Is the sustainability profile of FinTech companies a key driver of their value?

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ABSTRACT

The digitisation process is affecting all markets and raising consumer awareness about companies' sustainable behaviour. This work studies the effect of the sustainability profile of FinTech companies on the firm (market value and book value) as the factors that add value to investors and motivate their evolution in markets are still unknown. Using the KBW and Nasdaq FinTech Indices, and the NASDAQ Insurance Index (IXIS), we composed a panel of 95 companies over a 10-year period (2010–2019) with economic-financial variables and data about green certificates and sustainability indices. The applied methodology is based on dynamic (GMM-SYS) and static (PCSE) panel data models. Our results show that the market value of FinTech companies is positively driven by an CSR report being issued, the position in the CSR RepTrak, company size and board size. In contrast, the number of green certificates, particularly their position in the Green Ranking, is negatively related to their market value. Surprisingly in the most transparent companies, the direction of the variables effect evidenced for the book value per share is the opposite to market capitalisation.

1. Introduction

Consumer behaviour has changed in the last few decades as a result of a constant process of accepting and adopting technology by individuals (Gao and Bai, 2014). "Newbies" diminish in size as more and more all-age consumers' discover the convenience of and access online services (Dholakia, 2012). Thus increased connectivity through ubiquitous technology creates a new bond between firms and consumers, which becomes a powerful asset to improve users' experiences and to build customer loyalty (Margulis et al., 2020). Millennials, or generation Y known as digital natives, own different types of technological devices that they use in every aspect of their daily lives, from seeking information to communication, but also mature generations (Baby boomers; generation Y) are technological users who benefit from major digital developments (Macedo, 2017; Bölen, 2020). Digitisation has resulted in consumers' behaviour evolving from visiting physical stores to ubiquitous consumer behaviour characterised by the combined consumption of products and services offline, but also e-commerce based on online transactions via payment platforms, payment processors and payment getaways, mobile and app services (Aquilani et al., 2020).

The digitisation process has affected all markets and sectors,and has brought about the fourth industrial revolution (Industry 4.0), which is associated with developing and adapting "traditional" face-to-face services to "tech" industries that radically transform the way we travel, go on holiday or listen to music (e.g., Blablacar, Airbnb or Spotify) (Pereira and Romero, 2017).

Thus like other economic activity sectors, the financial industry has undergone an unprecedented change due to disruptive innovation and technologies. The numerous disruptive innovations and technologies have caused the financial sector's revolution with the emergence of what is known today as FinTech service companies, which use the Internet, mobile devices, software technology or cloud services to perform or connect with financial services, and place customers at the centre of their business model (Basole and Patel, 2018). Meanwhile, traditional financial institutions focus on the product in an attempt to adapt to the new digital environment as consumers increasingly move online and new also competitors emerge. The established financial institutions' immediate response to the new environment was the mobile banking system, but they also launched their own fully online banks (e.g., Open Bank in Spain owned by Santander). However, their future strategy will depend on the level of regulation.

The term FinTech industry comprises the myriad of business models

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that focus on providing financial services (direct financial investment services, loan provision services, insurance services) to satisfy those users who demand intelligent, but easy-to-use, financial services regardless of location and time, and at continually lower costs by using a variety of technologies, artificial intelligence (AI), big data, blockchain, cloud computing, etc. (Lee et al., 2011; Gomber et al., 2017; Liu et al., 2020). This means that industry embraces start-ups or new entrants, but also includes scale-ups, maturing companies, and even non-financial service companies, such as telecommunication providers and even e-retailers (OECD, 2020). The FinTech industry is dynamic. Recently one of its branches, the Insurtech industry, has become more important. Thus Li et al., (2017), showed how the FinTech industry in South Korea focused on payments, platforms and banks, and switched in 2016 to securities, business and support, while the Insurtech industry, a branch of FinTech, is still in its development stage, but its relevance is rapidly growing, (Cao et al., 2020). In contrast, the digital crowdfunding platform industry (lending and equity) is characterised by its heterogeneity in diffusion terms, but is well-developed in some countries as an alternative finance tool, and is still underdeveloped in others depending on their formal institutional development (Di Pietro and Butticè, 2020).

Moreover, digital users are not only moved by utilitarian factors, such as security, privacy and the above-mentioned factors required for financial services, but also by hedonic factors like the enjoyment and sociality effect of the employed platform, which increase their digital use intentions' (Boateng et al., 2016; Arcand et al., 2017).

Such is the volume of business and the profits they generate for online stores, developed countries are enacting new laws to regulate such activity by extending the definition of who can provide more diverse and competitive financial services markets (KPMG, 2019; OECD, 2020). The regulation of FinTech (over 30% of firms were reported to be unregulated) (EBA, 2017) is vital for the financial system's stability, but to also prevent illegal activities like money laundering, and will clearly determine the type of competition between established institutions and FinTech firms.

Consequently, established banks are no longer the only financial providers, and the emergence of new players can stimulate competition and product variety with positive outcomes for societies and economies (Zetzsche et al., 2020). This is especially relevant for economies based on small- and medium-sized enterprises (SMEs) as a stricter banking regulation implemented after 2008 limited their access to finance. In fact in their study, Abbasi et al., (2021) demonstrated how FinTechs improve SMEs efficiency as firms find more financing options in the credit, lending and payments FinTech subsectors at lower costs. Furthermore, the propensity of SMEs to adopt generic tech and digital solutions across their business increases as the FinTech industry also does (Abbasi et al., 2021).

One of the positive consequences of the FinTech revolution is consumer empowerment, who gain access to information about products and services. Thus Sharma et al., (2020) suggest that financial services providers should concentrate their efforts on enhancing their reputation and image to boost higher consumer trust levels. Al nawayseh (2020) argues that during the post-COVID era, consumers will be more likely to use FinTech services when perceived benefits, social value and trust are high and, at the same time, when risks perceptions are low. With their study, Senyo and Osabutey (2020) highlighted how consumer trust in digital and technological services can be addressed by a review of policies and regulations. In contrast, Cumming and Schwienbacher, (2018) affirmed FinTech investments were relatively commoner in countries with weaker regulatory enforcement and with no major financial centre after the 2008 financial crisis.

