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THE IMPACT OF DIGITAL REVOLUTION ON ENTREPRENEURSHIP AND FINANCIAL SERVICES

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ABSTRACT

In this dissertation, I study how the recent emergence of new technology innovations affects entrepreneurship and financial services industry, affecting the value creation mechanisms.

More specifically, I study how the Fintech initiatives, leveraging on innovation, disintermediate traditional organizations such as financial institutions, leading to the emergence of alternative financing for business initiatives, or collaborate with them, leading to the creation of new business models.

The first paper aims to increase our theoretical understanding of the driving forces behind the success and volatility of digital currencies. More specifically, I demonstrate that the success and volatility of digital currencies depends on their business type and on their technology type. I find strong complementarities between digital currencies that are related to a platform business model and are based on their own blockchain technology, which make them to outperform others over time on several value dimensions.

In the second paper I argue, and empirically show, that the entry of digital platforms into the financial industry acts as a trigger for the incumbents' business model transformation. There is a connection between resource (mis)allocation and the market value of diversified firms, and this issue have been greatly studied in banking literature: despite expected benefits from economies of scope the literature suggests and largely show a diversification discount. What is pretty new is that I argue that the complementarities that arise should not be seen on the basis of classic management literature (supply side) but on the basis of the network effects. Through a demand perspective the investment in the Fintech business create value for the users, that's why I will expect a diversification premium, rather than a discount.

My results confirm that diversified firms trade at discounts compared to a portfolio of comparable single segments, if is adopted an asset perspective, while using an income- based approach the diversification conducts to a premium. Moreover, I argue that, if financial conglomerates diversify their activities into FinTech businesses, the results change, or at least are moderated. The market attributes value to the growth opportunities and the risk reduction associated with Fintech, and rewards financial institutions that are transforming themselves into platform-based, digital banking ecosystems.

In the last chapter of this thesis I move to the concepts of price and value, to test if the market methods, after the financial crisis, are reliable to estimate companies' value. It is a widespread belief that the free negotiation of shares in financial markets originates prices that correctly represent, at least in terms of trends, the value of companies. In fact, analysts and practitioners, through so-called "multipliers", determine the value of the companies according to parameters in significant part related to prices marked by other securities companies, deemed "comparables". This paper aims to show that only criteria solidly based on the analysis of fundamentals and scenario, sector and business perspectives, can correctly lead to full appreciation of value.

Through an empirical analysis with an international focus I also highlight that liquidity and governance affects the value of the multipliers, leading to misvaluation of companies in some unsubstantiated cases.

Chapters

1) **TWO SIDES OF THE SAME COIN? DECENTRALIZED VERSUS PROPRIETARY BLOCKCHAINS AND THE PERFORMANCE OF DIGITAL CURRENCIES**

   Authors: Cennamo Carmelo– Copenaghen Business School, Marchesi Cecilia – Bocconi University, Meyer Tim – Bocconi University

2) **DIVERSIFICATION IN FINTECH ACTIVITIES: A DEMAND BASED VIEW**

   Authors: Marchesi Cecilia – Bocconi University

3) **MARKET VALUE VS INTRINSIC VALUE. DOES LIQUIDITY MATTER?**

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TWO SIDES OF THE SAME COIN? DECENTRALIZED VERSUS PROPRIETARY BLOCKCHAINS AND THE PERFORMANCE OF DIGITAL CURRENCIES.

Over the past years, the increasing usage of blockchain technology for various applications has received increasing attention both from academics and practitioners. The most prominent application for this technology to date are digital currencies. While some of these digital currencies have had unprecedented success, others have been subject to strong volatility and at times failure, which has led to frustration among investors and users alike. In this paper, we aim to increase our theoretical understanding of the driving forces behind the success and volatility of digital currencies. We use a detailed dataset of 335 digital currencies for our explorative analysis and identify some of the key factors that can explain the performance of digital currencies. More specifically, we find that the success and volatility of digital currencies depends on their business type (i.e. whether their business is based on a platform or not) and on their technology type (i.e. whether they are based on their own specialized blockchain technology or on a third-party blockchain technology). We uncover strong complementarities between digital currencies that are related to a platform business model and are based on their own blockchain technology, which make them to outperform others over time on several value dimensions.

"This innovation is more substantial then the internet. The blockchain is going to have an even larger impact." – Brock Pierce, Director of the Bitcoin Foundation

INTRODUCTION

In 2018, *Helbiz*, a peer-to-peer mobility service startup, was able to raise about $40 million from anonymous investors by launching a digital currency through an Initial Coin Offering (ICO) and, in less than a year, successfully launched its peer-to-peer mobility platform, offering a range of services that will soon include also flying taxi drones. This is not an isolated case; ICOs, and the associated digital currencies[1], have emerged in recent years as a new mode of funding business venture initiatives, in alternative to the traditional investor-mediated capital markets (e.g., IPOs, venture capitals…) (e.g., Garratt and van Oordt 2018; Malinova and Park 2018). The relevance of ICOs as a phenomenon is well reflected in the numbers. It is estimated that until 2017 included, ICOs raised as much as $6.2 billion around the world[2]; the total market capitalization of cryptocurrencies in 2018 is estimated at $211 billion[3]. Venture capitalists invested $3.9 billion in blockchain and crypto companies in 2018[4], whereas, well-known crowdfunding portals, such as Kickstarter and Crowdcube, raised a total of $3.4 billion and $483 million, respectively.

What is distinctive about this phenomenon is that ICOs rely on a digital, decentralized technology, the blockchain, that allows users to exchange assets directly and anonymously and with no intermediaries. As per the opening quote by Brock Pierce, director of the Bitcoin Foundation, there is a shared belief that the blockchain is a revolutionary digital technology that will transform the way firms and users transact, and possibly, the way firms create value. For instance, ICOs can enable startups to raise large amounts of funding while limiting compliance and intermediary costs (Kaal & Dell' Erba, 2018; Sameeh,2018). Also, the creation of digital currencies in an ICO allows funders to create a secondary market for their investments, offering a liquid asset that is, substantially, separated from the underlying business. These benefits explain why startups, as well as large firms, are increasingly embracing ICOs and conducting activities via blockchains.

[1] In this paper, we use the term "digital currency" in a broad sense to refer to any type of digital asset that relies on blockchain technology and can be exchanged for other fiat or digital currencies on digital marketplaces. In our paper, the term "digital currency" does not imply any particular intended usage. As will be explained in more detail below, we divide digital currencies into "coins", which are based on their own blockchain technology and can operate independently, and "tokens" which depend on another party's blockchain technology to operate.
[2] CoinSchedule (2018)
[3] CoinMarketCap, All Cryptocurrencies (October 2018)
[4] Diar, Volume 2, Issue 39, Venture Capital Firms Go Deep and Wide with Blockchain Investments (October 2018)

However, because of the decentralized nature of the blockchain technology, companies can have little control and influence over the system, hence, limited ability to directly coordinate transactions and steer the value of their digital currencies (and assets). How do firms then leverage the blockchain and ICOs to raise money and grow the underlying value of the digital currency over time?

ICO projects can use existing or custom made blockchain networks. Most projects use existing distributed ledger technologies, like Ethereum, which is the leader blockchain platform network offering standardized tools for creating ICOs. Through interviews with professional operators[5], we discovered that companies decide to create a digital currency linked to an existing blockchain because it gives access to a large network of users and is faster and cheaper than creating a proprietary blockchain *ex novo*[6]. Instead, when creating their own blockchain, companies need to create a network, attract "miners" (independent actors responsible for clearing transactions in the blockchain market) and pay for transaction confirmation; a complex process that can take several months to setup and require specialized, technical skills, network orchestration skills (to rally and coordinate multiple actors around the network), and substantive financial resources. We discovered through our interviews that companies may want to create their own blockchain because they can have more flexibility to design it around their core offerings for their specific

[5] We had an interview with Stefano Ciravegna, CEO of Babylonia, a crypto exchange based in Singapore, and Chief Strategy Officer (CSO) of Helbiz. Thanks to his daily experience with companies that are or want to be listed exchange we were able to collect very specific informations about the factors that companies really consider to make their ICO successful and how they deal with the strategic choice of the creation or not of an own blockchain. We interviewed also Angelo Fasola, founder/chief executive officer of TrustMeUp, a platform of fundraising, that explained us the key role of their blockchain in their social funding project.

[6] The process behind the creation of a token on Ethereum is very straightforward and a token can be created within 20 minutes. The code can be downloaded from Ethereum's website and then easily adapted along some parameters such as the total amount of tokens, how fast a block gets mined, and whether to implement a possibility to freeze the contracts in case of emergency (e.g., a hack). (Momtaz 2018).

business purposes, and for controlling and leveraging the data flow on the network; a critical aspect to enhance the quality and value of the core offerings and, most importantly, to coordinate actors and facilitate the emergence of complementary products and services by third-party firms.

While some of these aspects are peculiar to ICOs, the core strategic dilemma of leveraging the network and standardized tools of a third-party blockchain platform or building a proprietary specialized blockchain reminds of the classical trade-offs between technology systems with high degrees of modularity and those with "synergistic specificity" (i.e., with integrated, system-specific components) (Schilling 2000). In fact, this trade-off is becoming increasingly at the core of the strategic challenges that firms face in the wake of digital transformation across a number of sectors and emerging digital markets. With the increased digitization of the economy, we observe possibly a paradigm shift in the way firms innovate and manage their products to create greater value for the customer. Digitization brings about increased modularity in and across sectors, which allows disaggregating and reaggregating components in complex solutions by connecting their core products to other firms' products and services (e.g., Baldwin and Clark 2000; Schilling 2000; Yoo et al. 2010). By doing so, firms can extend the range and scope of their product functionalities and create complementarities that enhance the consumption benefits and value for the final customer (Jacobides et al. 2018). Accordingly, firms are now presented with the challenges of how to connect their core offerings to other firms' offerings, within and beyond their core operating sector (Parker et al. 2017). Essentially, firms can either design their own specific technological infrastructures to facilitate this connectivity and shape and contain the complementarities among the connected products and services to create greater value for the customer or leverage standardized technological infrastructures managed by other firms. Both strategies entail tradeoffs and require different management approaches and skills[7] (e.g., Cennamo et al. 2018; Rietveld, Schilling, Bellavitis 2019). The emergence of platform markets and ecosystems across an increasing number of sectors is a manifestation of this broader management paradigm shift ensuing from digitization (e.g., Jacobides et al. 2018; Yoo et al. 2010).

In this study we focus on this core strategic trade-off in the context of ICOs and blockchain technologies. We explore whether and when ICOs projects and their digital currencies built on proprietary blockchain networks can outperform ICOs projects built on third-party blockchain networks. In particular, we are interested in understanding the tradeoffs that firms face in creating value with one or the other option and how they affect performance. Our study relates more closely to the early work on the different business and technology nature of digital currencies (e.g., Amsden & Schweizer 2018; Gans and Halaburda 2015; Halaburda and Sarvary 2016). We expand this body of knowledge by examining digital currencies' performance after the ICO, distinguishing between the type of digital currencies and the type of business model of the issuing firm. In particular, on the technology side, we distinguish between "coins", digital currencies that can operate independently through their own blockchain technology, and "tokens", digital currencies that rely on third-party blockchain infrastructures to operate (Amsden & Schweizer 2018). On the business side, we distinguish between "platform-related" digital currencies, digital currencies that are related to a platform business (a platform on which users can exchange the digital currency for products or services provided by third-parties or engage in peer-to-peer exchanges), and "non-platform-related" digital currencies that are not linked to any such platform business (e.g.,

[7] Network orchestration skills for designing the technological architecture to enable the creation of a market for complementary products and services and governing the relationships with third-parties therein (e.g., Cennamo & Santaló 2019; Rietveld, Schilling, Bellavitis 2019); and product system integration skills for designing products that can best integrate with and leverage third-party technological infrastructures (Boudreau & Jeppesen 2015; Cennamo et al. 2018)

Halaburda 2016). Accounting for this business type distinction is important because the core trade-off we examine can be particularly pronounced for firms that want to create their own platform marketplace business. One the one hand, control over the technology infrastructure is critical to coordinate platform users and might thus require building a custom made, proprietary blockchain. One the other hand, a large network of users is also needed to create value for the platform business; firms can leverage the existing user network of a third-party blockchain to launch and grow their platform business. We believe these are important questions to address to develop knowledge about the distinct mechanisms of value creation of these approaches and the managerial levers that firms have to influence these dynamics. We draw on the results of a longitudinal analysis of 345 digital currencies over a period of 2 years after their launch to find answers to these research questions.

