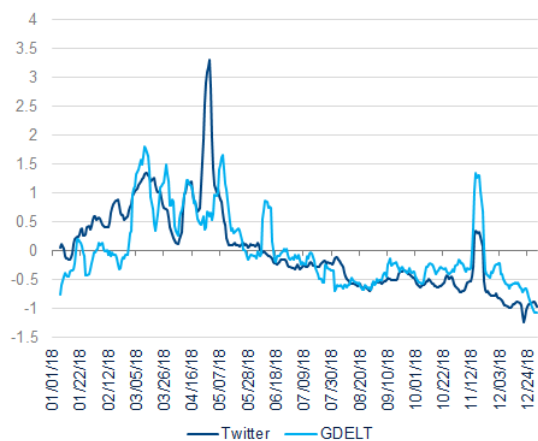
Source: BBVA Research and www.gdelt.org

Figure 2.1.6 Media and social media sentiment evolution of FinTech over time
(In standard deviations. Mov. Avg. 15 days)
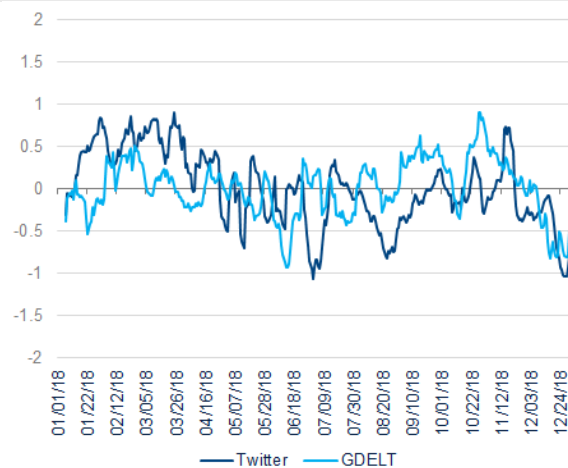
Source: BBVA Research and www.gdelt.org

8: "... while the case for digital currency is not universal, we should investigate it further, seriously, carefully, and creatively. More fundamentally, the case is about change—being open to change, embracing change, shaping change. Technology will change, and so must we". The full speech is available in https://www.imf.org/en/News/Articles/2018/11/13/sp111418-winds-of-change-the-case-for-new-digital-currency

## 2.2 Where is it happening most intensively? Evolution of FinTech perception and coverage by country

Geography is another important dimension to study in the FinTech universe. Media coverage of FinTech related news has increased all over the world since 2015 and it has not decreased in any country up to 2018.

United States, United Kingdom, Singapore, Hong Kong, China, India and some Eastern European countries such as Hungary and Estonia show the highest growth in media coverage, in contrast with Algeria, Israel and Nepal, which have a media coverage rate of variation near zero. [9] In the case of Israel, where the FinTech ecosystem has great traction, the dialogue was already very active before 2015 and it maintains the interest for our period of analysis. The FinTech industry emerged in the country at the beginning of the 2000s and currently is a competitive consolidated sector. Moreover, media coverage of FinTech-related news has substantially increased for South American countries. High venture capital (VC) FinTech Funding secured by South American companies in 2018 might be a plausible explanation for such increase of coverage in the region.

Media sentiment has been positive worldwide and over time. In Figure 2.2.1, we observe its evolution from 2015 to 2018, across countries. Despite a prevalent positive sentiment all over the world, in the period analysed, we find some countries with periods of negative sentiment (i.e. end of August 2015, September 2016 and March 2017). Hong Kong, Russia, Finland and Malaysia are the countries where the media perception improved most in the whole period, while Cameroon, Iraq and Iran are the ones where media sentiment declined the most. [10]