With the development of the FinTech industry, the efficiency of the financial sector increases with both the reduction of asymmetric information problems and the increase in competition by lowering costs. Undoubtedly FinTech firms promote the creation of value while promoting economic and, therefore, social growth (CISL, 2017; Anshari et al., 2019). However, the question that arises as a result of the expected impact of the FinTech sector is whether FinTech firms are sustainable, or to what extent are they catalysts for sustainability, and even if the level of sustainability adds value to the FinTech industry.

In recent years, considerable progress has been made in both the FinTech business models (Liu et al., 2015; Liu et al., 2020) and sustainability areas. In fact FinTech is recognised by the United Nations (2019) as one of the key innovations that can facilitate the achievement of the Sustainable Development Goals (SDG). Hence in accordance with Arner et al., (2020), FinTech is the key driver of financial inclusion and the answer to how regulators and government can support the achievement of SDGs. The transition towards a more sustainable society requires identifying the financial returns associated with it (Geissdoerfer et al., 2017), which explains the demand to review the financial relationships amongst the stakeholders interacting with the company (e.g., shareholders, customers, etc.) (García-Castro et al., 2010; Alcaide et al., 2019). Pizzi et al., (2021), and changes the financial and capital markets' perception of implementing SDG.

Nevertheless with very few exceptions, these two areas of FinTech and sustainability research have not been combined, despite being the two major drivers of change in the financial sector (Nassiry, 2018). The literature shows a gap in this regard because practically no studies have shed any light on this topic. Thus Macchiavello and Siri (2020) theoretically question for the first time in the European context the relation that should exist between the two words technology and sustainability by merging them into a single "Green FinTech". In the same year, Moro-Visconti et al., (2020) stated that FinTechs promote both sustainable development and green finance, but their study was limited to analysing differences in the stock market value and the market multipliers associated with a subsample of seven FinTechs, five banks and three Information Technology firms for the 2018–2020 period.

Clearly, FinTech companies are somehow novel, and it is still not known the factors that add value to investors and, consequently, motivate a firm's evolution in markets. This is why our work focuses on analysing the sustainability profile of FinTech firms and studying its effect on their value by considering total market capitalisation (MC) and book value per share (BVS) without segregating FinTech firms into their different types of services, such as direct financial investment services, loan provision services, insurance services (InsurTech), etc. Hence by employing the KBW and Nasdaq FinTech Indices, and the NASDAQ Insurance (IXIS) Index, we built a database of 95 firms for a 10-year period (2010–2019) with 950 observations. The economic-financial variables were obtained from the Eikon database, while the data about green certificates, sustainability indices and SDGs were hand-collected.

This paper makes several contributions. Firstly, the study is of particular importance for investors, policy makers and the FinTech industry itself, who should consider increasing the transparency of financial service companies to benefit both financial markets and the real economy. The results of this study evidence that the market value of FinTech companies is driven by the selected sustainability indicators. Moreover, firms' financial performance is a key factor in their value and size acts as a positive significant factor for their market value. Secondly, the paper contributes to the debate about creating value to FinTech shareholders by modelling the total MC and BVS using dynamic (GMM-SYS) and static (PCSE) panel data models. It is worth stressing that no research has yet analysed the effect of sustainability indicators of FinTech firms on the MC and BSV. Our modelling allows FinTech companies in their different maturity stages to gain a clear and objective (quantitative) understanding of the financial impact of their sustainability profile. Thirdly, this research adds understating about this emerging sector to empirically study for first time the sustainability profile of FinTech. Thus our results evidence a significant difference in the drivers of market value when comparing the most transparent companies to the total sample. Finally, our findings provide insights into the FinTech sector, and offer managerial policy-making reflections about the link between FinTech characteristics' and the firm's value.

The study is arranged as follows. The second section provides the

background and hypotheses development. The third section describes the materials and methods. The fourth section presents the results. Finally, the fifth section concludes this study.

2. Background and hypotheses development

2.1. FinTech industry

FinTech is a term used to refer to those firms that use technology-based systems to provide innovative and cheaper financial services directly or to make traditional financial business more efficient (Lee et al., 2011; Gomber et al., 2017; EC Fintech; Liu, et al., 2020).

Since the fourth industrial revolution, the increased competition in the financial sector has not stopped growing. Thus it is one of the most dynamic sectors that continuously transforms, and its fast growth makes it difficult to quantify its size and potential. According to the industry's composition, providers of financial services can be grouped into three main categories: newcomers to the sector, such as start-ups that offer new services or products; (2) traditional financial services providers, or incumbents; (3) technological companies that develop tools, services and products in the field.

The size and activity of the FinTech industry varies a lot from one country to another given the different maturities of FinTech industry ecosystems. The FinTech ecosystem is built on four characteristics: (i) availability of technical, financial services and entrepreneurial skills; (ii) availability of financial resources for start-ups and scale-ups; (iii): government policy beyond regulation; (iv) demand: consumers, firms and financial institutions (EY, 2019).

Countries deal with the challenge to make the most of this revolution. Lee and Shin (2018) identify five different players of any FinTech ecosystem, namely: (i) FinTech startups; (ii) Technology developers; (iii) Government (financial regulators); (iv) Financial customers; (iv) Traditional financial institutions. In their study the authors argue that the more geographically concentrated the FinTech ecosystem is in a country (fewer cities), the stronger the socio-economic impact. A higher concentration relates to fewer traditional financial entities, with FinTech organisations being larger and with more resources. This leads to more applied technological changes because it is easier to share knowledge. In the dispersed context (more cities), smaller companies will appear and, although competitiveness improves, resources will be more distributed and their global reach and impact will lower.

One of the advantages of FinTech is financial inclusion as it provides users with accessibility and affordability of financial services. These factors enhance market dynamics in terms of transactions and invested capital which, in accordance with Cumming and Schwienbacher, (2018), is commoner in less regulated countries. The authors argue that this leads to develop products and services that are beyond the scope of financial regulators (such as crowdfunding platforms and alternative payment systems). A lesser regulation context lowers costs, which facilitates the development of technological innovations and makes financial services more affordable (Dharmapala and Khanna, 2016; Hornuf and Schwienbacher, 2017).