Insert FIGURE 1a and 1b bout here

Initial examination of simple trends from the data reveals that, while tokens seem to reach higher value than coins as the digital currency matures in time (FIGURE 1a), platform-related digital currencies grow much larger in value over time compared to other digital currencies (FIGURE 1b). We discovered that the two types of digital currencies reflect different network effects dynamics and differ systematically in terms of performance. We find that, while leveraging a third-party blockchain network might help initially to successfully launch and grow the value of the currency, the value of these digital currencies (tokens) is also more volatile over time, largely influenced by high variations in the underlying value of the third-party blockchain network they are linked to. In contrast, the value of digital currencies that are related to a platform business grows larger over time and more steadily. We find that this is particularly the case when these currencies are linked to their own blockchain (i.e., for coins). Also, we discovered that users hold more and for longer platform-related digital currencies, and that firms can positively influence the value of these currencies by pricing them more aggressively during the initial phase of the ICO (i.e., through strong "underpricing"). We uncovered some of the mechanisms underlying these findings, advancing some propositions about the distinct value creation dynamics and strategic tradeoffs that firms face when launching their digital currencies on third-party or custom-made blockchains.

Our discovery makes an important contribution to the literature by clarifying the conditions under which to expect complementarities to arise between the type of business and the type of digital currency, revealing a theoretical intersection of demand-based complementarities (in this case, network externalities in the market for digital currencies) and firm-based complementarities (in this case, the type of a firm's business model). Essentially, our big discovery is that, paradoxically, to obtain the promised benefits of decentralized technologies (such as ICOs on blockchains in our context), firms need to centralize part of the technology system to retain control over critical strategic dimensions. The implications of our discovery go beyond our specific research context and might (to a certain degree) explain, for example, why in the context of another decentralized technology, the internet, firms that have built proprietary, centralized platform technology systems on top of the internet infrastructure are those that have captured most of the benefits of this technology. Our findings suggest that we should regard the ICO phenomenon not just in technological terms as an esoteric new digital technology but in light of the possible business paradigm shift that this technology can bring about; a new way for firms to create value. In this regard, this study represents an initial step to develop theory about the (theoretical) distinctiveness of the digital currency market based on decentralized blockchain technologies and how firms can leverage technology and business complementarities in such markets.

In the next section we introduce the blockchain technology and the institutional framework of ICOs; define the two types of digital currencies, coins and tokens, and discuss the main differences, shortly reviewing related existing studies as a way to ground the framing of our discovery. We then present our longitudinal analysis assessing the differential impact of the two types of digital currencies on value and underlying risk. We show a battery of tests, trying to identify the mechanisms behind these relationships. We conclude the article by discussing these mechanisms in the light also of their broader potential implications to other digitizing contexts.

THE ICOs AND DIGITAL CURRENCIES PHENOMENON

Blockchain Technology and Digital Currencies

The digital currency market surpassed the barrier of $100 billion market capitalization (i.e., market price multiplied by the number of existing currency units) in June 2017, reaching the value of $211 billion in 2018.[8] The interest of the economic world in blockchain and 'distributed ledger' technology arose because of the possibilities that this technology is expected to deliver (Yuan & Wang, 2016). In a little less than a decade, blockchain technology has evolved from a by-product of Bitcoin's development to a forecasted $10 trillion market (Stevens, 2018)[9]: blockchain technology diffusion and its entrepreneurial applications increased tremendously, letting new decentralized and ownerless business models to emerge and, in some cases, to replace the need of

[8] CoinMarketCap
[9] Mitch Steves is an analyst at RBC Capital Market: his interview with CNBC is available at https://www.cnbc.com/2018/01/03/one-stock-analysts-10-trillion-bull-case-for-cryptocurrencies.html (2018)

trusted intermediaries. Blockchain could dramatically reduce the cost of transactions and, if adopted widely, reshape the economy (Iansiti & Lakhani, 2017).

Digital currencies rely on blockchain technologies to create a distributed system of certification and integrity on the internet whenever payment transactions occur. This distributed system strikingly contrasts with the case of fiat money, where a central trusted party (namely, the central bank) guarantees the value of national currencies and banknotes (Adhami & Giudici 2018). The phenomenon of digital currencies represents new market organizing principles that blends some of the characteristics of financial assets with the opportunities offered by new digital technologies such as the blockchain. The blockchain is a digital, decentralized, distributed ledger (Pilkington, 2016), a file that records transactions between two parties efficiently and in a verifiable and permanent way[10].

Bitcoin is the first application of blockchain technology, it's a digital asset designed to work as a medium of exchange (Barrdear et al., 2016; Nakamoto 2008); a virtual currency system that eschewed a central authority for issuing currency, transferring ownership and confirming transactions: users can send and receive native tokens, the 'bitcoins', while collectively validating the transactions in a decentralized and transparent way[11]. After Bitcoin, a plethora of digital currencies have been created and dedicated platforms emerged to exchange fiat money into

[10] All network nodes have a copy of the ledger and no one has the sole authority to update it. Blockchains rely on hashing, a cryptographic system to transform any text of any arbitrary length into a theoretically irreversible fixed-length string of numbers and letters (the "hash") to provide security, accuracy, and immutability of the registrations.

[11] The underlying technology is based on a public ledger, the blockchain, shared between participants and a reward mechanism in terms of Bitcoins as an incentive for users to run the transaction network. It relies on cryptography to secure the transactions and to control the creation of additional units of the currency, hence the term 'cryptocurrency' (Vigna & Casey 2015). Bitcoins, and other digital currencies, are generated by a "mining process" that solves a computational puzzle: the first miner that solves the puzzle earns the right to add his block to the blockchain (Decker & Wattenhofer, 2013). Bitcoin's protocol intentionally makes mining increasingly difficult, meaning that gaining control of a majority of the network is prohibitively expensive in term of computational efforts (Eyal & Sirer, 2014).

cryptocurrencies and vice versa. Moreover, hundreds of large companies worldwide accept Bitcoin for their services, including Amazon, Bloomberg, Microsoft, PayPal, Subway, Target, and Tesla[12]. These 'cryptocurrency and blockchain innovations' can be grouped into two categories: new (public) blockchain systems that feature their own blockchain (Ethereum, Peercoin, Zcash), and Apps/Other that exist on additional layers built on top of existing blockchain systems (Counterparty, Augur).[13]

THEORETICAL BACKGROUND

Digital currencies and ICOs

The rise of digital currencies and ICOs as a phenomenon has stimulated an increasing body of academic research. The ICO is a mechanism used by new ventures to raise capital by selling digital currencies to a crowd of investors, without involving any intermediaries. To some extent, ICOs are similar to the more traditional market-based funding mechanism of IPOs as they share the same logic. In both scenarios, the initiators are trying to raise funds and find investors who are willing to invest money in exchange for a stake in the company. Investors on the other hand are attracted by potential profits on their investment. Both ICOs and IPOs therefore differ greatly from the purpose of crowdfunding, where supporters want to realize a specific idea based on minor rewards or early access to a certain product or service (Ahlers et al., 2015; Connelly et al., 2011; Megginson and Weiss, 1991). Compared to other forms of entrepreneurial finance such as crowdfunding or venture capital, liquidity is a defining feature that distinguishes ICOs (Howell, Niessner, and Yermack 2018). In ICOs investors can sell their assets immediately, as they are detached from the

[12] In 2017, the proposal for a Bitcoin ETF investment vehicle that would be easily accessible to retail investors was rejected by the U.S. Securities and Exchange Commission (SEC). Yet, other financial products, such as ETNs (listed in countries such as Sweden that, in contrast to the United States, allowed such issuances) and CFDs (derivative products) that replicate Bitcoin's price performance, are available on the markets by brokers.
[13] CoinMarketCap (2018)

issuing firm and can be traded as standalone assets. Nonetheless, their value partly shapes with the ICO and can be affected by the underlying business of the issuing firm.

Broadly, most of previous empirical work on digital currencies and ICOs focuses on the determinants of a successful ICO, generally assessed as the extent a token is subsequently listed on an exchange (token tradability) and traded actively, and/or the total amount of money raised (Ahlers et al. 2015; Amsden & Schweizer 2018). In an ICO, a tradable token is very important for both investors and venture founders as it enables founders to raise additional funds and investors to monetize their investments. Research on ICOs has been largely confined to explain the characteristics of ICOs and its market; i.e., what it is. However, these studies do not reveal the extent which ICOs and digital currencies differ in their functioning from other funding market mechanisms and the nature of such differences. Missing is an understanding of the managerial implications for entrepreneurs and organizations about what instruments are best suited for the distinct types of organizations, and how to best leverage ICOs. As a first step towards this direction, in our study we focus on the digital currencies' value *after* they become tradable on exchanges, rather than the successful completion of the ICO per se. Thus, we focus on the digital currencies that have already gone through a successful ICO. Some analysis has considered the returns from ICOs. There is however no systematic analysis for instance on the differences, if any, between the distinct types of digital currencies. To the extent that scholars have considered the distinct types of digital currencies, they have tended to emphasize the distinct technical characteristics, and uses. But how does the distinct type of digital currencies impact on the underlying value creation for an entrepreneurial project? Are there systematic differences in the value creation mechanisms between the distinct type of digital currencies? What managerial levers do firms have to influence these dynamics, if any? We believe these are important questions to address if ICOs were to gain managerial relevance to firms, and not be confined only to an esoteric market.

Types of Digital Currencies

Coins vs. Tokens. Digital currencies can be grouped into different categories depending on their characteristics. In terms of the type of technology that they are based on, we can distinguish between coins and tokens. While the terms "coin" and "token" are often used interchangeably, previous literature has increasingly followed a definition that sees them as two different things. For instance, Amsden and Schweizer (2018) base their work on a classification of digital currencies that is derived from the SEC regulation. In this classification, digital currencies are grouped into different categories depending on blockchain technology, legal status and purpose of usage. The categorization that is of most interest for this paper is the one based on blockchain technology, which differentiates between coins and tokens. Therein, a coin is classified as a digital currency that "can operate independently", whereas a token is a digital currency that "depends on another cryptocurrency as a platform to operate". In other words, tokens are based on a third-party's blockchain platform technology connecting to and leveraging an existing network infrastructure, whereas coins are based on a firm's own blockchain that has been developed specifically for the firm's given business purposes. In this paper, we follow the SEC-based classification adopted by Amsden and Schweizer (2018), differentiating our cryptocurrency in coins and tokens, as this is more standard and in line with the categorization of the many databases on ICOs.

Platform- vs. Non-Platform-Related. Digital currencies can also be categorized based on their business type. "Platform-related" digital currencies are primarily designed to support a platform business model (Halaburda, 2016), as a medium that users can exchange for complementary products or services on a specific digital platform[14]. Early examples of platform-related digital currencies include Amazon Coins or Facebook Credits, which can be exchanged for products or services on the respective platform (Halaburda, 2016). Other examples include *Filecoin*, a decentralized storage blockchain platform where the coins (*FIL*) can be earned by hosting files that lie on the unused storage of private hard drives, or *Trust Me Up*, a charity platform where the customers (i.e. donors) receive PassionCoins for their donation that can be spent on selected merchants that join the platform's network.

"Non-platform-related" digital currencies on the other hand are not linked directly to any platform business and are designed as a potential substitute for fiat currencies (Halaburda, 2016; Amsden & Schweizer, 2018). Much like traditional money, they are created to store value over time to allow for trading and exchange among users. Unlike platform-related digital currencies they do not grant any direct access to a specific product or service available on a platform but can rather be thought of as a genuine type of currency; the most prominent example being *Bitcoin*.

It is important to highlight that the two dimensions along which digital currencies can be distinguished (i.e. their technology type and their business type) are independent from one another. In other words, tokens can be either platform-related or not, and coins can be platform-related or not. The effect of different combinations of technology type and business type has not received scholarly attention as yet. But we believe this analytical angle can be very promising as it can reveal the potential tradeoffs and complementarities between technology type and business type, and thus help to understand the performance of digital currencies.

[14] While Halaburda (2016) restricts the term "platform-related" digital currency to only those digital currencies that can be traded *exclusively* on the given platform, we use the term more broadly to refer to any kind of digital currencies that are linked to a platform, including the ones that can be traded both on the platform they are linked to and on online trading marketplaces.

POTENTIAL VALUE CREATION MECHANISMS

We lack theory on the different value creation mechanisms for the different types of digital currencies. Some studies have focused on the interaction between digital currencies and the platforms on which they can be used (Sockin and Xiong 2018, Li and Mann 2018, and Cong, Li and Wang 2018). While informative on many aspects, largely, these studies focus on the differences between launching platform businesses with and without digital currencies. We draw on these studies' insights and our interviews with professionals from the field and analysis of specific cases[15] to identify the possible strategic tradeoffs associated with each type of digital currency, and the potential value creation mechanisms that can be at play. We first discuss the pros and cons of building a custom-made blockchain network versus using a standardized blockchain platform such as Ethereum, and then relate these to the platform versus non-platform business model choice.