Figure 2.2.1 Media sentiment evolution of FinTech all over the world 2015-2018
(Red colours indicate negative tone, green colours positive tone and yellow ones, neutral)
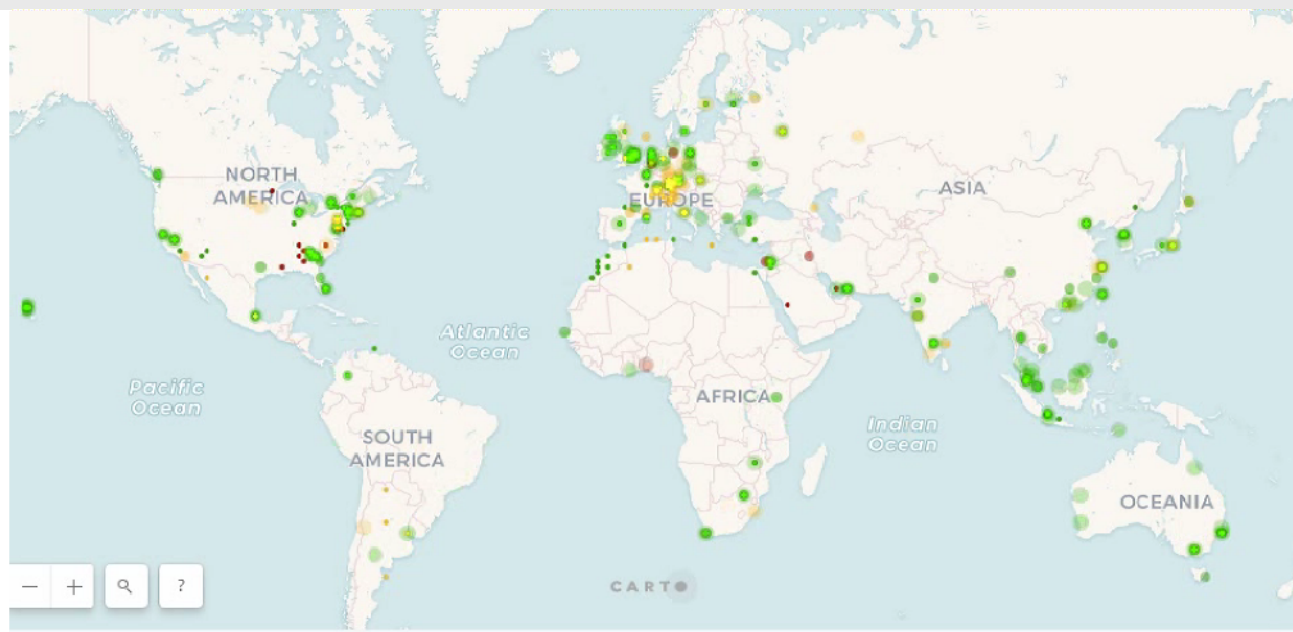
Source: BBVA Research and www.gdelt.org

9: We do not include these Figures for the sake of brevity. They are available upon request.
10: These four countries outperform in terms of digitisation according to the BBVA Digitization Index (DiGiX) for its last update of 2018.

3. FinTech dialogue

In this section we analyse topics linked to FinTech and the relations between them as well as the most important organizations in this subject.

3.1 FinTech: Is it going beyond technology financial services?

3.1.1 Structural multiyear overview

The use of the term FinTech is not confined to the financial sector but its innovation in products and processes affects also other industries and the economy in general. It also triggers reactions in other areas such as policymaking or education. This is clearly illustrated in Figure 3.1.1, which sums up the dialogue on FinTech that has taken place in the media between 2015 and 2018.

In that figure, we identify the topics that are usually associated with FinTech in the media and have classified them in broader categories in order to have a structural picture of where FinTech is having the strongest impact on society.

Figure 3.1.1 Most outstanding FinTech-related topics in the media
(2015-2018. Most commented topics with FinTech based on media coverage)
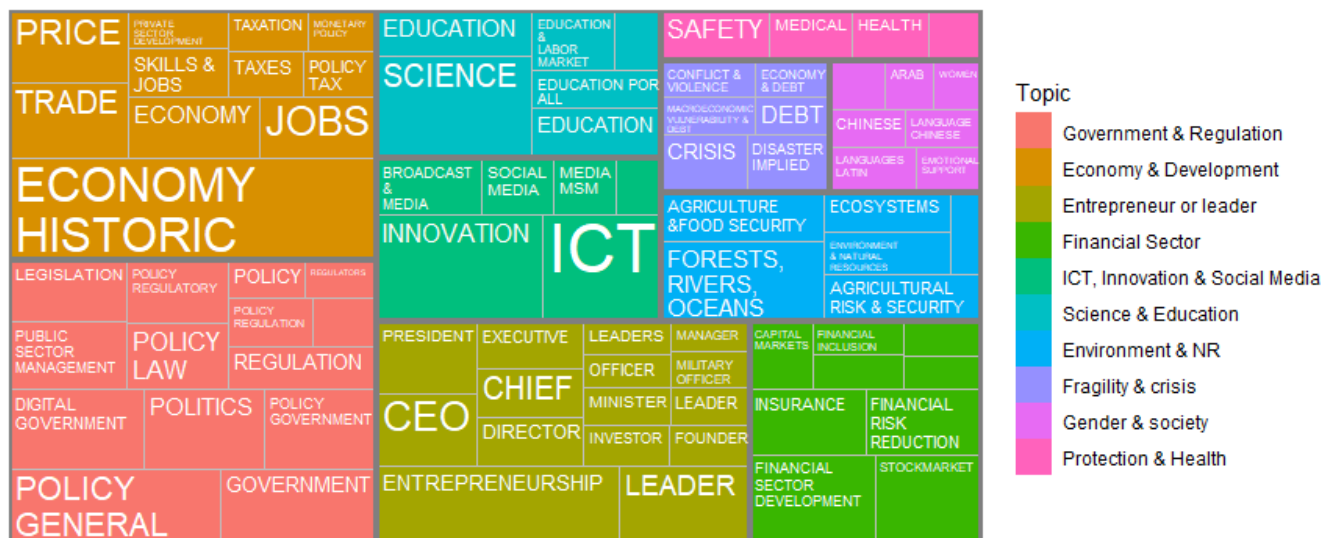
Source: BBVA Research and www.gdelt.org