The trust and security of users are essential components to guarantee the industry's future sustainability, which is attained mainly through regulation (Senyo and Osabutey, 2020). The participation of states in the daily lives of people is increasing and generates high expectations for the rights acquired by citizens, which leads to less confidence in markets. This generates a paternalistic climate in the state-individual relationship and increases citizen demand on the regulatory bodies that develop mechanisms to generate more security and investor confidence in the intervening agent, but increase costs and reduce the efficiency of the process (Donovan, 2012; Mugambi et al., 2014; Arner et al., 2016; Cobla and Osei-Assibey, 2018).

In the present-day, not raising awareness and lack of trust are the two main reasons for why consumers opt to use an incumbent financial institution rather than a FinTech (EY, 2019). Policy makers can fight these two factors by promoting the existence of "regulatory sandboxes", known as "safe spaces" in which businesses can test innovative products, services and business models without incurring normal regulatory consequences (HM Treasury and Financial Conduct Authority, 2015).

The principal adopters of FinTech services are SMEs whose access to finance has become limited with the global financial and economic crisis after 2008. Thus SMEs adopt FinTech solutions to address specific problems and FinTech improves SMEs' efficiency, especially in emerging markets (Abbasi et al., 2021).

FinTech comprises a wide variety of business models, all of which are customer-centric that result in innovative products and services (Nicoletti, 2017). Lee and Shin (2018) attempt to classify the FinTech business models in accordance with their value propositions into six groups: (i) including payment business model (online foreign exchange; overseas remittances; digital-only branches banking; peer-to-peer payments; in-store mobile phone payments); (ii) wealth management business model (online investment advice and investment management; online retirement and pensions management tools; online budgeting and financial planning tools); (iii) crowdfunding business model (investments via crowdfunding platforms); (iv) lending business model (online-only loan providers; online marketplaces and aggregators for loans; online loan brokers and broker facilitation websites); (v) capital market business model; (vi) Insurtech or insurance business model (insurance premium comparison sites; insurance-linked smart devices; app-only insurance).

2.2. Corporate social responsibility

Sustainability in financial firms refers to delivering financial products and services that are developed to meet people's requirements and to safeguard the environment while generating profit (Sannino et al., 2020). Thus financial services firms share more responsibility towards sustainable development (Loew et al., 2020) because, with diverse activities, they influence borrowing firms in many industries with their lending decisions, which contribute to the economy's stability and growth (Nguyen and Nguyen, 2020).

There is increasing investor demand for information about environmental, social and corporate governance (ESG) risks. This (instrumental) perspective would lead organisations to focus on sustainability performance to meet organisational objectives like market value or maximising profits (Traxler et al., 2020). Hence Frías-Aceituno et al., (2013) and Lee and Maxfield (2015) argue that sustainability performance reporting reduces agency costs for investors and may ease access to capital markets.

Creating value for stakeholders has been explicitly linked with the reporting of corporate social responsibility (CSR) information by firms (Adams, 2017). However, long-term value creation can be threatened by shareholders' short-term investment horizon requirement and their lack of understanding ESG firms' strategy (Cho et al., 2015). Flammer and Ioannou (2021) argues that the companies which sustain their investments in CSR have shown higher performance in post-crisis years as such investments contribute to companies' competitiveness in times of crisis.

Communicating CSR actions not only affects shareholders, or the company itself, but also their competition, investors and customers and, generally, society as a whole. Thanks to companies communicating their CSR, groups of interest will predictably take a different vision of the company and the policies that it adopts (Alcaide et al., 2019, 2020).

The literature evidences a positive relation between CSR and firm performance (Ok and Kim, 2019; Cupertino et al., 2019) and, particularly for established financial services providers, CSR boards could play an effective role in preserving reputation and procuring financial sustainability (Scholtens and Klooster, 2019).

So FinTechs have the tools to enable more transparency for customers and to reduce costs by enhancing the financial sector's sustainability. Several studies have analysed the sustainability of established

financial institutions, such as banks (Costa and Martínez, 2018), but no empirical studies have analysed the relation between disclosing CSR information and its impact on the firm value stock of FinTechs firms.

Based on the above arguments, we propose the following hypothesis:

H1. There is a positive association between disclosing CSR information and FinTech's firm value (total market value and BVS)
H2 There is a positive association between the presence of a CSR Committee Board and its size and FinTech's firm value (market value and BVS)

2.3. Sustainability indicators

Sustainability reporting serves to create transparency about the efforts and performance pursued by organisations to contribute to sustainable development (Traxler et al., 2020). A sustainability report should also disclose organisations' values and governance models to drive change to make business activities more sustainable (GRI, 2019).

In order to achieve the sustainable goals set by organisations, firms adopt standardised reporting systems and sustainability indicators by means of a sustainability reports to increase the quality of reporting in accordance with the instrumental perspective (Traxler et al., 2020), and stakeholders' firm vision is positively affected. Corporate management is also interested in how environmental management impacts firms' finances.

In recent years, the rising awareness of ESG issues has resulted in the growth of the agencies that provide standards and score firms' sustainability performance. As a previous section argues, several studies evidence the positive correlation between financial performance improvement (earnings per share and share price) and listed companies' green certification (De Jong et al., 2014), although most of those studies focused on analysing the impact of only one CSR initiative. This is the case of Orzes et al., (2020), who focused on the United Nations Global Compact Initiative (started in 1999), while many studies have employed ISO 14,001 (published in 1996) (Wu et al., 2019; Arocena et al., 2020).

In addition, the aforementioned diverse international sustainable rating systems emerged in the last decade of the 20th century and at the beginning of this century to certify the sustainability level of firms, projects and/or investments.

The pioneering method of sustainability certification was BREEAM (Building Research Establishment Environmental Assessment Method), created by the Building Research Establishment in 1990, which developed a scoring system going from 0 to 100 points (30 points is a "pass", while 85 points or above is an "outstanding" assessment). The BREEAM system, along with LEED (Leadership in Energy and Environmental Design), led the market for certifying buildings' energy efficiency and sustainability. LEED is a non-governmental labelling programme governed by the United States Green Building Council (USGBC), which started certifying in 1998. Its certification process consists of six sustainability pillars: sustainable sites, water efficiency, material and resources, indoor environmental quality, innovative design and energy performance. The certification level varies from "certified" (40 points) to "platinum "(80 points or more) (Brem et al., 2020).