Insert TABLE 1 about here

Table 1 summarizes the pros and cons of using an existing or custom-made blockchain network, offering also some stylized examples. Among the main benefits of using a third-party blockchain platform for creating digital currencies are the limited costs in terms of effort, skills and money

[15] We analyzed 5 specific cases (Binance, Filecoin, Helbiz, Musicoin, Trust Me Up) and we integrated our analysis with interviews from three of these cases. We had an interview with Stefano Ciravegna, CEO of Babylonia, a crypto exchange based in Singapore, and Chief Strategy Officer (CSO) of Helbiz. Thanks to his large experience with companies that are or want to be listed, we were able to collect very specific information about the factors that companies really consider when launching their ICO and how they deal with the strategic choice of the creation or not of an own blockchain. We interviewed also Angelo Fasola, founder/chief executive officer of TrustMeUp, who explained to us the key role of their blockchain in their social funding project. We had an interview with Richard Titus, CEO of Ark Advisors, a company that support firms through the tokenization and creation and sale of digital assets and securities, who confirmed that the choice of the cryptocurrency typology, related to the business model of the firm, is critical when a company decide to run an ICO.

required compared to building a custom-made blockchain. In fact, it has been estimated that more than 80% of companies use the Ethereum blockchain platform, which is the market leader, to create their digital currency (EY 2017); the process is standardized and it can take less than 20 minutes to create a digital currency (Momtaz 2018). Because of its highly modular, decentralized structure, such a blockchain system can foster innovation (i.e., the creation of ICOs and new currencies in this case) by decentralizing decision making on "hidden modules" – modules ("blocks" of code in our context) that integrates with the system but work independently of other modules (Baldwin and Clark 2000). Users do not need to coordinate with each other and know how the other parts of the system works to be able to use the system and build their own modular extensions. Thus, modular systems can best respond to and meet heterogenous demands from the market by allowing for the creation of greater variety and configurations of solutions (Schilling 2000). The promised benefits of the blockchain, i.e., greater innovation and value potential, lower transaction costs, lack of centralized control, and "trustworthy" transactions (Kaal and Dell'Erba 2017, Burns and Moro 2018, Ofir and Sadeh 2019), are directly related to the increased modularity of the technology, which allows for independent, diffused and fragmented resources and inputs in the (blockchain) user network to be recombined in an increasing number of possible configurations. In our context, therefore, a large variety of heterogenous digital currencies can be created by leveraging the standardized tools of blockchain platforms such as Ethereum and its network of users, at (relatively) low costs and in large scale. However, there is a downside to its popularity; the blockchain network can be overloaded and congested, with the growing demand raising the cost of Ether and the cost to run ICOs on it. It has been reported that the increasing number of transactions on the Ethereum blockchain are associated with an increase in transaction costs[16] (EY

[16] Each digital currency must be first converted in Ether, the Ethereum digital currency, before it can be exchanged against other digital currencies (e.g., Bitcoin) or dollars; each transaction must be validated by users in the network

2017). Also, because of the standardized and decentralized structure of the blockchain and the public nature of the ledger network, it offers firms very little flexibility over the rules of the blockchain, transactions and control over data. As with any system with high degrees of modularity, its interfaces and core infrastructures need to be kept at a standardized level that guarantees high recombinatorial possibilities through mix and matching of a variety of components and applications (Baldwin and Clark 2000; Constantinides et al. 2018; Schilling 2000; Yoo et al. 2010). This might be problematic for companies that need to customize the blockchain network to their specific business needs. Helbiz, our opening example, is a case in point. They were able to build quickly a network of potential users for their platform leveraging the existing user base on the Ethereum platform. However, while implementing their technological system, Helbiz faced two strong constraints for its business model. The lack of control over data prevented Helbiz from being able to effectively use the blockchain to verify the identity of people using their peer-to-peer system for the mobility services. This was particularly problematic because Helbiz would need that information to allow its technology system to securely unlock another user's car and make it available to the focal user. As in any peer-to-peer system like for instance Airbnb, the information about the identity of the user is critical for guaranteeing trust in the network and incent users to transact. Also, it was not possible for Helbiz to trace the route of the vehicles; only the point of departure and arrival was made available. This created problems in terms of insurance for the

(the miners). With an increasing number of transactions, a larger number of "blocks" need to be created in the network to validate and clear the transaction. This is because each block on Ethereum has a size limit that determines how many transactions can fit in a block. Ethereum can increase the transaction size of blocks but this will require an extra cost because the validation operations will require additional computational steps and thus become computationally more expensive. Accordingly, with an increasing number of transaction demands (e.g., ICOs; currency exchange, network usage, etc…) placed on the network, the costs of such transactions can increase either because greater monetary incentives will be required for miners to validate those transactions timely if the size limit of blocks does not change, or because they become more computationally expensive if the size limit of blocks increases to accommodate for greater demand.

owners of the vehicle and for the company itself, which could not use this information to optimize their vehicles' locating and routing algorithm. Helbiz decided to build its blockchain network to customize it to its needs. While increased modularity may be a substitute for inter-firm coordination mechanisms in terms of the production process, it does not ensure that the objectives of the focal firm (e.g., specific content output and quality; development trajectory of the technology…) are met; coordination in product output might still be highly needed to achieve specific goals (Tiwana 2008). Also, "some product systems achieve their functionality only through optimizing each of the components to work with each other" (Schilling 2000: 316). In other words, parts of the system might still need to be specialized and centralized for the company to be able to better coordinate production and transactions, and enhance value creation opportunities. As advanced by Brusoni, Prencipe and Pavitt (2001), integration of different parts of complex systems and coordination of actors might not happen automatically in decentralized, modular systems; superior information and knowledge over the overall system's functioning is required to best coordinate the actors and activities involved and achieve an optimized system integration. A central actor, or "system integrator", must thus hold control over a core, specialized component of the system, which allows to secure the needed information and knowledge over the system's architecture. In this regard, Filecoin is a counter example of the benefits of control over data and rules offered by proprietary blockchains. Filecoin is a peer-to-peer platform for buying and selling storage space, where the blockchain verifies the transactions between clients and miners, and serves as a record of their legitimacy. Control over the blockchain and the user data allows Filecoin to shape the rules of the blockchain, revert transactions (if needed), modify balances and accordingly guarantee the well-functioning of its platform market. If a customer, for example, needs to modify the data shared and the storage required, and the miner (provider of storage) is not addressing the request after having received the coins, the blockchain administrator can act directly on the nodes that approved the transaction, deleting or modifying it.

The disadvantages of tokens (e.g., particularly the lack of control over the data and the rules of the blockchain) might be more problematic in the case of platform-related cryptocurrencies, where the digital currency is used both as a means to grow the underlying platform business network, and as a means to coordinate interactions in the marketplace associated to the platform business. Platform business models differs from traditional value chain models in that value creation takes place by linking directly the demand side to the supply side rather than focusing on value creation on the supply side only (Massa, Tucci & Afuah, 2017). Massa et al. (2017) argue that value on the demand side can be created by users either through their mere presence – for instance on a platform (see Cennamo & Santaló, 2013) - or if they actively contribute to the innovation process (von Hippel, 2005). Business models are often seen as being essential to connect technologies to the market environment (Chesbrough and Rosenbloom 2002), as they define the business value architecture; i.e., how the configuration of the business activities relates to value creation/capture opportunities on the market. This is particularly relevant in many digital contexts that are characterized by strong network effects and in which the installed user base, as well as the entry time play an essential role in determining which firms will succeed (Schilling, 2002). Sockin and Xiong (2018) highlight that digital currencies[17] have a dual role if they are linked to a platform business: they act as a membership fee to access the platform and as a service fee to compensate miners for providing clearing services on transactions. Because the firm does not control the underlying value of the token, which is linked instead to the third-party blockchain, it can be more difficult to use it effectively as a coordination mechanism to induce greater user

[17] The authors refer to digital currencies as tokens

adoption and greater participation by complement providers. The literature on two-sided platforms has largely documented the importance of pricing for platform adoption and growth (e.g., Evans et al. 2005; Rochet & Tirole, 2006; Parker & Van Alstyne 2005). Cong, Li, and Wang (2018) find that, in fact, there could be potential complementarities between the platform business growth and the associated digital currency's value. They argue that if users expect increases in future popularity of the platform, they are more likely to purchase the related digital currency and join the platform. Increased adoption in turn has a positive feedback effect on digital currency price and ultimately leads to accelerated platform adoption as investors also become customers, and vice versa. The authors also show that platforms with related digital currencies face less volatility in terms of user base than platforms without related digital currencies because of the positive expectations about user base growth in the future[18]. Thus, in the case of positive expectations, the value of the platform business can grow with the value of its associated digital currency, or can decrease in case of negative expectations. However, in the case of tokens, whose value is linked to the value of the blockchain's currency it is based on (e.g., Ethereum), there is not such one-to-one correspondence with the underlying value of the platform business, limiting its ability to act as coordination mechanism for platform adoption. Also, blockchains require that all transactions be verified cryptographically by independent miners that are rewarded for their validation job through digital currencies; this process requires a huge amount of computational energy since each block needs to be validated and can significantly slow down the transactions (Constantinides et al. 2018). This is particularly so on large, third-party blockchain platforms (such as Ethereum) where

[18] Also, according to Li and Mann (2018), ICOs of platform-related digital currencies can help mitigate to some extent the "chicken-and-egg" problem in platform adoption (see e.g., Caillaud and Jullien 2003; Rochet & Tirole 2006). Initial participation of investors in ICOs can signals positive expectations about the future value of the platform business, hence the future value of the currency, and can thus trigger adoption by other users. In other words, the value of the digital currency associated with the platform business will convey relevant information to prospective users of the, possibly, "true" value of the platform business, and can thus shape their expectations about platform growth.

validation rules are standardized independently of the type of transaction, and where a large and heterogenous set of transactions must be validated. Platform-related currencies can thus face a particular severe problem for the growth and scalability of their platform business, which largely relies on increased transactions' volume, such that some authors have raised the concern that scaling platforms on third-party standardized blockchains appears to be seriously challenged (Constantinides et al. 2018). We aim to get a better understanding of the overall possible complementarities between the distinct type of digital currencies (i.e., the diverse technology type they are based upon) and the distinct type of business (platforms vs. non-platforms) and the implications for performance.

METHODS

Data

For our analysis, we used web-scraping techniques to collect data from three sources: *icorating.com, icobench.com* and *coinmarketcap.com*. *Icorating.com* and *icobench.com* collect information related to the initial coin offerings (ICOs) of digital currencies and allowed us to gather data on various characteristics of the digital currencies in our sample, such as their underlying business model, the amount of money they raised during the ICO, the quality of the project idea and founding team (as assessed by experts), and the level of attention that they attracted on relevant social media platforms. Additionally, we gathered information on the daily trading performance of digital currencies over time from *coinmarketcap.com*. An overview over the variables that we use in this paper and their source can be found in TABLE 2.

Insert TABLE 2 about here

The main variables of interest in our analyses are the daily closing value, trading volume and weekly volatility of digital currencies. The daily closing value is the price in US Dollars that users have to pay for one unit of the digital currency and reflects the performance of the digital currency over time. Furthermore, we use the daily trading volume as an indicator of the extent to which users exchange a digital currency for other currencies or vice versa. Finally, the weekly volatility indicates how much the value of a digital currency varies over time and thus reflects the stability of a digital currency's value. Following the theoretical reasoning outlined above, we excluded 10 digital currencies that are marked as "Securities" in the "Type" field on *icorating.com*, as they share some of the characteristics of VC funding or crowdfunding (i.e. the digital currency essentially represents a share of a company) and do not fit into our classification of different business models. Additionally, we also collected information on the digital currencies' age (*AgeInDays*), the amount of money that digital currencies raised during their ICO (*Raised*) and the extent to which digital currencies were initially priced below their market value (*Underpricing*). For a subsample of digital currencies, we were able to collect the variable "*Rating*" from *icobench.com*. These ratings are a combination of an automatic evaluation performed by the website and ratings by experts, which evaluate, for instance, the quality of the product idea and the team behind the currency. From *coinmarketcap.com*, we were able to obtain information on the extent to which a given digital currency was able to attract interest on relevant digital media platforms (*HypeScore*) and on the extent to which its characteristics signal unreliability or even potential fraud (*RiskScore*).

In our analyses, we also control for the daily closing value of the two most prominent digital currencies - *Bitcoin* and *Ethereum* - to account for the potential spillover effect of their performance onto less prominent digital currencies. Summary statistics of our variables grouped by business type can be found in TABLE 3.