As shown in Figure 3.1.1, environment, protection and health categories are frequently related to FinTech. Thus, the substantial gap between Finance and FinTech media sentiment, found in the previous section, could be influenced in part by the way in which FinTech is revolutionising not only the financial system but also other sectors with a high potential for economic growth.

The first issue related to FinTech, ranked by importance, is government and regulation, as they create the conditions for FinTech and other related firms to enter the market, compete and impact society. In this category, topics related to legislation such as policy, politics, law or regulation and other related to the public sector (government, digital government, or public sector management) stand out. Closely related to it, we found topics related to startups, entrepreneurship and leadership.

Issues related to "economy and development" come in second place when the media talks about FinTech, given the importance and relationship between innovation in the financial system and economic growth and development. The creation of more FinTech firms fosters productivity and growth through competition, innovation, new business opportunities and automation, among others. This is probably why in this category we find topics such as prices, labour market, private sector development, fiscal policy or trade.

Topics related to "entrepreneur or leader" appear as another relevant category, as technology is nowadays a relevant driver for investors and entrepreneurships who want to obtain high returns for their money or who have a groundbreaking idea that can transform it into a startup business. After all, behind any innovative or disruptive idea there is an inventor, a founder or a CEO of game-changing companies that have transformed not only the financial services industry but many other aspects of people's everyday lives.

As expected, issues related to the financial sector also arise. We find topics like the stock market, financial sector development, risk reduction or insurance. However, they do not appear as frequently as innovation or technology issues. Thus, it seems that in digital media, FinTech coverage is more focused on the use of new technologies in finance than on specific applications in financial services.

Another relevant category is related to Information and Communication Technologies (ICT), innovation & social media. This is logical as FinTech firms are continuously seeking, investing, researching and communicating new value propositions that allow them diversifying and innovating on the services they provide. Those topics are also closely related with Science and Education where terms like science, university and education are important, probably influenced by the need to be at the frontier of knowledge.

The FinTech concept has also influenced other sectors of economic activity, like those related to "Environment and Natural Resources" that originates from the very popular topic of Green Finance. In this category, we find the agricultural sector, where the term "AgTech" (not shown in the figure) has also became popular. AgTech refers to a set of technologies used in the agriculture value-chain, from seed production and farming to food fabrication. In recent years, there has been an increase in farm-focused startups. Some of them specialised in providing financial services to agriculture firms, such as crop insurance for weather or price fluctuations, credit and credit scoring services, specialised payment platforms, savings alternatives, product distribution, etc. Therefore, it makes sense to find those kinds of themes in our FinTech map.

Finally, there are other issues with less weight but are related as well. This is the case of "gender and society" where "women" and "Arabs" stand out. This may be because some FinTech value propositions are oriented to the inclusion of social groups that have been traditionally lagging behind in some parts of the world or to enable finance services embodying religious or cultural beliefs.

In short, "FinTech" relates to a very wide range of topics, not only technological but, surprisingly, to many other social themes. From employment issues and new skills to gender and environmental debates. We interpret this wide range of topics with the diversity of edges that can encompass the application of new technologies on financial services at a global level.

3.1.2. Overview of the FinTech Universe in 2018

To review the year 2018 in FinTech, we focus on the conversation about this topic held in Twitter. Social networks have become a powerful communication tool used by companies, governments and consumers to spread information and opinions in real time. Contrary to what we see in the media, where events, companies or people need a certain level of public interest and maturity to be addressed, Twitter offers real-time unfiltered and independent information provided by active users. The public timeline that transmits tweets from all users around the world is an extensive information flow in the streaming of more than one million of messages per hour.