The Global Reporting Initiative (GRI) was founded in 1997 as an international independent standards organisation to identify the global best practice for publicly reporting a range of economic, environmental and social impacts. Sustainability reporting based on standards provides information about an organisation's positive or negative contributions to sustainable development.

Later in 1999, the NABERS (National Australian Built Environment Rating System) rating system was introduced. In the same year, the EPA energy star was launched by the Environmental Protection Agency as the certification programme for buildings and plants in the United States.

In 2000, the Carbon Disclosure Project (CDP) was founded as a not-for-profit charity that runs the global disclosure system for investors, companies, cities, states and regions to manage their environmental impacts. CDP scores companies from A to D for climate change, deforestation and water security.

Next in 2002 came Natural Capital Partners, a private corporation that launched the Carbon Neutral Protocol designed to deliver solutions to clients who were setting net zero emission reduction targets. Later in 2011, the Sustainability Accounting Standards Board (SASB), which acts as an independent not-for-profit organisation, launched its standards to guide the disclosure of financially material sustainability information by companies for their investors.

In 2014, RE 100 was set up as an organisation led by the Climate Group in partnership with CDP for bringing together the world's most influential businesses committed to 100% renewable power.

In the 21st century, four agencies began to design free-access sustainability rankings: Newsweek in press, Corporate Knight (in press), Reputation Institute, the Yahoo Finance Sustainalytics, in press Server. These four institutions score from 1% to 100% (from worse to better) the CSR level of the world's biggest companies on an annual basis, whose scores are included in these rankings: "Green ranking", "RepTrack", "Global 100 most sustainable corporations," and "Finance Yahoo Sustainability", respectively (Alcaide et al., 2020). Accordingly, we propose the following hypotheses:

H3. There is a positive relation between the level of sustainability certification and a FinTech's firm value.
H4. The sustainability profile of FinTechs is a key driver for a firm's value.
H5. A firm's transparency impacts its value.

3. Materials and method

3.1. Description of the variables

Our work focuses on studying the effect of the sustainability profile of FinTech companies on their market value by considering the total MC and the BVS during the 2010–2019 period. The economic-financial variables were obtained from the Eikon database, while data about green certificates and sustainability indices were hand-collected. The Global100 Index was removed from the study because no firm in the sample is indexed in it.

The explanatory variables include sustainability, corporate governance and control variables. Our sample includes the following variables that measure companies' sustainable behaviour:

- *CSR_Rep*: a dummy variable that takes a value of 1 if the company discloses a CSR Report in year *t*, and 0 otherwise.
- *CO2TE*: the total CO_2 emissions (in tons) in year *t*.
- *DuCO2TE*: a dummy variable that takes a value of 1 in year *t* if the company reports its total CO_2 emissions, and 0 otherwise.
- *GRI_Rep*: a dummy variable that takes a value of 1 if the company follows GRI guidelines in year *t*, and 0 otherwise.
- *Green*: a dummy variable that takes a value of 1 if the firm is included in year *t* in the Green Ranking, and 0 if it is not.
- *RepTrak*: the data for this ranking are available only from 2012. This dummy variable takes a value of 1 if the firm is included in year *t* in the CSR RepTrak Ranking for $t>2011$, and 0 otherwise.
- *Yahoo*: a dummy variable that takes a value of 1 if the firm is included in year *t* in the Finance Yahoo Sustainability Ranking, and 0 if it is not. Only the data for 2020 are available and have been extended to the whole study period.
- *Q_Cert*: Number of Green certificates of the Company in year *t*. We consider the following certificates: LEED, BREEAM, Carbon Neutral, EPA Energy Star, NABERS, Carbon Disclosure Project, RE100, SASB and ISO14001.

Secondly, corporate governance variables, such as *CSR_Com* and

BoardSize, were incorporated. *CSR_Com* is a dummy variable that takes a value of 1 when the company has a CSR committee in year *t,* and 0 otherwise. *BoardSize* is a quantitative variable that indicates the number of directors in the board in year *t.*

For the purpose of assessing the economic-financial behaviour of companies, we used the following subrogates: variable *EPS* (earnings per share) is the ratio between earnings and the number of shares of a company. *PER* (price-to-earnings ratio) is a variable that relates the price of a share to the earnings per share of a company. In addition, we proxied firm size by the natural logarithm of total assets (*SIZE*) following studies like Clarkson et al., (2008), Andrikopoulos and Kriklani (2013), Iatridis (2013) or Córdova et al., (2018), Ok and Kim (2019) amongst others, for facilitating its handling and statistical comparison by reducing heteroscedasticity problems. Regarding the firm's economic-financial structure, we considered two independent variables: financial performance (*ROE)* and leverage (*LEV)*. ROE was calculated as the net income over total equity, while the LEV of a company was obtained as total debt divided by total equity. We also considered the variable sales per employee of a company (*Sales_Emp)*, calculated as total sales divided by all the employees of company *i* in year *t*. With the characteristics of these control variables, we expected those companies with less debt and higher profits, size, profitability and sales values per employee to obtain higher MC.

3.2. The sample

The sample included the main FinTech sector companies, which were identified from three reference indices. Thus 49 FinTech companies were identified from the KBW and Nasdaq FinTech (KFTX) Indices and 51 companies from the NASDAQ Insurance index (IXIS). Three non-listed companies were discarded from the sample, along with two firms with double quotes. Companies' diversity is manifested by their age as they were set up after an average of 44 years, with a minimum of 4 and a maximum of 179 years. The final sample comprised 95 firms for a 10-year period (2010–2019) with 950 observations. However, there were no complete data available for some variables and years, and the sample was an unbalanced panel. Table 2 shows the descriptive statistics of the studied variables (Table 1).