Insert TABLE 3 about here

In total, our sample contains information on 335 digital currencies. We restrict our data to the first two years after the launch of a given digital currency. Given the young age of many digital currencies, we do not have the full two years of observations for all digital currencies in our sample. However, it is important to note that we do not have any periods in the life span of digital currencies for which we only have data on one type of digital currencies.

The composition of our sample in terms of business type and technology type can be seen in TABLE 4. Most of the digital currencies are tokens; that is, about 87% in our sample use a third-party blockchain platform (largely Ethereum) instead of custom-made blockchain infrastructures, which is in line with the general trend remarked elsewhere (e.g., EY 2017). However, we do observe an almost even distribution between platform- and non-platform-related cryptocurrencies.

Insert TABLE 4 about here

Analysis

We start with some descriptive analysis to examine potential differences in trends between platform-related and non-platform currencies. In particular, in FIGURE 2, we explore how the weekly volatility of different types of digital currencies evolves as their age increases. The underlying idea is that, if the value of the platform-related currency depends indeed largely on the underlying platform business dynamics, we should expect it to grow over time in tandem with the growth of the platform (for successful platforms), and thus show a more stable path in value. Instead, for non-platform related currencies, we might expect greater volatility, particularly for those directly linked to other currencies, i.e., tokens. We can see from the figure that the volatility of both types of digital currencies initially evolves along the same path. Over time however, the volatility of platform-related digital currencies decreases significantly, while there is no such decrease for non-platform-related digital currencies. This suggests that the value of platform-related digital currencies becomes more and more stable over time compared to the more volatile value of non-platform-related digital currencies.

Insert FIGURE 2 about here

We expect this pattern to be reflected in more quantitative analyses as well. Results of a t-test that compares the volatility of the two types of digital currencies reported in TABLE 5 confirm that the average volatility of platform-related digital currencies is statistically significantly lower than that of non-platform digital currencies. Also, consistent with the value growth's path in FIGURE 1, the results of the t-test show that the closing value of platform-related digital currencies is significantly higher, statistically and economically (in terms of size effect), than the closing value of non-platform currencies. Taken together, these patterns provide preliminary evidence that digital currencies on average can reach higher value and grow more stable in value over time if they are linked to a platform business model, which might suggest that there could be indeed a reinforcing effect (i.e., a virtuous cycle) between the value of the currency and the value of the platform business.

Insert TABLE 5 about here

Our starting assumption in the analysis is that these differences cannot be attributed solely to the different business type, but are driven, at least in part, by the underlying technological characteristics of the digital currency. For instance, we expect the potential reinforcing effect between currency value and platform value to be greater for coins compared to tokens. Since the value of tokens is directly linked to the associated currency of the blockchain platform it is built on, it can be more volatile and disjoint from the underlying platform business dynamics because it is influenced to a large extent by the expectations of the market value of the third-party blockchain platform (e.g., Ethereum) rather than the focal ICO's business. Accordingly, we might expect tokens to be associated to higher volatility and potentially lower closing value on average compared to coins.

We also expect different types of digital currencies to be affected in different ways by the extent to which they manage to attract attention from potential users on relevant digital media platforms. Particularly in the case of platform-related digital currencies, strong user attention might trigger the typical indirect network effects dynamics of platform businesses, where initial hype around the platform by some actors can attract actors on the other side of the platform in a self-reinforcing way and lead to increases in the overall value of the digital currency over time. Instead, these dynamics are not present for non-platform digital currencies. A higher hype score might influence the initial value of the currency but, absent any complementarities between the underlying business and the currency's value, such as the indirect network effects in platform-related currencies that can reinforce users' expectations over time, the initial hype effect around the non-platform digital currency's value can quickly dissipate. In other words, the initial hype around the currency might have a short-lived effect for non-platform currencies and a more long-lasting effect for platform-related currencies because of the reinforcing effect between the user expectations of the currency value and the platform value.

To get a sense of whether these factors can indeed explain the differences that we observed, we run a set of panel regressions to analyze the relationship between our key variables of interest (i.e. *Weekly Volatility*, *Trading Volume* and *Closing Value*) and some of the main characteristics of the digital currency. We regress each of our key variables of interest on *Token*, *HypeScore* and *RiskScore*. Additionally, we add time fixed-effects (γ_t) to control for confounding factors such as differences in the popularity of digital currencies over time (or market volume and liquidity).

$$ClosingValue_{it} = \beta_1 * Token_i + \beta_2 * HypeScore_i + \beta_3 * RiskScore_i + \gamma_t + u_{it}$$

We estimate this model using subsamples that either contain only digital currencies that are related to a platform business model or only non-platform digital currencies[19]. The results of this analysis are presented in TABLE 6. The first two columns show that there is statistically significant negative relationship indeed between token (as opposed to coin) and the currency's closing value. All else equal, for non-platform related currencies, the closing value of tokens is 0.703 USD lower (on average) than that of coins. The coefficient is statistically different from zero. For platform-related currencies, the closing value of tokens is 20.36 USD lower (on average) than that of coins, or 113% lower closing value compared to platform-related coins. This suggests that being tied do a third-party blockchain is particularly harmful in terms of currency's closing value for platform-

[19] One concern might be that observations belonging to the same group might be correlated and require clustered standard errors. However, as shown in Abadie et al (2017), this is not a concern when, as in our case, all clusters are represented in the data instead of only a subset of clusters of the population of clusters. Moreover, clustering adjustment might lead to too conservative and large errors in case of small size samples; Angrist and Pischke (2008) suggest that having fewer than about 50 clusters can result in "biased standard errors and misleading inferences". For the coins group, we only have 20 platform-related and 21 non-platform related coins in our sample, which is well below the suggested threshold value. The small size of the sample is one of the limitations of our analysis.

related digital currencies. We use a seemingly unrelated regression analysis[20] (SUR) to test for statistical significance of the difference in these coefficients across the sub-samples; the analysis confirms the significant differences across the subsamples.

It can also be seen that the hype score of platform-related digital currencies is positively related to their closing value. This suggests that digital currencies that manage to attract attention from users might indeed be able to activate reinforcing (indirect network) effects dynamics. In contrast, in line with our reasoning, we find no systematic relationship between the hype score and the closing value in the case of non-platform-related digital currencies, where indirect network effects are not present. We also find, as reported in columns (3) and (4), that token (i.e., being based on a third-party technological infrastructure) is positively associated with higher weekly volatility of non-platform digital currencies; but there is no effect for cryptocurrencies linked to a platform business model. This effect can be attributed to the fact that these digital currencies are not only affected by changes in their own value, but to a large extent they are influenced by variations in the value of the underlying cryptocurrency linked to the third-party blockchain platform.

Results in the last two columns also indicate that there is a negative relationship between token and the trading volume, and this is much larger in terms of size effect for platform-related digital currencies compared to non-platform currencies (as also confirmed by the explicit comparison test via the SUR analysis). This finding suggests that tokens, in general, are traded less than coins, and this is particularly the case for platform-related business. One explanation for this result is that there might be higher transaction costs associated with tokens, as advanced by some in the industry

[20] This approach simultaneously estimates our two regressions (i.e. the regressions for platform and non-platform currencies) and therefore allows us to compute the covariance matrix between the coefficients from the two regressions (which would be zero in the case of separate estimation). We then test for statistically significant differences between the two coefficients. Results are not reported here but are available from authors upon request.

(EY 2017), that make exchanges more costly and thus less frequent. But this, alone, would not explain why we observe a much larger effect for platform-related currencies. Another possible explanation is that users hold longer their tokens, either as an investment option or as a means of access to the platform network and its services in the case of platform-related currencies, which would explain why we observe a larger effect for these currencies.

Insert TABLE 6 about here

Plausible Underlying Mechanisms.

To get a better sense of the mechanisms behind these results, we ran an extended version of the model described above, in which we added not only the remaining variables of interest, but also their interactions with currency age. This allows us to detect changes in the relationship between performance-related variables and the characteristics of the digital currencies.

Based on the reasoning described above, we expect to see significant differences in how our key variables of interest (i.e., *Daily Closing Value*, *Weekly Volatility* and *Trading Volume*) evolve over time depending on the type of digital currency. In the case of platform-related digital currencies, we assume that to the extent that indirect network effects can take place and reinforce over time as more users adopt the digital currency and more products/services become available on the platform, we should observe lower volatility over time and higher value compared to non-platform-related digital currencies. In other words, if there are complementarities between the type of business, platform business, and the value of the currency in terms of reinforcing feedback effects in this case, we should expect the value of platform-related currencies to grow over time and be more stable. We also expect that the benefits from network effects should be triggered by factors that lead to strong user adoption particularly in the early days of the life of a digital currency. For instance, a high value of *HypeScore* (i.e., a high amount of attention on social media platforms) and strong *Underpricing* (i.e., selling the digital currency below its market value at the time of release) should both have a positive effect on early user adoption and therefore boost particularly the value of platform-related digital currencies.

TABLE 7 shows the results of these tests for *Daily Closing Value* as the dependent variable. Consistent with our previous results, token is negatively related to the daily closing value of digital currencies and the magnitude of this negative relationship is larger for platform-related currencies (the two coefficients are statistically different as confirmed by SUR-based t-test analysis). In principle, an alternative explanation for these results could be that *Token* and *Daily Closing Value* are both driven by systematic differences in other characteristics of the organization behind the digital currency, such as capabilities or resources. For instance, one might argue that less capable organizations create less valuable digital currencies and at the same time lack the capabilities needed to develop their own technological infrastructure. While we cannot fully rule out this alternative explanation, we took some measures that alleviate this concern. More specifically, we included two variables in our model, *Raised* and *Rating*, that control for some of these potential differences. The variable *Raised* measures the amount of money that a given digital currency has raised during the ICO and allows us to rule out, at least in part, concerns that differences in financial resources of the organization behind the digital currency drive both their decision whether or not to develop their own digital infrastructure and also the value of the digital currency. Similarly, *Rating* is a combined “quality” evaluation of factors such as the team behind the digital currency and the product idea, which helps us alleviate concerns that differences in capabilities are the key driver behind differences in technological infrastructure and closing value.

Similar to the figures above, the results also show that the value of platform-related digital currencies increases much more with increasing age than the value of non-platform currencies. Again, we attribute this to the presence of the positive, reinforcing indirect network effects; that is, to the presence of complementarities between the value of the currency and the value of the platform business. Platform-related digital currencies are not merely used for trading purposes but are directly linked to the platform value, which is influenced by the number of users and the amount of products and services available on the platform and exchanged therein. The digital currency, in this case, is both a means to access the platform network, and to exchange products therein. To the extent this is the case, as more users join the platform business network over time, and more products/services become available for it, the value of its associated digital currencies grows.

These indirect network effects dynamics typical of platform business models can also help explain the relationship between underpricing and currency value. Different theoretical models of platform businesses prescribe that firms should "subsidize" (i.e., lower the price even below marginal cost) their users initially to grow the network and activate the reinforcing virtuous circle between their users and complementary service providers. In the case of digital currencies, this can be achieved through the initial underpricing of the currency. For platform-related digital currencies, thus, underpricing should be especially beneficial as it encourages initial adoption of the digital currency by users and can thus activate the network effects that can then self-reinforce over time.

Insert TABLE 7, 8 and 9 about here

In TABLE 8 we report results of the same model estimation when using *Weekly Volatility* as the dependent variable. The results confirm the pattern that emerged from FIGURE 2; as the currency age increases, we see a stronger decrease in volatility of platform-related digital currencies compared to non-platform currencies. Again, we attribute this finding to the stabilizing effect of the platform business that the digital currency is related to. In TABLE 9 we replicate the same model with *Trading Volume* as the dependent variable. It is important to highlight that *Trading Volume* refers to trading in exchange for other digital or fiat currencies and not to trading in exchange for products or services that might be available through a platform. The results confirm that token is negatively related to trading volume, suggesting that tokens are traded much less than coins, and this effect is much larger for platform-related currencies (again, the SUR analysis confirms the statistical significance of the coefficients' difference across the subsamples). As we noticed, two plausible explanations can be in place. First, transactions costs associated with trading tokens are higher and therefore users hold them longer before trading them, in expectation of larger gains in value. While this might be plausible, it would not explain the striking difference between platform-related and non-platform currencies. In particular, we see that the effect over time disappear for non-platform currencies, while it is still present and significantly so (both statistically and economically) for platform-related currencies. We interpret this result as evidence of the second plausible explanation we advanced above: users hold longer their tokens in the case of platform-related currencies possibly to be able to use the platform network and services. Though we might not entirely exclude the possibility that part of the users might in fact hold the currency under the expectation that the platform value, and thus the currency value will grow larger over time, we think that this is less a plausible mechanism. In order for the platform value to grow over time, there must be growth in terms of transactions volume in the platform, such that, at least a substantive portion of users must be active users of the platform.