We assess information contained in Twitter throughout the year 2018 to complement media information and to offer an alternative view of the dialogue about FinTech. [11] We aim to identify the most frequent and relevant topics as well as their distribution over time in the conversations surrounding the 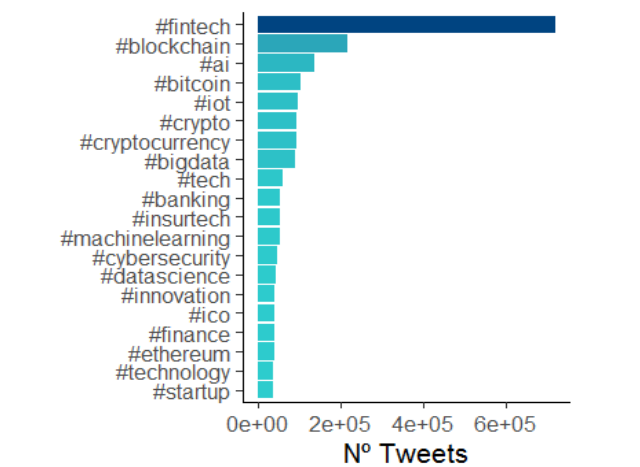FinTech environment. This rich and constant flow of information allows us to see the strong links between sectors that are apparently distant and even capturing new trends.

Figure 3.1.2 Most used terms in the FinTech Universe
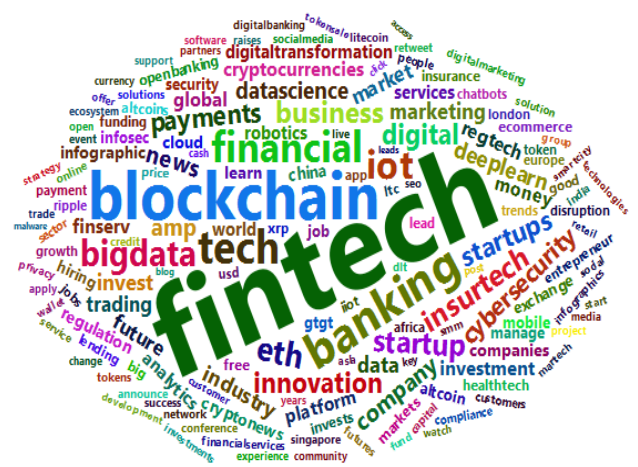
Source: BBVA Research and Twitter

Figure 3.1.3 Most used hashtags in the FinTech Universe

Source: BBVA Research and Twitter

Analysing the most frequent terms and hashtags related to FinTech in Twitter (Figure 3.1.2 and 3.1.3), we find Blockchain as the most commented topic by far, which reflects the great interest in the distributed ledger technology (DLT) behind cryptocurrencies, considered one of the technologies with greatest impact in the sector. In addition, numerous names and symbols of cryptocurrencies appear in tweets, such as Bitcoin (btc), Ethereum (eth), Altcoin or Litecoin (ltc). Hashtags seem to be related to technological concepts, while terms in tweets are more business-oriented. Artificial Intelligence (AI), Internet of Things (IoT), Big Data, Technology, Machine Learning and Data Science are the most outstanding hashtags, while the most frequent words commented in FinTech tweets are Financial, Banking, Payments, Business, Startups, Innovation and Regulation.

Deepening in the word cloud (Figure 3.1.2), we notice terms referring to locations related to innovation hubs or FinTech activity in general, such as Europe (especially London), China, Singapore or India[12], in line with the media information (Figure 2.2.1). In addition, new acronyms appear as global trends such as FinServ which refers to the traditional banking sector or InfoSec which represents the discipline responsible for information security. In the same way that Finance and Technology are blended in FinTech, similar portmanteaus such as InsurTech, HealthTech, MarTech and RegTech appear in other sectors. [13] These technological ecosystems symbolize interconnected networks of various actors that combine to create innovative solutions for different markets. In general, the actors involved are mainly technology startups, more established technology companies, investment groups and organisations providing business support (accelerators and incubators).

11: We analyse around 2M tweets containing the term FinTech during 2018. The messages obtained are written in more than 50 different languages, of which English (87%), Spanish (4%), French (2%) and Japanese (1%) are leaders. We focus the analysis on English tweets.
12: Leading countries in the FinTech disruption: https://www.businessinsider.com/global-FinTech-landscape?IR=T
13: InsurTech (Insurance + Technology), HealthTech (Health + Technology), MarTech (Marketing + Technology) and RegTech (Regulatory + Technology).