In short, more than 80% of the companies in the sample report information about their MC, with more than 85% for *BVS*. The average board size goes up to 10.54 members, although only slightly more than 45% report information about this, as they do for the CSR report. In the sample, 12% of the companies have a CSR Committee and 16% issue a CSR report or include detailed information in their annual report. However, only 4% of the firms in the sample follow GRI when reporting CSR information.

On CO_2 emissions, only 70 firms report them. Hence we subsequently replaced this with a dummy variable. More than 32% of the rankings are included in at least one of the three analysed sustainability indices. Note that most are represented in Finance Yahoo Sustainability, and only 2% and 1% respectively appear in the Green Ranking and CSR RepTrak. Approximately 57% of the firms are certified by at least one green certificate.

By paying attention to economic-financial variables, EPS gives a very low result due to the large number of total common shares outstanding, with an average of 187 million. FinTech companies are growing (Ignatyuk et al., 2020), which supports the PER and ROE averages. Although the high average PER value may indicate that these companies are overvalued, both the context and economic situation would indicate that investors estimate that these companies' profits will rise in forthcoming years. However, the variance of these companies is very wide. Financial profitability is consistent because, despite having negative average data, they would be supported by those positive expectations that, according to the PER, the market seems to expect from these companies. It should also be noted that, on average, total debts exceeds equity by more than 3-fold. *SalesEmp* indicates that, on average, total sales represent more than 26% of the average number of the employees in these companies.

Regarding the correlation between variables (Table 3), we observed an expected behaviour. Only in two cases did the correlation exceed 60% for the dependent variables BVS and EPS, and also for CSR and GRI reports. These expected results would be determined by the few observations that report environmental information, but would not prevent these variables being included bin the econometric model. However, multicollinearity problems were checked with variance inflation factors (VIFs), as reported in the next section.

Table 1
Descriptive variables.

Variable	Description	Source
MC	Market capitalisation	EIKON
BVS	Book Value per Share	EIKON
CSR_Rep	CSR report in the company	EIKON
CO2TE	Total CO_2 emissions (in tons) in year t	EIKON
DuCO2TE	Dummy of the total $C0_2$	Computed from Eikon
GRI_Report	GRI report in the company	EIKON
Green	Dummy of Green Ranking	Hand-collected from Green Rank
RepTrak	Dummy of CSR Rep Track	Hand-collected from Rep Track
Yahoo	Dummy of Finance Yahoo Ranking	Hand-collected from Yahoo Rank
Q_Cert	Number of green certificates per company	Computed
CSR_Com	CSR Committee in the company	Computed from EIKON
BoardSize	Size of the Board of Directors	EIKON
EPS	Earnings per share	Computed from EIKON
PER	Price-to-earnings ratio	Computed from EIKON
ROE	Net income of total equity	Computed from EIKON
SIZE	Natural logarithm of total assets	Computed from EIKON
LEV	Total liabilities to total equity	Computed from EIKON
Sales_Emp	Sales of total employees	Computed from EIKON

Table 2
Descriptive statistics.

Variables	Obs	Mean	S.D.	Min	Max
MC	765	11,389.05	31,403.94	1.18	405,365.70
BVS	822	24.10	54.64	-33.52	585.32
CSR_Rep	430	0.16	0.37	0.00	1.00
CO2TE	70	102,549.00	117,850.40	5617.00	499,902.00
GRI_Rep	950	0.04	0.19	0.00	1.00
Green	950	0.02	0.14	0.00	1.00
RepTrak	950	0.01	0.08	0.00	1.00
Yahoo	950	0.32	0.47	0.00	1.00
Q_Cert	950	0.57	1.35	0.00	7.00
CSR_Com	950	0.12	0.33	0.00	1.00
BoardSize	430	10.54	3.76	1.00	36.00
EPS	820	0.00	0.00	0.00	0.00
PER	838	94.11	1630.81	-854.82	46,785.80
ROE	831	-0.21	7.36	-208.68	6.54
SIZE	836	7.71	2.09	-2.59	12.53
LEV	833	3.16	13.37	-222.73	218.35
Sales_Emp	684	1.26	3.70	0.00	68.38

Source: the authors.

Table 3
Correlations Matrix. * For the 5% significance level.

	MC			*BVS*		
Dummies	*obs 0*	*obs 1*	*Z*	*obs 0*	*obs 1*	*Z*
CSR_Rep	360	68	-9.3420***	362	68	-0.7010
DuCO2TE	695	70	-11.5170***	752	70	-1.8010*
GRI	731	34	-8.0610***	788	34	2.7260***
Green	750	15	-2.7130***	806	16	-1.1800
RepTrak	759	6	0.3710	816	6	-2.8560***
Yahoo	520	245	-1.8430*	558	264	-4.5520***
CSR_Com	649	116	-12.3110***	706	116	-0.4560

Source: the authors.

Here we took the total CO_2 emissions level as a dummy. We also ran a non-parametric test to check whether there were significant differences between the companies that disclose environmental information or are included in a green ranking and those that are not.

Table 4 shows the Wilcoxon rank-sum (Mann-Whitney) test results for the two studied dependent variables. Note that we ran a non-parametric test because the behaviour of the variables did not follow normal distribution, which is verified both visually with histograms and statistically with the Shapiro-Wilk W test. In addition, their variances were not homogeneous and the combination of the different group sizes and heteroscedasticity can negatively affect the consistency of the results. Therefore, this non-parametric test was directly used. Regarding MC, except for the CSR RepTrak Ranking, all the variables showed significant differences between groups. The *BVS* results evidenced relevant differences in all the variables, except for *CSR_Rep, Green* and *CSR_Com*.

3.3. Dynamic and static panel data model

The methodology applied in this paper is based on the dynamic and static linear panel data models computed in the Stata software. Panel data offer the possibility of controlling certain unobserved characteristics of selected companies and present several advantages over cross-sectional data. As Arellano and Bover (1990) or Hsiao (2007) point out, such models improve the efficiency of econometric estimates by containing more degrees of freedom and wide variability of samples. This allows a better control of the complexity of the each unit's behaviour and reduces measurement errors when there are several observations for one company.