DISCUSSION

In the previous sections we have presented analyses that help us advance our theoretical understanding of the drivers behind digital currency success. More specifically, we were able to shed some light on the drivers behind differences in the value of digital currencies by grouping digital currencies into different categories depending on their business type and technology type. Our analyses suggest that two factors play an important role in determining the success of digital currencies: the extent to which their business model allows them to benefit from indirect network effects and the extent these dynamics create reinforcing feedback (i.e., the degree of complementarity) between the business model and the underlying technological infrastructure.

Network Effects and Value Creation

The value of digital currencies that are not related to a platform business model is mainly driven by *direct* network effects – the more users adopting the currency, the higher the potential value of the currency. Users often purchase these digital currencies for trading purposes, and the value of the currency is ultimately determined to a large extent by how many other users are interested in buying the currency, in the case of coins, or the collateral currency, in the case of tokens. The value of these digital currencies is therefore not linked directly to the value of any business but depends mostly on trading-related factors. As we discovered, the value of these currencies may change drastically over time (i.e., being much more volatile) following changes in the interest of users for these digital currencies; this is particularly the case for tokens, where the value of the currency is influenced largely by the value of the third-party blockchain it is linked to. Firms, therefore, have little means to influence this value and are dependent to large extent to the value dynamics of the collateral value trading markets, which they do not control. Not only the value of these currencies is more volatile, but is also significantly lower, over time, than the value that platform-related currencies can achieve. For these currencies, the value is driven to a much larger extent by *indirect* network effects - the value of the digital currency depends on the number of users adopting the currency, which in turn can largely depend on users' interest to trade the currency for products or services available on the associated platform network. In principle, users could trade these digital currencies for other digital currencies, much like in the case non-platform-related digital currencies. However, we find that tokens, in general, are traded less than coins, and this is particularly the case for platform-related business currencies. This finding indicates that users hold more and for longer period platform-related digital currencies and might suggest the existence of strong reinforcing feedback effects indeed for these currencies: users are interested in adopting the currency for trading within the platform (to a larger extent than exchanging the currency against other currencies). The more valuable products or services are available on the platform, the less likely users are to exchange the digital currency for another one. In other words, in the case of digital currencies that are related to platform business models, the value of the digital currency is instrumental to the value of the underlying business. One alternative explanation for why we observe lower trading volume for tokens could be attributed to higher transaction costs in the case of tokens, which might constrain their tradability, and not to the characteristics of the underlying business. However, this reasoning would not explain why we observe a strong difference in trading volume between platform-related and non-platform-related tokens. Also, it falls short in explaining why we find a large decrease in volatility for platform-related digital currencies. Our analysis instead might suggest that the reason behind this effect is related to the market dynamics on the platform which the digital currency is related to. To the extent that more users adopt the digital currency and more products and services become available for it, users of the digital currency would have greater incentives to hold their currency either because they want to benefit from its increasing value (ensuing from the growing value of the related platform business) or because they want to use the currency as means to access the platform's network and complementary offerings over time. Firms can further boost digital currencies' network effects if they engage in strategic actions such as underpricing or if they are able to attract significant attention on relevant social media platforms. Both these factors can increase interest and usage of the digital currency early on and thus trigger the emergence of direct and indirect network effects. Ultimately, network effects drive the value of the digital currency as they increase the opportunities for exchange on the platform that the digital currency is based on. Anecdotal evidence for the importance of these network effects can be found in *Decentraland*, a blockchain-based virtual world where users can buy virtual land and engage in games and other applications using the *MANA* token. The initial strategy of the founders behind *Decentraland* included hosting a number of contests for developers and content creators[21], which resulted in a strong user network and a cooperation with smartphone producer *HTC*[22].

Complementarities between Technology and Business Model

Based on our analyses, we propose that digital currency success does not only depend on the business type (i.e. whether it is platform-based or not), but also on the extent to which the digital currency is able to exploit potential complementarities between its business type and its underlying technological infrastructure. More specifically, if digital currencies rely on the technological infrastructure provided by third parties instead of developing their own technological infrastructure, they face several limitations. On the one hand, interacting with potential users is only possible through the third-party technology, which poses potential constraints to the volume of transactions and thus the value of the currency. As we pointed out when assessing the pros and

[21] https://www.coindesk.com/information/what-is-decentraland-mana
[22] https://sludgefeed.com/decentraland-surges-25-percent-on-htc-partnership/

cons of using a third-party blockchain platform, while firms can leverage the large user base of the blockchain network, this popularity can also have negative externalities in the form of higher transaction costs and network congestion from the heavy use of the network by the large number of other users and businesses.

On the other hand, this negative effect can also be due to the standardized nature of the technological infrastructure of third-party blockchains that have not been developed specifically for the particular type of business of the firm and might cause a mismatch between business type and underlying technology and constrain the potential value of the digital currency. Our finding of a stronger negative impact on the currency value for platform-related currencies using third-party blockchains indicates that these technological constraints are more problematic for digital currencies that are related to a platform business model. Instead, we found that platform-related currencies based on their own blockchain infrastructure perform better on different value dimensions.

By setting up and using their own blockchain, firms can design the technological infrastructure to the specific needs of the business, such to create reinforcing feedback between the functioning of the infrastructure network and the functioning of the related market. In this case, a more integrated, centralized blockchain system with higher "synergistic specificity" (Schilling 2000) can obtain greater functional utility and value for its users. A case in point is *Filecoin*, a custom made blockchain where users can buy, sell and use cloud storage of other users in the network using the native *FIL* coin from *Filecoin*. The blockchain is designed and managed by *Filecoin* to enable greater matching of users' buying-selling storage capacity and needs, and higher speed in the validation and completion of transactions. Also, *Filecoin* retains control and residual decisional power over the transactions in the network, such to guarantee privacy (some of the user data that are exchanged are not displayed), which contributes to higher trustworthiness in the network and greater incentives for transacting. Control over the technological infrastructure can thus be strategic for keeping control over the rules for participation and transactions in the market. To the extent that firms can shape the technological infrastructure design to shape the market design, they can influence the market functioning to larger extent and boost the indirect network effects dynamics of platform businesses (to greater extent). Instead, when building the platform business on third-party technological infrastructures, stearing the market development and boosting business growth might be more problematic because of the lack of control over the user data and the impossibility of shaping the rules of participation and engagement in the blockchain network. Such a decentralized blockchain system with high degree of modularity will be a poor fit to the specific needs of the focal firm for creating and running a platform marketplace business. A case in point of these problems is the cited example of *Helbiz,* that decided to move its business from *Ethereum* to its own proprietary blockchain after facing challenges related to transaction costs and limited control over data, which prevented *Helbiz* from exploiting possible reinforcing complementarities among its mobility services and from developing additional lines of businesses for third-party providers.

Ultimately, this suggests that the business model and underlying technology are strongly intertwined. Even though blockchain related technologies are nowadays made available by various providers, it seems to be more beneficial for distributors of digital currencies to invest into the creation of their own specialized technological underpinnings, especially when the intent of the venture is to create its own platform business and marketplace. In other words, while blockchain technology is to a large extent based on the idea of decentralization, it still requires that specialized blockchain technologies are developed for each specific purpose (i.e. for each specific type of business model). While technological advances related to blockchain have led to increasing decentralization and made it increasingly simple and potentially more democratic to access money to fund business initiatives, this evolution also has drawbacks. Often, the fact that ICOs provide investors with a liquid asset that is detached from the underlying business, is cited as one of their main advantages. However, our analyses suggest that firms might need to centralize part of the decentralized blockchain network as way to retain control over some of the important technological and business dimensions (i.e., user data, rules of transactions and blockchain validation) to ensure greater alignment between the value of their digital currency and the underlying business. This is particularly critical and valuable in the case of platform businesses.

Practical Implications

The patterns that we identified based on our analyses hold important practical implications as well. We have shown that, for entrepreneurs who want to attract long-term support by investors, it is important to design their business model in a way that allows them to benefit from network effects that unfold over time. While blockchain technologies bring several advantages such as a reduction in the costs of capital raising, they also come with potential risks for entrepreneurs. More specifically, the creation of a secondary market for investments allows investors to take back their support more easily if they lose their interest in the business. Relying on ICOs and the underlying blockchain technology might therefore backfire and put startups at risk in the long run if they do not manage to sustain engagement by investors through their business model.

In order to fully release the potential benefits of a platform business model, we have argued that it is important to rely on blockchain technology that was developed specifically for the given purpose. At the same time, the development of such technologies generally requires significant investments upfront, which might be problematic for individuals that seek funding support from investors. A potential alternative might be to initially rely on blockchain technology developed by a third party and then develop specific blockchain technology for the given purpose at a later point in time (as in the case of *Helbiz*). Additionally, this approach might stimulate continued investors' interest, even after the initial phases, and allow them to benefit from purpose-built blockchain technology when it is needed the most, i.e. when the indirect network effects come into play with the growing underlying platform business.

Avenues for Further Research

The research presented in this paper has allowed us to gain a better understanding of what might be some of the drivers behind digital currency success. At the same time, it has also highlighted some areas that require further investigations. For instance, it would be interesting to get a better understanding of the role of investors and their expectations. In our analyses, we use currency value as a key measure of interest but we cannot disentangle the extent to which this value is driven either by the actual quality of the digital currency or by the extent to which the digital currency's characteristics match investors' expectations. A related aspect that merits further research relates to the organizations behind the digital currencies, i.e. the start-ups or firms that launch them. While we do observe several characteristics of the digital currencies, we cannot fully understand how these characteristics come about. More specifically, we need not only a better understanding of what drives a firm's decision to launch, for instance, a token or a coin, but also a better sense of the extent to which they consciously engage in strategic activities such as underpricing.

These questions are important also in the light of the potential implications of our discovery for other contexts that are undergoing the process of digitization with emerging digital markets, including IoT connected smart products (smart home, smart car…), financial services (fintech), healthcare services (meditech) or electric-vehicles related services. In these sectors we observe firms increasingly experimenting with a variety of new products, following basically the two approaches examined here – some are building and selling their products through third-party infrastructures while others are trying to build their own infrastructures to promote their own and third-party offerings. It would be valuable to understand to what extent the tradeoffs we identified in our context applies also to these settings and what are instead the differences and why. We might expect, for instance, in the context of IoT smart home connected products, that firms building their own digitally enabled smart products may tend to connect and leverage existing technological infrastructures such as Google Home, Apple Home or Amazon Alexa. While this approach offers immediate benefits at low cost to firms from enhanced product connectivity and access to large user base, it might also constrain the potential value of these products in terms of the technical, specific functionalities. Being standardized platforms for any smart home product, there is a limited set of functionalities that these platforms can enable for the specific devise (e.g., alarm product systems can only be activated or disarm according to a given scenario preset by the customer but other specific functions will need to be managed through their dedicated technological infrastructure). Consider also the case of electric-vehicles' services market. With the electrification of cars and mobility services in general, cars are increasingly becoming digitized and the new platform for services. In this scenario, controlling the data flow on the underlying technological infrastructure might become strategic to enable the creation of a service market and unleash value creation in the system. Understanding these dynamics may offer us also a new lens for understating market power dynamics in digitized contexts where convergences of multiple and distinct markets makes market boundaries less clear cut; a fascinating direction for future research.