3.1.3 Monthly FinTech Universe overview

In order to dive deep into the evolution of the FinTech ecosystem throughout 2018, in Figure 3.1.4 we select the relevant topics that have experienced the strongest monthly variation. [14] Although we find that the most frequent terms are practically invariant over time, those topics that show the highest variation give an idea of some of the main events occurred during the month over the year.

As January is the first month in our sample, the topics listed in that month are the most outstanding topics in the Twitter dialogue on FinTech. Blockchain, banking and technology (tech) are the most frequent terms. In addition, machine learning, internet of things and artificial intelligence appear, together with startup, financial and Ethereum, as the most popular topics as stated above.

For the remaining months, we list the ten topics out of the 300 most frequent ones of the month that have seen a larger variation with respect to the previous month. The size of each word corresponds to the degree of variation in the frequency of appearance of that term. In such a way, the graph shows the most outstanding terms related with FinTech in the Twitter dialogue each month comparing with the previous one.

As can be seen in Figure 3.1.4, terms related to trendy technologies such as blockchain, internet of things or artificial intelligence are the ones whose presence in the conversation fluctuate more month-to-month. This is a consequence of the ongoing conversation on their potential application and implications that has brought those topics at the top of the political agenda in many jurisdictions.

Other terms related to FinTech events just appear around the month when they were held: Money Europe 20/20 in June and Money USA 20/20 in October, ones of the world's most important payments, commerce and financial services event, or the Singapore FinTech Festival in November, one of the largest platform for the global FinTech community. Topics like cybersecurity, UK, EU or India also go viral in social media associated with specific events. In particular, references to cybersecurity and UK seem linked to the Facebook–Cambridge Analytica data scandal and EU mentions to the publication of the EU FinTech Action plan in March. [15] [16]

Furthermore, we observe a higher interest in Airdrop than ICOs. [17] [18] Earlier this year, several of the biggest cryptocurrencies Airdrops in history were launched hogging conversations on social networks. Terms such as airdrop, token or tokensale appear on twitter throughout the month of February as part of a distribution and promotion campaign. Since Facebook and Google have now banned ICO advertising, as well as governments are increasingly supervising them because of they represent a high level of risk, Airdrop is taking a run in this highly uncertain regulatory environment.

14: We compute variation across topics and over time, using a probabilistic weighted approach to identify the most outstanding topics in terms of frequency (levels) and their variation over time.
15: It was revealed that Cambridge Analytica had harvested the personal data of millions of people's Facebook profiles without their consent and used it for political purposes.
16: For more information see Pacheco, 2018 "A new roadmap for European FinTech: Have we gone far enough?" May, 2018 available at
https://www.bbvaresearch.com/wp-content/uploads/2018/05/201805-EU-FinTech-Action-Plan-Watch_GB.pdf
17: The acronym ICO (Initial Coin Offering) is the cryptocurrency space's rough equivalent to an IPO (Initial Public Offering), in the mainstream investment world.
18: A crypto airdrop is when a blockchain project distributess free tokens or coins to the crypto community to increase brand awareness.

Figure 3.1.4. Evolution of the most commented issues in Twitter over 2018
(January data is in levels, represented in green. Feb- Dec data are in monthly differences. Blue colour indicates positive differences and orange colour indicates negative differences between consecutive months)
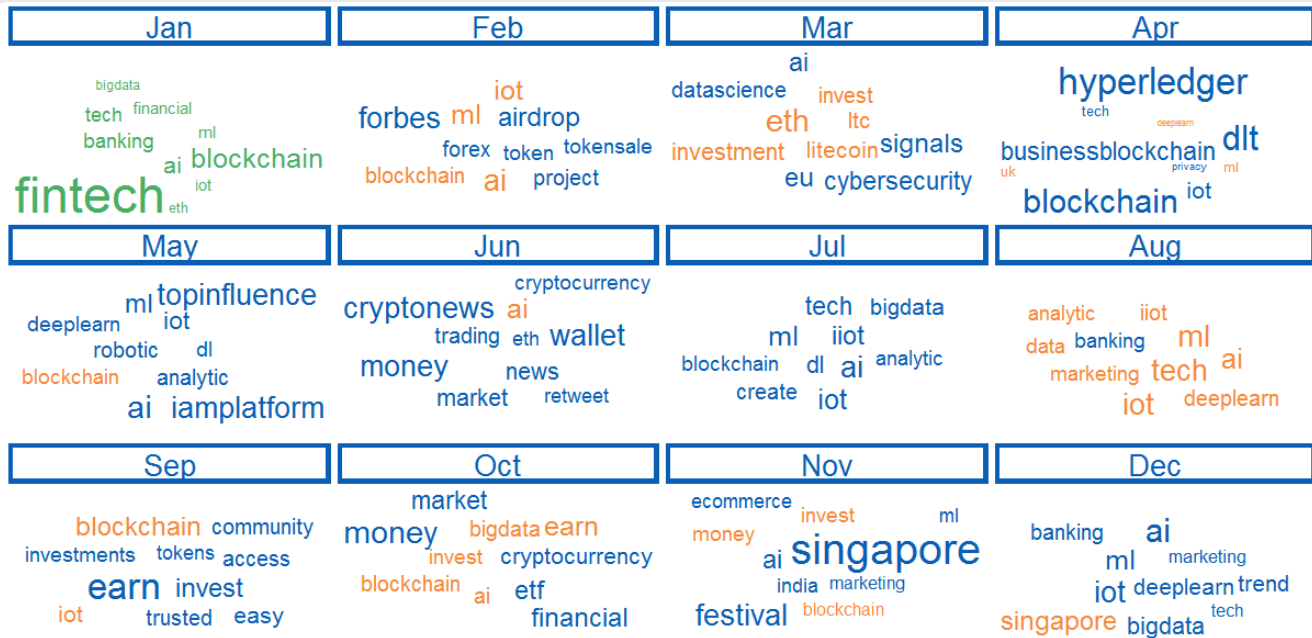
Source: BBVA Research and Twitter