The main objective of using panel data models is to capture the non-observable heterogeneity that affects variations in sustainability promotion (Cormier et al., 2005), and cannot be detected with temporal series or cross-sectional studies. For this reason, and as Cormier et al., (2005) began analysing environmental disclosure using panel data to test their respective hypotheses, panel data frequently come over in the previous literature (Carnevale et al., 2012; Córdova et al., 2018; Birindelli et al., 2019).

CSR data are characterised by the particularity of presenting endogeneity. In our sample, the Hausman's test results, ratified by the Ramsey test, confirmed the existence of endogeneity. Therefore, we used the GMM estimation of system of equations (GMM-SYS) by controlling endogenous variables using their differences and levels as instruments. We included the first delay of the dependent variable as an explanatory variable (Arellano and Bover, 1995).

Different regressions are performed with a robust estimation and a two-step option to improve efficiency, avoid any estimation bias and overcome possible heteroscedasticity problems, as initially confirmed by Breusch-Pagan's Test. The Sargan Test (1958) analyses the validity of the instruments used to confirm whether the applied over-identification restrictions are valid in all cases (Roodman, 2009). With the Arellano-Bond test, we checked the first- and second-order autocorrelations to guarantee that there were no autocorrelation problems in the models. If the aforementioned tests provided adequate results, we assumed that endogeneity had been removed from the models.

In our study, the dependent variable took two definitions: a company's MC and BVS. The independent variables were those previously defined, plus the first lag of the dependent variable. The GMM system model and all the statistical tests were estimated for the two dependent variables (Models 1 and 2).

The GMM System models come as:

$$Y_{it} = \beta_0 + \beta_1 Y_{it-1} + \beta_2 CSR\_Rep_{it} + \beta_3 DuCO2TE_{it} + \beta_4 GRI\_Rep_{it} + \beta_5 Green_{it} + \beta_6 RepTrack_{it} + \beta_7 Q\_Cert_{it} + \beta_8 CSR\_Com_{it} + \beta_9 BoardSize_{it} + \beta_{10} EPS_{it} + \beta_{11} PER_{it} + \beta_{12} ROE_{it} + \beta_{13} SIZE_{it} + \beta_{14} LEV_{it} + \beta_{15} Sales\_Emp_{it} + YEAR_{2010-2019} + \varepsilon_{it}$$

where Y_{it} is the dependent variable for company i in year t, Y_{it-1} is the first lag of the dependent variable, and $\varepsilon_{it} = \mu_i + \vartheta_{it}$ is the random error term for company i at time t, and is composed of two orthogonal components: μ_i (the combined effect varies between companies and periods of time) and ϑ_{it} (individual effect, which is characteristic of the company). The inclusion of year dummy variables prevents more delays being included in the GMM System model and avoids over-identification problems.

Furthermore, we performed an additional model, which was run by taking *CO2total* to be a quantitative variable. In this case, the relation between the number of companies and instruments generated an over-identification problem that prevented its analysis with dynamic panels. Following the recommendation of Roodman (2009), we performed the estimation using static panel data models. We corrected autocorrelation and heteroscedasticity problems with a robust estimation of regressions (Models 3 and 4) using the Panel Corrected Standard Errors (PCSE) Static technique (Beck and Katz, 1995; Bailey and Katz, 2011).

It is noteworthy that as none of the resulting VIFs exceeded 10 in any regression, multicollinearity was not considered to pose a serious problem. According to the correlation matrix, any Pearson's correlation coefficient exceeded 0.5, except, and as mentioned earlier, between BVS and EPS, and also between CSR and GRI reports

We dealt with outliers by different approaches. Firstly, robustness tests were carried out by replicating the four models with winsorisation in both tails of 1% of all the (dependent and independent) variables as extreme values were detected in some of them. The (unreported) results are consistent with those reported in Tables 5 and 6. Regressions retained their joint significance and maintained both the sign and relevance of all the variables in all the estimated models.

The sample was an unbalanced panel. In particular, 2010 and 2011 were the years with the fewest observations, which was why we replicated the analysis after discarding these two years. We verified that all the models maintained their joint significance. As some companies came from a merger, we checked if the models maintained their significance by discarding those companies for the years before the merger when they operated as individual companies. The results were the same in all the variables and models.

Finally, additional robustness tests were performed by considering alternative definitions for some independent variables: *SIZE*, measured as the natural logarithm of MC only in the models with dependent variable *BVPS; LEV*, measured as total liabilities divided by total assets. The unreported results of the four models maintained their joint significance with no substantial significance for the estimated coefficients or for the sign of their estimated effects.

4. Results and discussion

4.1. Total sample

Table 5 shows the results of the estimation using the GMM System of the models for MC (MC, model 1) and the BVS (Model 2). Note that in all cases, the results of the robustness tests confirmed that the over-identification restrictions (Sargan test), the autocorrelation of

Table 4
Wilcoxon rank-sum (Mann-Whitney) test. *, *** For the 10% and the 1% significance level, respectively.

	MC	BVS	CSR_Rep	CO2TE	GRI	Green	RepTrak	Yahoo	Q_Cert	CSR_Com	BoardSize	EPS	PER	ROE	SIZE	LEV	Sales_Emp
MC	–																
BVS	-0.0319	–															
CSR_Rep	0.3134*	-0.0453	–														
CO2TE	-0.0086	0.0410	0.1654	–													
GRI	0.2987*	-0.0547	0.6761*	0.1209	–												
Green	0.2315*	-0.0181	-0.0021	-0.0641	0.0534	–											
RepTrak	0.0923*	0.0128	0.0244	-0.0378	0.0562	0.3682*	–										
Yahoo	0.0489	0.1307*	-0.0354	-0.3099*	0.0642*	0.2103*	0.1174*	–									
Q_Cert	0.6304*	-0.0686*	0.5284*	-0.1125	0.5164*	0.1294*	0.0353	-0.0210	–								
CSR_Com	0.2926*	-0.0559	0.4977*	0.2159	0.4474*	0.0615	0.0109	0.0095	0.4415*	–							
BoardSize	0.2266*	0.0702	0.2735*	0.3103*	0.0817	0.0036	0.0312	0.1180*	0.1564*	0.2849*	–						
EPS	0.1098*	0.7108*	0.0938	-0.1865	0.0840*	0.0218	-0.0048	0.1439*	0.1042*	0.1225*	0.1483*	–					
PER	-0.0150	-0.0010	-0.0297	0.1478	-0.0091	-0.0061	0.0016	0.0568	-0.0187	-0.0175	-0.0548	-0.0227	–				
ROE	0.0246	0.0184	0.0795	-0.1068	0.0184	0.0078	0.0033	0.0227	0.0288	0.0210	0.0711	0.0336	0.0019	–			
SIZE	0.4217*	0.2813*	0.3458*	0.2548*	0.1762*	0.0714*	0.0404	0.0248	0.4262*	0.3584*	0.3930*	0.2992*	-0.0006	0.0998*	–		
LEV	-0.0070	0.0331	0.1059*	-0.1052	0.0004	-0.0160	-0.0021	-0.0384	-0.0021	0.0012	0.0349	-0.0147	-0.0001	-0.4791*	-0.0148	–	
Sales_Emp	-0.0430	0.0587	-0.0757	-0.3529*	-0.0494	-0.0022	-0.0069	-0.0815*	-0.0777*	-0.0749	-0.0574	-0.0065	-0.0025	-0.0042	0.0045	0.0197	–