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FIGURE 1
Average Daily Closing Value over Currency Age

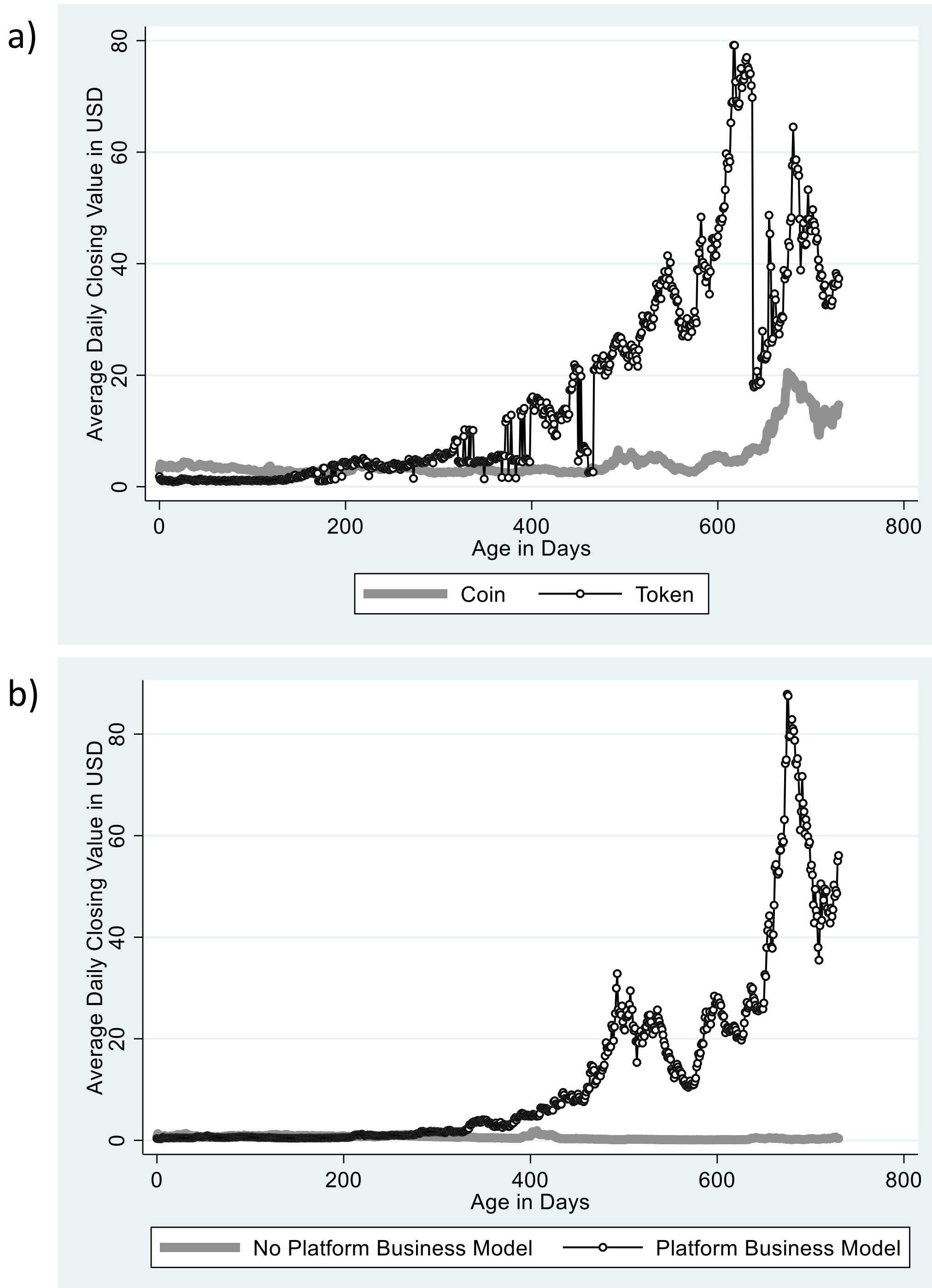

FIGURE 2
Weekly Volatility over Currency Age

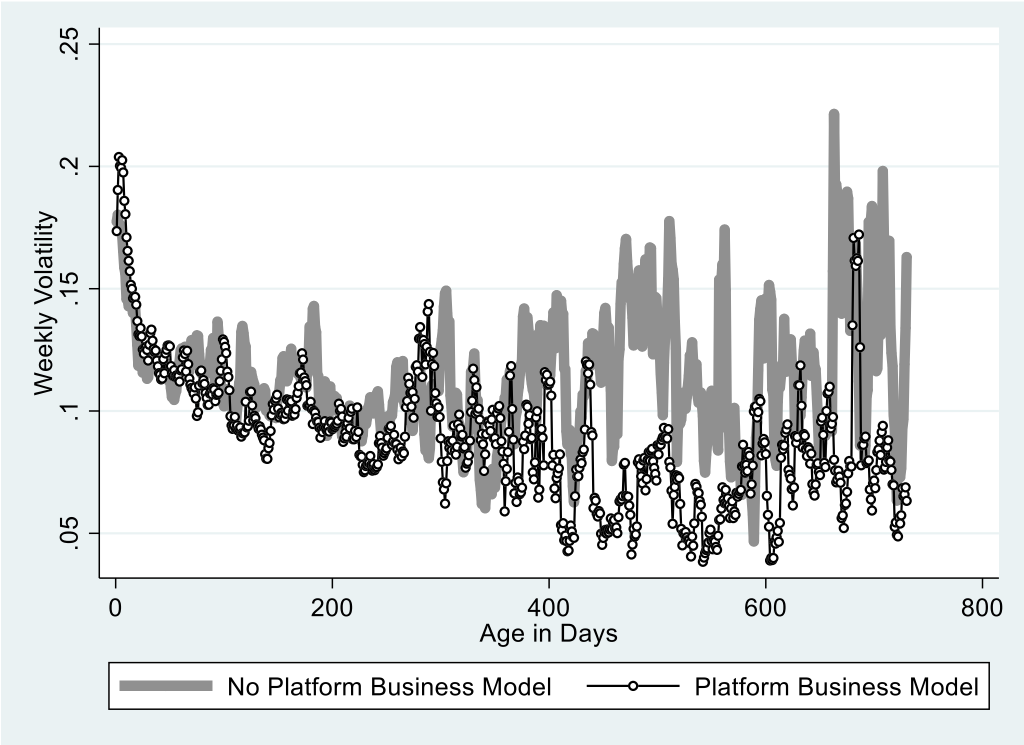

TABLE 1
Pros and Cons of Building a Custom Made Blockchain

Building a digital currency on an own blockchain	
PROS	**EXAMPLES**
Flexible control over what data is kept private and what is shared on the public ledger	Helbiz, a company offering mobility services, decided to develop its own blockchain to exploit the data collection in order increase the amount of services offered, in a logic of smart mobility.
Possibility to change the rules of a blockchain, revert transactions, modify balances..	Filecoin is a decentralized platform for cloud storage that employs the peer-to-peer system to store and secure data on its blockchain. The own blockchain allows the company to act directly on the nodes approval, what data are shared and what are private, and controlling directly, and in case, reversing the validation of a block transaction. This guarantees a secure (although not irreversible) service to its costumers.
Cheaper transactions since only few nodes are needed for verification. Validators are known / lower risk of collusion.	Binance, one of the biggest cryptocurrency exchanges by volume, moved its native token Binance Coin (BNB) from the Ethereum Blockchain to a new, own blockchain, to reduce the transaction fees and the volatility risk. Since Binance shifted to a private blockchain the risk of collusion in trading has been reduced. The nodes approving the transactions are known and it is possible to identify them in case of fraude.
Better privacy	The Filecoin blockchain verifies the transactions between clients and miners, and serves as a record of their legitimacy: it is a guarantee for the privacy in the business of data sharing.
Designed specifically for a given purpose; not a wide set of rules/standards that need to be followed	Musicoin, a music streaming platform, built an own blockchain that supports the creation, distribution and consumption of music in a shared economy.
CONS	
Typically owned by a single individual or corporation, making them centralised and less secure than public blockchains. Need to find miners that verify transaction.	Trust Me Up, a blockchain based fundraising platform, chose Optherium, a third party blockchain to guarantee transparency and security in the transactions for its donors. Thanks to its decentralization, Optherium is less vulnerable to cyber attack, and transaction data cannot be manipulated by Trust Me Up to influence donors.
Limited network scale - network needs to be built over time.	Trust Me Up decided to rely on an external blockchain to connect globally all the actors involved in the projects (i.e. donors, sponsors, merchants), reaching a relevant user base. Helbiz, after launching its currency through the Ethereum network, was able to raise $40 millions in less than one month, and launched its first service in less than one year, leveraging the Ethereum network scale.
Requires more time and technical ability to build. More expensive to scale.	Helbiz started to move to a private blockchain one year after the ICO, even if it noticed problems with Ethereum set up before, because of the high entry costs of a private blockchain's development.

TABLE 2
Variable Definition and Source

Variable Name	Definition	Source
Weekly Volatility	7-day standard deviation of daily logarithmic returns	coinmarketcap.com
Trading Volume	Trading volume in USD. For tokens, trading volume is first calculated in terms of underlying coin and then converted into USD	coinmarketcap.com
Closing Value	Daily closing value of the digital currency in USD	coinmarketcap.com
Platform Business Model	Dummy variable that takes the value of 1 if the digital currency is based on a platform business model (i.e. if the field "Product Type" on *icorating.com* contains the word "platform") and 0 if it is not based on a platform business model	icorating.com
Token	Dummy variable that takes the value of 1 if the digital currency is a token and 0 if it is a coin	coinmarketcap.com
Age in Days	Number of days since the digital currency was first traded	coinmarketcap.com
Hype Score	Parameter calculated by icorating.com "on the basis of the number of users on project pages on social media (Bitcointalk, Telegram, Twitter) and other social activity metrics"	icorating.com
Risk Score	Parameter calculated by icorating.com to "determine the reliability of a project against aspects such as its team, the product, the existence of partners and so on"	icorating.com
Raised	Amount of money raised during ICO	icorating.com
Rating	Evaluation of the quality of the product idea, vision and the team behind the currency (Combination of an automated assessment by the website and expert ratings)	icobench.com
Underpricing	Difference between first day opening price and first day closing price divided by first day opening price	coinmarketcap.com
BTC Value	Daily closing value of *Bitcoin* (*BTC*) in USD	coinmarketcap.com
ETH Value	Daily closing value of *Ethereum* (*ETH*) in USD	coinmarketcap.com

TABLE 3

Summary Statistics

Variable Name	Observations	Mean	Std. Dev.	Min	Max
No Platform Business Model					
Weekly Volatility	26,145	.1171019	.106064	0	2.317356
Trading Volume	26,044	2038830	1.05e+07	0	5.40e+08
Closing Value	26,298	.8244001	4.285565	3.00e-06	89.11
Age in Days	26,298	159.0592	151.0602	0	730
Token	26,298	.7246178	.4467151	0	1
Hype Score	26,298	3.183664	.8579999	2	5
Risk Score	11,671	3.089624	.9801917	1	5
Raised	17,115	1.97e+07	1.59e+07	3000	6.80e+07
Underpricing	26,298	6.443139	46.59278	-.2797519	353.3279
Rating	22,774	3.248626	.7154146	1.6	4.8
Platform Business Model					
Weekly Volatility	31,543	.1116692	.11058	.0009674	2.654866
Trading Volume	31,314	8186617	6.67e+07	0	2.88e+09
Closing Value	31,751	2.150857	15.35063	3.00e-06	401.49
Age in Days	31,751	141.1625	138.2364	0	730
Token	31,751	.8188089	.3851825	0	1
Hype Score	31,751	3.270952	.7325073	1	5
Risk Score	12,506	2.887254	.7326852	1	5
Raised	19,708	2.95e+07	5.94e+07	49000	5.75e+08
Underpricing	31,751	.0978965	.419288	-.8703217	3.472603
Rating	24,563	3.340471	.6302642	1.8	4.7

TABLE 4
Sample Composition by Business Type and Technology Type

		Business Type	
		No Platform Business Model	*Platform Business Model*
Technology Type	*Coin*	20	21
	Token	121	173

TABLE 5

T-Test Results

	No Platform		Platform		Difference = No Platform - Platform		
	N	Mean	N	Mean	Mean	Std. Err.	N (Total)
Weekly Volatility	26145	.1171019	31543	.1116692	0.0054***	0.0009	57688
Trading Volume	26044	2038830	31314	8186617	-6147787.29***	417373.4257	57358
Closing Value	26298	.8244001	31751	2.150857	-1.3265***	0.0977	58049