3.1.4 Relationship between topics

To complete the analysis, we have analysed the relationship between FinTech-related topics as not every word identified is equally linked nor has a similar place in the "FinTech hierarchy". Figure 3.1.5 evaluates and displays statistics of bigrams (i.e. frequencies of adjacent pairs of terms) with information from Twitter. This helps to provide the conditional probability of a word given the preceding word. Thus, we can extract information about any sets of words and their position in a piece of publication as well as pairs of words with a high probability of them occurring together, which is useful to quickly understand enormous amounts of information in an easy and intuitive way.

The aim of this analysis is twofold. Firstly, to detect new topics of interest that might not have importance by themselves, but they are important when are considered in pairs. We observe the previously commented topics but also new ones such as Digital, Analytic or Cloud. Each topic is placed in a point, whose size represents the degree of the vertex that is the number of links that affects the vertex. Secondly, to understand the dynamics in the dialogue by observing the connections between groups of words. Both the thickness and the connectivity of the edges show interesting links that are worth to explore.

At first glance, the thickest edges convey some powerful messages:

- The FinTech activity is dominated by the blockchain technology. The weaker links among blockchain and terms such as 'cryptocurrency' or 'eth' reinforce the previous messages, the higher interest lies on applying the technology behind cryptocurrencies (blockchain) than in cryptocurrencies themselves. [19]

- Although the definition of FinTech does not limit it to a specific type of company, the social media users tends to identify FinTech companies with startups, not with banks.

- Insurtech and banking are the activities more frequently associated with the FinTech activity.

19: As shown in previous sections, debate on cryptocurrencies is also very active in Twitter since the movement in favor of P2P financial services, or an alternative decentralized financial system, use this network intensively to express their opinion and to influence debate.

Going more into detail, on the technology side, a strong linkage is captured between the terms ai (artificial intelligence), ml (machine learning), deeplearn (deep learning) and big data. As it is widely known, those terms are deeply interlinked since big data is one of the building blocks that has caused a leap in machine learning and deep learning techniques and applications, provoking a renewed interest in AI, a discipline which Alan Turing had already named in the 50s (Turing, 1952). Chatbots and IoT are the applications more frequently linked to AI technologies.

In addition to blockchain and AI, cloud computing seems to be the third hottest technology, reflecting the opportunities that this technology offers to FinTech companies and the rising interest of the banking sector in using this technology in equal conditions. Not surprisingly, it is connected to terms such as cybersecurity and infosec, some of the topics that focuses the debate on the application of this technology.

Regarding financial services, payments are also one of the main FinTech activities. In particular, real-time (rt) payment solutions is the area that shows the greatest potential for improving customer experience and offering new value-added services.