Source: the authors.

Table 5
Empirical results per CO_2 emissions in the GMM model.

	GMM regressions			
Explanatory variables	*(1)Market Capitalisation*		*(2)Book Value Per Share*	
	Coef.	*z*	*Coef.*	*z*
L1	0.93	49.46***	0.85	18.92***
CSR_Rep	4872.96	2.70***	1.10	1.23
DuCO2TE	1483.25	0.82	-1.18	-1.15
GRI_Rept	1431.77	0.39	-1.58	-1.10
Green	-5245.25	-1.91*	-0.22	-0.35
RepTrak	56,754.61	20.64***	-0.57	-1.04
Q_Cert	-2386.62	-2.30**	-0.98	-1.71*
CSR_Com	3828.18	1.16	0.34	0.43
BoardSize	662.58	1.95*	0.33	0.95
EPS	-7,354,742.00	-0.05	-173,779.80	-0.94
PER	-0.06	-0.21	0.00	-1.25
ROE	718.64	0.69	4.41	2.04**
SIZE	4400.31	1.77*	7.60	3.18***
LEV	-189.06	-0.93	-0.74	-2.01**
Sales_Emp	-121.7588	-0.38	0.29	1.05
YEAR	YES		YES	
Obs/groups	313/64		317/65	
Wald *(chi2)*	22,103.31***		591.30***	

*, **, *** For the 10%, 5% and 1% significance level, respectively.
Source: The authors.

residuals (Arellano-Bond test) and endogeneity avoidance were guaranteed. In all the estimated regressions, there were fewer instruments than the number of companies. Note also that the first lag of MC and BVPS was positively significant in Models 1 and 2 (Table 5), which evidences that FinTech companies' MC and BVS were directly related to their values in the previous year (L1). This justifies including the variable in this study.

By firstly paying attention to the considered sustainability variables, MC (Model 1) evidenced more significant factors than BVS (Model 2). Specifically, a CSR report and the position in the CSR RepTrak significantly increased MC. In line with Clarkson et al., (2008), Iatridis (2013), Krishnamurtia and Velayuthamn (2017), Córdova et al., (2018) and Birindelli et al., (2019), the companies that published a CSR report had a more sustainable profile and, as expected, the market positively reacted to that profile according to our results. Therefore, we can accept Hypothesis 1. On the contrary, the number of green certificates and, particularly, their position in the Green Ranking, were unexpectedly negative drivers of MC. Regarding BVS, only the number of green certificates obtained the same significant result. Thus we reject Hypothesis

Table 6
Empirical results per certificates and rankings in the PCSE model.

	PCSE regressions			
Explanatory variables	*(3)Market Capitalisation*		*(4)Book Value Per Share*	
	Coef.	***z***	***Coef.***	***z***
CSR_Rep	-12,852.73	-1.14	3.37	1.38
CO2TE	0.08	1.98**	0.00	2.77***
GRI_Rep	39,121.81	2.98***	-6.02	-2.11**
Green	63,282.11	2.07**	-5.66	-1.67*
RepTrak	42,595.66	0.80	0.61	0.13
Q_Cert	2595.26	0.78	-2.11	-2.68***
CSR_Com	-42,493.26	-3.41***	6.90	2.30**
BoardSize	-11,866.54	-4.16***	0.73	1.36
EPS	-2,030,000,000.00	-0.87	-806,035.50	-0.95
PER	-151.31	-1.27	0.03	1.24
ROE	24,789.67	3.89***	-4.66	-2.36*
SIZE	15,814.32	3.54***	-1.71	-1.50
LEV	-4471.21	-4.65***	0.70	2.41**
Sales_Emp	88,566.26	5.80***	15.12	3.80***
YEAR	YES		YES	
Obs/groups	69/13		69/13	
R-squared (within)	0.6778		0.8026	
Wald *(chi2)*	101.26***		346.11***	

*, **, *** For the 10&, 5& and 1% significance level, respectively.
Source: The authors.

3. This result would show the agency problem (Friedman, 1970), whereby companies with higher MC would be less motivated to obtain green certificates or enter sustainability rankings (Andrikopoulos and Kriklani, 2013; Alberici and Querci, 2016; Birindelli et al., 2019), as pointed out by Tauringana and Chithambo (2015), Birindelli et al., (2019) and Scholtens and Klooster (2019). Nevertheless, as RepTrak evidenced a positive relation, this could indicate that this ranking was better valued by investors or large companies more strongly influenced it. In relation to corporate governance variables, only the number of board members was evidenced as being positively and significantly related to MC. Thus we can partially accept Hypothesis 2.

Our results evidenced that the market value of FinTech companies is driven by the selected sustainability indicators. Thus we can accept Hypothesis 4. Companies' financial performance is a key factor for their value. Particularly, form size is a positive significant factor in MC and BVS. This positive relation indicates that the largest companies had a higher value on average. In line with the literature, our results support the notion that larger companies have a significantly more sustainable profile (Clarkson et al., 2008; Andrikopoulos and Kriklani, 2013; Iatridis, 2013; Zorio et al., 2015; Alberici and Querci, 2016; Córdova et al., 2018).