TABLE 6
Regression Results – Main Variables

Dependent Variable	Closing Value		Weekly Volatility		Trading Volume	
Sample	(1) No Platform	(2) Platform	(3) No Platform	(4) Platform	(5) No Platform	(6) Platform
Token	-0.703***	-20.36***	0.0626***	0.0693	-2576368.1***	-48104573.0***
	(0.005)	(0.000)	(0.000)	(0.373)	(0.000)	(0.000)
HypeScore	-0.226**	2.247***	-0.0147***	-0.00510	957603.9***	9825568.5***
	(0.018)	(0.000)	(0.005)	(0.855)	(0.000)	(0.000)
RiskScore	0.0258	-5.694***	-0.00259	0.0692**	127203.5	-13770434.1***
	(0.799)	(0.000)	(0.640)	(0.015)	(0.659)	(0.000)
Constant	1.183*	33.07***	0.603***	0.526***	-894590.1	39572733.7***
	(0.060)	(0.000)	(0.000)	(0.002)	(0.706)	(0.002)
N	11671	12506	11600	12416	11655	12493
R^2	0.0286	0.511	0.183	0.0208	0.123	0.391

p-values in parentheses; $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$

TABLE 7
Regression Results – Daily Closing Value

Dependent Variable	Daily Closing Value			
Sample	(1) No Platform	(2) Platform	(3) No Platform	(4) Platform
AgeInDays			0.00478***	0.0671***
			(0.000)	(0.001)
Token	-1.950***	-12.40***	-2.823***	-4.547***
	(0.000)	(0.000)	(0.000)	(0.000)
TokenXAgeInDays			0.00177***	-0.0409***
			(0.000)	(0.000)
HypeScore	0.310***	0.658***	0.128***	0.755***
	(0.000)	(0.000)	(0.000)	(0.001)
HypeScoreXAgeInDays			0.00168***	-0.00163
			(0.000)	(0.476)
RiskScore	-0.00383	-2.919***	0.0473*	-1.443***
	(0.791)	(0.000)	(0.062)	(0.000)
RiskScoreXAgeInDays			-0.000194	-0.00253
			(0.319)	(0.315)
Raised	2.10e-08***	1.18e-08*	2.29e-08***	1.50e-08
	(0.000)	(0.057)	(0.000)	(0.141)
RaisedXAgeInDays			-9.97e-11***	-2.40e-10***
			(0.000)	(0.007)
Underpricing	-1.059***	17.11***	-0.252***	9.435***
	(0.000)	(0.000)	(0.000)	(0.000)
UnderpricingXAgeInDays			-0.00594***	0.00203
			(0.000)	(0.679)
Rating	0.194***	-1.485***	0.397***	-0.815***
	(0.000)	(0.000)	(0.000)	(0.001)
RatingXAgeInDays			-0.00169***	-0.00113
			(0.000)	(0.641)
BTCValue	0.0000437	-0.000188	0.0000446	-0.000176
	(0.348)	(0.565)	(0.310)	(0.579)
ETHValue	0.00117**	0.0148***	0.00118**	0.0149***
	(0.029)	(0.000)	(0.019)	(0.000)
Constant	-1.452***	12.57***	-2.086***	-0.795
	(0.000)	(0.006)	(0.000)	(0.866)
N	8634	9584	8634	9584
R^2	0.587	0.715	0.634	0.730

p-values in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

TABLE 8
Regression Results – Weekly Volatility

Dependent Variable	Weekly Volatility			
Sample	(1) No Platform	(2) Platform	(3) No Platform	(4) Platform
AgeInDays			-0.000738***	-0.00101***
			(0.000)	(0.001)
Token	0.0407***	0.161	-0.0280***	0.0731
	(0.000)	(0.107)	(0.000)	(0.450)
TokenXAgeInDays			0.000305***	0.000129
			(0.000)	(0.355)
HypeScore	-0.0123***	-0.0161	-0.0120***	-0.0324
	(0.000)	(0.518)	(0.000)	(0.163)
HypeScoreXAgeInDays			-0.0000103	0.0000633**
			(0.383)	(0.038)
RiskScore	0.0130***	0.125***	0.0150***	0.0879***
	(0.000)	(0.000)	(0.000)	(0.001)
RiskScoreXAgeInDays			-0.0000517***	0.0000319
			(0.006)	(0.321)
Raised	5.33e-11	-2.72e-09**	-5.48e-10***	-1.42e-09
	(0.747)	(0.013)	(0.000)	(0.191)
RaisedXAgeInDays			2.45e-12***	2.24e-12*
			(0.009)	(0.083)
Underpricing	0.0274***	0.224***	0.0149**	0.256***
	(0.007)	(0.000)	(0.023)	(0.000)
UnderpricingXAgeInDays			0.000149***	0.000187***
			(0.000)	(0.003)
Rating	0.0213***	0.0118	-0.00225	-0.000846
	(0.000)	(0.662)	(0.379)	(0.974)
RatingXAgeInDays			0.000177***	-0.0000445
			(0.000)	(0.165)
BTCclose	0.00000465	-0.00000320	0.00000459	-0.00000320
	(0.250)	(0.356)	(0.275)	(0.355)
ETHclose	-0.000145***	-0.0000854**	-0.000146***	-0.0000904**
	(0.002)	(0.047)	(0.002)	(0.035)
Constant	0.0841**	-0.177	0.149***	0
	(0.017)	(0.337)	(0.000)	(.)
N	8588	9518	8588	9518
R^2	0.362	0.0484	0.426	0.0855

p-values in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

TABLE 9
Regression Results – Trading Volume

Dependent Variable	Trading Volume			
Sample	(1) No Platform	(2) Platform	(3) No Platform	(4) Platform
AgeInDays			-4934.5 (0.417)	132871.5 (0.154)
Token	-4016693.9*** (0.004)	-32413852.1*** (0.000)	-7139124.7*** (0.000)	-12702084.9*** (0.007)
TokenXAgeInDays			807.9 (0.765)	-145206.6*** (0.007)
HypeScore	811354.3** (0.050)	2852669.2*** (0.000)	447296.0*** (0.000)	2921376.2*** (0.008)
HypeScoreXAgeInDays			4316.1*** (0.000)	-322.0 (0.976)
RiskScore	1301605.0** (0.024)	-7374340.9*** (0.000)	2143509.8*** (0.000)	-5579542.5*** (0.000)
RiskScoreXAgeInDays			-3610.1** (0.012)	9328.3 (0.431)
Raised	0.164*** (0.000)	0.0905*** (0.002)	0.224*** (0.000)	0.115** (0.017)
RaisedXAgeInDays			-0.000276*** (0.000)	-0.000742* (0.076)
Underpricing	336386.1 (0.849)	43233120.6*** (0.000)	3909703.7*** (0.000)	30975394.8*** (0.000)
UnderpricingXAgeInDays			-25771.9*** (0.000)	-24566.5 (0.287)
Rating	338047.3 (0.601)	-3471324.1*** (0.000)	-1575.9 (0.994)	-2663241.7** (0.026)
RatingXAgeInDays			3513.4** (0.010)	5658.6 (0.619)
BTCValue	447.7 (0.114)	1677.5 (0.264)	425.1 (0.191)	1693.4 (0.257)
ETHValue	6253.4* (0.054)	28343.8 (0.129)	6891.3* (0.064)	28450.5 (0.126)
Constant	-6523333.3 (0.118)	25975712.3 (0.218)	-11807147.7*** (0.000)	-377446.6 (0.986)
N	8625	9579	8625	9579
R^2	0.332	0.522	0.384	0.526

p-values in parentheses; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

DIVERSIFICATION IN FINTECH ACTIVITIES: A DEMAND BASED VIEW

This paper investigates whether the diversity of activities conducted by financial institutions influences their market valuations. We suppose to find that there is a diversification discount: the market values of financial conglomerates that engage in multiple activities, e.g., lending and non-lending financial services, are lower than if those financial conglomerates were broken into financial intermediaries that specialize in the individual activities. While difficult to identify a single causal factor, the results are consistent with theories that stress intensified agency problems in financial conglomerates engaged in multiple activities and indicate that economies of scope are not sufficiently large to produce a diversification premium.

Moreover, given the wave of startup that is changing the financial world (FinTech – techfin companies), we want to see if when the financial conglomerates diversify into a business that is a platform (i.e. benefit from network externalities and economies of scope) the effect of diversification on market valuation is confirmed, mitigated, enlarged or has the opposite sign.

So, we argue that financial conglomerates that diversify in platform businesses could benefit a premium rather than suffering the diversification discount on financial markets.

We propose a demand- based view to analyze the complementarities and the network effects. Moving away from the supply perspective the diversification in the Fintech business is willing to create value for the users.

"Today every business is a digital business"

Bertelè, U., Preface in Downes, L. & Nunes, P.,"Big Bang Disruption", Egea.

INTRODUCTION

While many non-financial firms around the world have been fighting for corporate business focus over the last two decades, financial services firms and especially banks have instead increased business diversification.

The growth of financial conglomerates (i.e., combination of banking, insurance, and other financial services within a single corporation) has been encouraged for several reasons, including banking regulatory reforms, changes in economic environment and increased shareholder pressure for financial performance.

Recent evidence suggest that diversification has not been beneficial for financial conglomerates and the international financial crises have shed doubt on previous findings: financial conglomerates haven't been able to exploit the potential benefits associated with diversification while controlling the associated costs.

Over the last few decades a sizable literature on non- financial conglomerates estimated the connection between resource (mis)allocation and the market value of diversified firms, showing that diversified firms trade at discounts compared to a portfolio of comparable single segments.

The issue of diversification and the creation of potential economies of scale and scope had been greatly studied in banking literature: despite expected benefits from economies of scope the literature suggests and largely show a diversification discount.

This paper aim to investigate, whether the diversity of activities conducted by financial institutions influences positively or negatively their market valuations, i.e. if they face a diversification discount or premium.

Hypothesis 1: *The market values of financial conglomerates that engage in multiple activities,* *e.g., lending and non-lending financial services, are **lower** than if those financial conglomerates were broken into financial intermediaries that specialize in the individual activities.*

Finance is, globally, a highly regulated industry involving licenses, registration, membership, and adherence to strict norms from various banking, insurance, and securities regulators. But the growth in digital technology and telecommunication caused disruption in finance too: let's think about the growth of techfin and FinTech companies.

Literature on platforms, and empirical evidence too, suggests that platform businesses like FinTech have several benefits: network effects on demand side generate economy of scope both on the consumption and production of bundled financial products and services.

In light of that, we want to see if when the financial conglomerates diversify into a business that is a platform (i.e. benefit from network externalities) the effect on market valuation is confirmed, mitigated, enlarged or has the opposite sign.

Hypothesis 2: *The market values of financial conglomerates that engage in multiple activities, e.g., lending and non-lending financial services, and diversify into one or more businesses that are **platforms**, are **higher** than if those financial conglomerates were broken into financial intermediaries that specialize in the individual activities.*

THE FINTECH REVOLUTION

The financial industry is one of the last large industries that have not been completely disrupted by the digital revolution yet. Bankers simply didn't understand immediately that technology companies are agile enough to take advantage of any piece of regulation. They also continue to believe that customers still trust banks. However, since the financial crisis and due to the never-ending financial scandals, customers are interested in alternative finance.

Since the crisis of 2007-08, policymakers have concentrated on making finance safer. Regulators have stuffed the banks with capital and turned compliance from a back-office job into a corner-office one. Away from the regulatory perspective, another revolution is underway, one that promises not just to make finance more secure for taxpayers, but also better for another, until now neglected, constituency: its customers.

The successful combination of technology and venture capital that has disrupted other industries has put financial services in its sights. From payments to wealth management, from peer-to-peer lending to crowdfunding, a new generation of startups is growing fast; in 2018 the global investment in FinTech companies hit $111.8B with 2,196 deals[23].

Insert FIGURE 1 about here

Insert FIGURE 2 about here

FinTech, short for "financial technology", is the popular term used to describe the rapid pace of technological change in various finance's areas. This emerging sector has been mainly driven by market forces, as FinTech entrepreneurs work and invest to meet the growing consumer demand for faster, more convenient, and individually tailored financial services.

For a long time, new market entrants found it difficult to break into the financial services industry. The large, well-established financial institutions (i.e. the incumbents) had advantages in term of size and networks. They had strong compliance systems in place to manage ever-increasing regulations, and they had the client base and resources to prosper even in tough economic

[23] The pulse of FinTech, KPMG report, 2018

conditions. But now they seem more vulnerable, and FinTech "disruptors", often start-ups focused on a particular innovative technology or process, have been attacking some of the most profitable elements of the financial services value chain (from mobile payments to insurance)[24]. This has been particularly damaging to the incumbents who have historically subsidized important but less profitable service offerings.

FinTech companies can be classified in two groups: companies providing services complementary to bank services (potential partnership with banks can be expected) and companies providing services traditionally covered by banks (FinTech are competitors, even if cooperation is possible). A closer cooperation with FinTech providers would allow banks to use comparative advantages of FinTech companies as highly standardized and low-cost financial services, and relatively lower risk of financial services/products (e.g., borrower default risk, maturity risk), technology-oriented consumer behavior, etc. The bigger effect from the FinTech revolution will be to force flabby incumbents to cut costs and improve the quality of their service.

The development of FinTech "creates" additional risks for the banking industry: partial loss of the market shares due to new competitors, additional pressure on margins, consequently lower revenues, increased operational risk and risk of fraud as well as growing bank dependence on financial services technology solutions.

Therefore, nonbank financial service providers require special attention of financial market regulators in terms of applied standards in dealing with customer information, monitoring, sufficient capital, etc. Thus, on one hand, development of FinTech is an additional challenge for banks; on the other hand, this challenge can be turned into an opportunity that will support further

[24] PwC Global FinTech Survey 2016

growth of banks. Hence, it is important for banks to start cooperation with FinTech companies especially in the business fields where those companies provide services that are complementary to the banks' ones. Banks should increase investment in FinTech, rethink service distribution channels, increase further standardization of back-office functions and services, etc., while a potential threat to the banking industry can be identified in the field of easily standardizable, less knowledge intensive products/services (payments, simple savings product, current account, and consumer credit). FinTech has become an integral part of banking, and banks have started to compete beyond financial services facing increasing competition from nonfinancial institutions. Consequently, traditional banks have started to lose part of their market share.