Figure 3.1.5 Relation between pairs of words
(The node size represents the connectivity of each term and the edge size represents the frequency of joint appearance)

Source: BBVA Research and Twitter

3.2. Who is who? FinTech companies and organisations

Media information allows us to identify the companies and organisations most frequently related to FinTech. We group the results into five categories showed in the legend of Figure 3.2.1. [20]

The first -Financial Services- as expected, includes the companies and organisations most closely related to FinTech, that is, the incumbents most active in the FinTech environment, either by developing their own solutions or by partnering or acquiring FinTech companies to widen or improve the financial services they offer. Among those institutions, we find Visa, NASDAQ, Mastercard, Wells Fargo, Deutsche Bank and Goldman Sachs. Those companies are investing highly in FinTech companies and innovative solutions, experimenting with new technologies such as blockchain or AI and disrupting in areas such as payments or open banking to keep up the pace of innovation in the banking sector. In media, big companies dominate the FinTech dialogue despite of its association with startups discussed in the previous section.

Secondly, hand in hand with those private companies, we find "Authorities and governments". The US plays an important role, given that it is a leading country in terms of funding FinTech firms. In this category, we also find Central Banks, the European Union, and the Federal Reserve, among others that have an important role to play in creating the conditions for innovation without putting financial stability at risk. It is worth noting the important role that the Monetary Authority of Singapore has in fostering financial innovation that has turned it in one of the global leaders in FinTech, competing directly with UK's Financial Conduct Authority.

The third category consists of firms related to media and social media. We find some BigTechs like Google, Facebook, Twitter and Microsoft. The presence of the US BigTechs is probably due to their activity in payment solutions, their investments in startups and the role of some of them as providers of cloud and AI services to FinTechs and banks. Also, they are perceived as one of the major menaces for incumbent financial entities, due to their large customer base that appears to be willing to become the first users of their potential FinTech solutions, the large amounts of consumer data they held and their great capacity for technological development. On the other hand, Telecom Argentina is among the most relevant companies because the company FinTech Telecom announced at the beginning of 2017 that it had taken control of it. Social media companies have become important participants in the FinTech landscape, as many FinTech firms take advantage of those platforms for different purposes. For example, they use Linkedin to recruit talent or build and grow networks; they also invest in marketing campaigns through Instagram, Facebook or YouTube to attract younger and more diverse clients. Yahoo is another player that is positioning in the FinTech environment by creating different apps, under its brand Yahoo Finance that offers different financial services, from brokerage services to small group savings (Tanda app).

The fourth category includes more traditional technology companies such as IBM, Accenture and Oracle. These tech-companies have a strong commitment to the FinTech sector. For instance, Accenture promotes knowledge, investments and provision of services to the FinTech sector. Also, it funded a global mentorship program in 2010 called the FinTech Innovation Lab. Oracle, on the other hand, offers platforms and infrastructure services which allow FinTech firms to integrate with banking API services. In June 2018, this company announced the creation of a FinTech innovation centre in Brussels.

Finally, although mixed with market research terms, the fifth category comprises companies dedicated to research and communication. We find "Thomson Reuters" as the most outstanding firm. This company is specialised in providing information and ancillary services to financial firms.

20: Groups have been created ad hoc to put in context the clusters that we find in data.

Figure 3.2.1 Most outstanding FinTech-related firms and organisations in the media
(2015-2018. Most commented topics with FinTech based on media coverage)
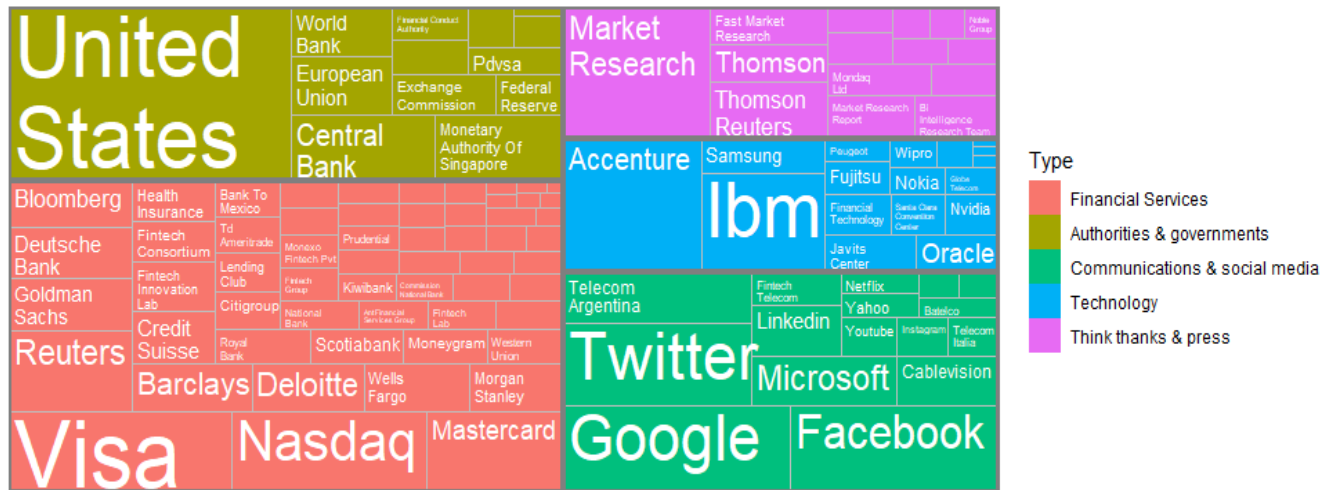
Source: BBVA Research and www.gdelt.org