Finally, return on equity and leverage did not evidence any significant relation to MC, while they were positive and negative drivers, respectively, of BVS. As expected, the most profitable and least indebted companies increased the market value (Córdova et al., 2018; Feng et al., 2018; Ok and Kim, 2019).

4.2. *Most transparent companies*

Table 6 shows the results of the estimations with the proposed model using the PCSE technique for the most transparent companies, and by taking into account that the expected reduction in observations would be greater as this method used their differences and levels as instruments (Difference and GMM System).

We considered that reporting information about total CO_2 emissions was a proxy of transparency (Córdova et al., 2018). Thus our results evidenced a significant difference in the drivers of market value when comparing the most transparent companies to the total sample. Unlike the results for the whole sample, the most transparent companies evidenced a positive relation between information on total CO_2 emissions and the market value for both MC and BVS. Hence we can accept Hypothesis 5.

Both dependent variables showed a significant relation to the numerous considered independent variables but, surprisingly, the direction of the effect evidenced for BVS (Model 4) was the opposite to that of MC (Model 3). With a view to discuss the obtained results, we had to consider that MC captures a company's market position and investors' interests, while BVS is related to a firm's net asset's value on a per-share basis by stating a minimum acceptable market price for shares.

As regards the CSR variables, following the Global Reporting Initiative (GRI) was positively related to MC, but negatively to BVS. The same occurred for the Green Ranking position. In addition, the number of green certificates (LEED, BREEAM, Carbon Neutral, EPA Energy Star, NABERS, Carbon Disclosure Project, RE100 and ISO14001) was statistically and negatively associated with BVS. These negative relations observed in Model 4 could be related to the agency theory expressed by Friedman (1970), and in line with Andrikopoulos and Kriklani (2013), Alberici and Querci (2016) and Birindelli et al., (2019), to show that large transparent companies do not make sustainability efforts. Moreover, the positive relations of Model 3 showed the opposite effect, which suggests that the market gives a positive value for companies' sustainability profiles (Clarkson et al., 2008; Iatridis, 2013).

For the corporate governance variables, having a CSR Committee was negatively related to MC (Belkhir et al., 2017) and positively to BVS (Iatridis, 2013). The number of board members was negatively related to MC, unlike the result for the whole sample. Contrarily to Birindelli et al., (2019), this result indicated that in more transparent companies, a larger Board of Directors size would negatively affect companies' MC.

Finally with the financial variables, the MC of the largest companies that were less indebted, more profitable for their shareholders and had a higher sales volume per employee was positively boosted. Of these relationships, only that of size remained in the total sample, which reveals different drivers for more transparent companies. Regarding BVS, size was no longer significant, probably because the most transparent (largest) companies were ones with the highest market value and company size was no longer relevant in this group (Broadstock et al., 2017). Moreover, both return on equity and leverage were conversely related to MC. On the one hand, the agency theory would explain this relation by pointing out that a company's social performance negatively affects its profitability (Andrikopoulos and Kriklani, 2013; Alberici and Querci, 2016; Birindelli et al., 2019). On the other hand, the stakeholder theory indicates that the most indebted companies make their managers take more effective environmental actions (Clarkson et al., 2008; Iatridis, 2013; Birindelli et al., 2019). Only sales per employee maintained that positive relation.

5. Conclusions

The fourth industrial revolution has led to the FinTech industry to emerge. FinTech firms have shaken the financial industry, which has ended with the traditional paradigm of established financial service providers. Its important contribution over the last decade seems to have no end, which is why, in connection with constant technological progress, FinTech companies will have an increasingly important weight in people's daily lives and, as a result, in the economies of countries.

The FinTech industry is composed of a wide range of companies with different maturity profiles, ranging from start-ups to consolidated technological developers. This paper contributes to understand the FinTech industry's sustainability. As far as we know, this is the first study to analyse the sustainability profile of the FinTech industry's main players, and precisely in a context in which governments promote green economy-related strategies.

Our study is in accordance with the stakeholder's theory, which highlights stakeholders' interest in understanding both the social impact and sustainability characteristics of FinTech firms. Our results evidence a positive relation between disclosing CSR information and FinTech's market value/book value. Our results also demonstrate the positive impact of firm size on a firm's sustainable profile in the FinTech industry: the larger firm size is, the closer the relation. However, CSR is not exclusive to large businesses.

Our study also has important practical and governance implications. Firstly, our results support the agency problem as sustainable firms' efforts diminish for the FinTech firms with largest MC; shareholders' short-term financial appetite might undervalue ESG firms' strategy and its impact on long-term value creation. Secondly, CSR Committee size differently impacts the FinTech industry: for the most transparent companies, a larger Board of Directors size negatively affects their market value, but positively impact the BVS; conversely for industry as a whole, CSR Committee size has a positive impact by turning CSR governance efforts into a tangible benefit for a firm's market value. Hence we recommend future research analysing the firm's transparency concept, which has been conceptualised in this study using CO_2 emissions metrics.

Thirdly, a FinTech firm's value is driven by sustainability indicators, such as rankings or green certificates, but also by economic-financial factors. The two parameters that explain a firm's value creation in FinTech industry, namely MC and BSV creation, are explained by different variables. This fact is especially interesting for future research. Inclusion in the Green Ranking and in the RepTrak negatively and positively affect MC, which is particularly remarkable for the FinTech industry as a whole. For more transparent FinTechs, appearing in the Green Ranking increases their market value, but lowers their BSV.

FinTech companies that are more transparent, larger, less indebted, have more profitability for their shareholders and higher sales volume per employee can increase their market value. The characteristics of such transparency, together with the agency and stakeholders' theory, explain the change in the sign of profitability and size, as well as the insignificance of size.

Finally, it would be interesting to identify the different FinTech firm types to analyse if their sustainability profile depends on their business model or if a link exists between the degree of regulation of the countries in which firms operate and their sustainability profile.

Author statement

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Supplementary materials

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