4. Conclusions

In the current scenario of rapid technological change, political polarisation and a fragile economic recovery, it is critical to define, assess and implement new pathways to foster economic growth and welfare. Particularly, the financial system is experimenting a dramatic transformation to take advantage of new digital technologies to improve efficiency, enter new markets, become client-centred and create new revenue streams. How to capture and measure the new dynamics has become a topic of much discussion. Digitisation raises measurement issues and new data needs to understand the magnitude and scope of such transformation.

The rapid evolution of the technological change makes real-time information a valuable asset to get timely information to understand the new global shape of the financial sector. Also, diverse information sources are important for getting a comprehensive framework of analysis. This report aims to contribute to the effort of identifying new financial system dynamics through the eyes of the FinTech universe by analysing the information in new data sources (i.e. media and social networks) with big data techniques. We navigate through the FinTech universe to find out the media perception of the FinTech ecosystem, the most closely related topics, which organisations appear in this phenomenon and the countries involved.

Our analysis confirm that topics related to FinTech are gaining momentum. Media coverage is increasing since 2015 and its tone is positive and above the general average tone in the media. However, society still perceiving FinTech and Finance as two different things while in reality the border is blurred. The perception of FinTech is more positive that the one of traditional Finance since it is a topic that raises high expectations and is considered to go beyond the financial system. Both media and social media offered similar findings in terms of coverage and sentiment on FinTech that increases its interest all over the world in the last three years.

In terms of topic analysis, our structural analyses show that FinTech is related to a very wide range of topics, not only technological but, surprisingly, to many other social themes (i.e. employment issues, new skills, gender and environmental). We interpret this wide range of topics with the diversity of edges that can encompass the application of new technologies on financial services at a global level.

In addition, if we focus on 2018, the most frequent term and hashtag related to FinTech is blockchain. It points out the great interest in the distributed ledger technology (DLT) behind cryptocurrencies. Other numerous names and symbols of cryptocurrencies appear in tweets, such as Bitcoin (btc), Ethereum (eth), Altcoin or Litecoin (ltc). Hashtags are related to technological concepts (i.e. Artificial Intelligence (AI), Internet of Things (IoT), Big Data, Technology, Machine Learning and Data Science) while terms in tweets are more business-oriented (i.e. Financial, Banking, Payments, Business, Startups, Innovation and Regulation).

The monthly variation by topic offers us insights of the debate temperature and how interest moves across topics and reacts to remarkable events as they arise. Terms related to trendy technologies such as blockchain, internet of things or artificial intelligence are the ones whose presence in the conversation fluctuate most month-to-month as a consequence of the ongoing conversation on their potential application and implications that has brought those topics to the top of the political agenda in many jurisdictions.

The analysis of the relationship between words that appear together illustrates three stylised facts: (i) it confirms the dominance of blockchain in the debate, (ii) the public tends to identify FinTech companies with startups rather than banks, and (iii) insurtech and banking are the activities most frequently associated with the FinTech activity.

Information about the organisations generates a cluster of five categories that represent the most active players in the FinTech world. These are Financial Services (i.e. Visa, NASDAQ, Mastercard, Wells Fargo, Deutsche Bank and Goldman Sachs), Authorities and governments (i.e. US, Central Banks, the European Union, the Federal Reserve, Monetary Authority of Singapore and Financial Conduct Authority), BigTechs (i.e. Google, Facebook, Twitter and Microsoft), traditional technology companies (i.e. IBM, Accenture and Oracle) and companies dedicated to research and communication (i.e. Thomson Reuters).

Comparing information in media and social media, we are able to present a picture with stylised facts for the FinTech universe to better understand the new framework of the financial system. Fintech has become an overwhelming phenomenon that is reshaping the financial system through technology and having an enormous impact on society. In this context, real-time information published on the Internet and the media has become a valuable tool for researchers, the industry and policy-makers to understand the new dynamics of the financial sector.

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