A timely integration of FinTech into business can allow banks to get comparative advantages in growing competition, while a cooperation with FinTech companies can help banks to create new opportunities.

This unstoppable rise of new startups caused different reaction of banks worldwide:

- banks start up programs to incubate FinTech companies,
- set up venture funds to finance FinTech companies,
- establish cooperation as partners
- some banks have acquired FinTech companies or launched own FinTech subsidiaries.

A number of successful cooperation examples can be identified: Santander Bank (UK) had a partnership with the peer-to-peer lending platform Funding Circle (for rejected bank business loan applicants); Goldman Sachs (USA) made significant investments into payments and alternative finance companies like Square, Bluefin Payments, Bill Trust, Revolution Money;

Citigroup (USA) launched a Citi FinTech unit that is responsible for the development of its mobile banking services etc.[25]

Banks are getting more and more active in involving into cooperation with FinTech and in terms of necessary investment, partnership with FinTech companies is the least-expensive option with relatively lower risk (comparing to acquiring of FinTech companies or establishing its own FinTech Company).

"The FinTech industry is not a threat, but rather an opportunity" Bryan Clagett, Geezeo[26].

FINANCIAL CONGLOMERATES

Overall, financial conglomerates combine banking, insurance, and securities business in the same group. These three business areas differ in terms of risk characteristics and the way they are supervised. The main business of financial conglomerates consists of commercial banking activity, which is collecting customer deposits to grant loans and invest in securities. Typically, financial conglomerates interact with customers through a branch network. The risks associated with this activity are credit risk and funding liquidity risk. The second business area is related to insurance: here, financial conglomerates interact with customers through tied agents and independent brokers; the main risks are underwriting risk and investment risk. The third business area is related to the securities business. Under this business, financial conglomerates are exposed to market risk and liquidity risk. The different core businesses correspond to different time horizons. Securities area has the shortest horizon, reflected in the "mark to market" valuation of their balance sheet, while insurance business has the longest horizon. Premiums are received in the present, but claims may

[25] Tech in Asia, 2015; American Banker, 2015
[26] Geezeo is a leading FinTech company providing personal financial management (PFM) tools to credit unions and banks to help create more engaging and meaningful online banking experiences.

occur far into the future. The different risks and time horizons force institution to adopt several risk management practices, such as internal ratings and credit risk portfolio models are used for the commercial banking business area, “value at risk” (VAR) models are used in securities business, while standard risk transfer techniques are used by insurance business area. Financial groups can provide financial services through various corporate structures, and their choice will depend on practical as well as regulatory elements.

What is a financial conglomerate?

The establishment of financial conglomerates is a new worldwide phenomenon, which has developed according to specific country patterns. Country specifics suggest a higher presence of financial conglomerates in continental Europe than in Anglo-Saxon countries. Hence, the complexities and specific characteristics of the different financial conglomerates do not permit the provision of a universal definition. Moreover, the meaning of the term “financial conglomerate” is quite different from the notion of “industrial conglomerate”. This is because industrial conglomerates are defined as organizations that combine completely different activities within one holding company (Herring & Santomero 1990), whereas financial conglomerates are characterized by an additional crucial element that is the high degree of balancing between the services provided by the different parts of the organization. In general financial conglomerates can be defined as a group of firms that predominantly deal with finance (i.e. banks) or, in other words, a publicly traded holding company with subsidiaries (and subsidiaries of these subsidiaries) devoted to different financial activities, such as commercial banking, securities brokerage and trading, investment advising, and insurance. The largest financial institutions in United States and Europe are generally financial conglomerates.

Main determinants of financial conglomerates

The growth of financial conglomerates has been encouraged for several reasons including banking regulatory reforms, changes in economic environments, and increased shareholder pressure for financial performance. These driving forces might be partially responsible for the rapid pace of conglomeration and consolidation of financial institutions (Berger et al. 1999, De Nicoló et al. 2004). Changes in economic environments relate to technological progress, improvements in financial condition, excess capacity or financial distress in the industry or market, international consolidation of markets, and increased competition in financial services. However, the starting point for financial conglomerate creation was very different between the US and Europe. While in Europe, the principle of universal banking was more or less recognized in all banking systems since the nineteenth century, in the US the Glass-Steagall Act of 1933 imposed a strict separation of functions between commercial banks that specialized in retail banking for private households and investment banks, which mainly specialized in wholesale banking and operations in capital markets. Overall, large banks and insurance companies were active in the consolidation process of the 1990s on domestic and cross-border level, and large financial conglomerates emerged as a result.

The universal banking model: the diversification

The concept of scale and scope economies is strictly connected with the business model adopted by financial institutions. More specifically, scale and scope economies could be exploited if financial institutions engage in diverse types of banking and financial business, like insurance, mutual funds, investment banking, housing finance, factoring, and retail banking.

Such business models, which allow financial entities to offer various services under one-roof, are referred to as universal banking models. The potential scale and scope economies derive from diversification benefits, with several products being close substitutes, for example pension, life insurance, and saving products. Combining these products and services within one organization mitigates the effects of demand substitution over these products/activities, which could be interpreted as a diversification benefit, but might also point at cross-selling benefits. From a corporate finance perspective, the benefits of diversification come from reductions in corporate finance costs and benefits from portfolio diversification. If investors (shareholders) could construct their own diversified portfolio, why would a financial institution itself need to do so? Various frictions might explain the value of diversification. For example, diversification facilitates an internal capital market where cash flow generating businesses could help fund other activities that need funding. If raising external funds is costly, this might add value. Nevertheless, this might be a mixed blessing. Often the presence of internal capital markets invites cross-subsidization of marginal or loss-making activities that could wipe out any potential benefits. Moreover, diversification on the asset side reduces the variance of the returns that accrue to claim holders of the bank, as the bank portfolio gets closer to the market portfolio. This is beneficial when claimholders are risk-adverse or if there are bankruptcy costs. A link can also be made to the proliferation of off-balance sheet banking. These activities involve a variety of guarantees that lead to contingent liabilities. For such activities, the credibility of the bank in being able to honor such guarantees is crucially important. One measure of this is a bank’s credit rating. With the proliferation of off-balance sheet banking, ratings have become even more important. If diversification assists in obtaining a better rating, a stronger argument for diversification can be made (Boot 2003). Conversely, because of the indivisibility of bank assets, increasing diversification implies increasing the size of the bank. From an intermediation point of view, traditional arguments suggest that banks should be as diversified as possible, as banks are typically highly leveraged, and diversification across sectors reduces the change of costly financial distress/bankruptcy. Several models of intermediation suggest that diversification makes it cheaper for institutions to achieve credibility in their role as screeners or monitors of borrowers (Diamond 1984, Ramakrishnan and Thakor 1984, and Prescott 1986). In fact, Diamond (1984) demonstrated that diversification might provide a mechanism for reducing the need to "monitor the monitor". Moreover, diversification of the bank portfolio is beneficial under debt financing, because it reduces the probability that the bank will go bankrupt and thereby the costs connected to bank failure. The expected costs of financial distress or bankruptcy might be reduced by spreading operations across different economic environments (Boot and Schmeits 2000). Hence, as the financial conglomerate represents the financial institution with the highest degree of diversification, this should enhance scope economies. Besides the diversification in product and line of service dimensions, there is also a trend toward banks diversifying geographically. Banks have the potential to achieve economies of scale in geographical dimension because once an initial investment is made and the basic infrastructure is in place, organizations can expand the system elsewhere at a potentially reduced cost. The benefits of geographical diversification include better access to capital markets in other regions/countries, which potentially leads to reduced cost of capital, greater markets, and reduced tax liabilities as geographically diversified banks can transfer resources from high-tax areas to low-tax areas. Consistent with these arguments, Mahajan et al. (1996), in a study based on US multinational and domestic banks from 1987 to 1990, concluded that multinational banks were able to fully exploit economies of scale and had lower inefficiencies than did domestic banks. Financial conglomerates can be seen as organizational structures where companies in the financial sector implement strategies of diversification. Predominantly, this diversification strategy is seen as an attractive way to realize a particular growth strategy in a mature market environment. However, this diversification can also aim at the realization of a competitive advantage by the exploitation of economies of scope and synergies. Although there are many variations in the definition, diversification in the broadest sense can be defined as the entering into new businesses by an existing business entity. This was noticed by Ansoff (1965), who considered diversification as a growth strategy by which a company attempts to serve new markets with new products. Generally, a firm enters the diversification stage after it has observed that the current market does not guarantee sufficient growth perspectives. Broadly, corporate diversification may take various forms, such as horizontal, vertical, concentric, and conglomerate. While the first two forms offer potential benefits when the economic environment is healthy and growing, the latter two strategies contribute more to the firms' objectives and are fundamental forms of diversification. Financial conglomerates adopt the conglomerate diversification, which means they apply diversification into completely different activities with a completely different technology and oriented towards different markets.

What has not been taken into account till now is how the introduction of FinTech, i.e. of a new digital way of delivering services, could affect the conglomerate diversification. A universal bank that adopt FinTech technologies can use them for all the portfolio of services, changing the previous idea that every business requires a different technological support. FinTech could decrease the cost of services, exploiting cross- businesses cost economies. The digitalization could also affect the attractiveness of new markets, i.e. the geographical diversification, making it more achievable.

LITERATURE REVIEW

There is a huge body of literature on the costs and benefits of diversification. Among the identified benefits are some economies of scope (Chandler, 1977; Teece, 1982), the improved resource allocation through internal capital markets (Williamson, 1975; Stein, 1997), the potentially lower tax burden due to higher financial leverage (Lewellen, 1971) and the ability to use firm-specific resources to extend a competitive advantage from one market to another (Bodnar et al., 1997). These benefits have to be traded off against the costs associated with diversification. These costs can be related to agency problems afflicting diversifying investments (Jensen, 1986; Meyer et al., 1992), inefficient internal resource allocation due to a malfunctioning of internal capital markets (Lamont, 1997; Scharfstein, 1998; Rajan et al., 2000), informational asymmetries between head office and divisional managers (Harris et al., 1992), and increased incentives for rent-seeking behavior by managers (Scharfstein and Stein, 2000).

There is abundant empirical evidence for US industrial firms that the costs of diversification outweigh its benefits from a shareholder’s perspective (Lang and Stulz, 1994; Berger and Ofek, 1995). However, more recent work argues that measurement problems (Whited, 2001), data problems (Villalonga, 2004b), sample selection biases (Graham et al., 2002; Lins and Servaes, 1999), and failure to account for the endogeneity of the diversification decision (Campa and Kedia, 2002) have driven the results of earlier studies. Though no final consensus has been reached, this evidence seems at least to suggest that for most industries value generating diversification is rather the exception than the rule.

The empirical literature on the benefits of bank diversification has largely focused on the question of whether the repeal of the Glass–Steagall Act allowed US commercial banks to reduce business risk by diversifying into non-traditional financial services. The potential to reduce earnings volatility was found for combinations of earnings streams from banking and insurance activities (Boyd et al., 1998; Lown et al., 2000) but was hardly found for the combination of earnings streams from interest-based banking activities and fee-based securities activities (Allen and Jagtiani, 2000; Estrella, 2001).

Stiroh and Rumble (2006) measure the effect of diversification on the risk-adjusted profitability of US financial holding companies for the period 1997–2002: they found that revenue diversification towards fee income reduced risk-adjusted returns. Over their observation period, fee-based activities were more volatile but not necessarily more profitable than traditional interest earning activities. The lack of evidence for positive diversification effects on profitability is emerged by event studies on diversifying bank mergers (DeLong, 2001) and by the vast empirical literature that applies frontier efficiency analysis to examine the productive efficiency of banks. In their survey, Berger and Humphrey (1997) report that there is a lack of evidence in favor of or against the joint provision of different financial services.

Laeven and Levine (2007) apply a modification of the Lang and Stulz (1994) ‘chop shop’ method to measure diversification effects on bank value. They confirm the existence of a diversification discount in banks that combine lending and nonlending financial services, and suggest that the potential economies of scope in financial conglomerates are not large enough to compensate for potential agency problems and inefficiencies associated with cross-subsidies. This finding is supported by Schmid and Walter (2009), who use the Laeven and Levine (2007) methodology to examine an expanded set of US financial conglomerates (i.e. including non-banks). Elsas et Al. (2010) use panel data from nine countries over the period 1996–2008 to test how revenue diversification affects bank value. Relying on a comprehensive framework for bank performance measurement, they find robust evidence against a conglomerate discount. Rather, diversification increases bank profitability and, as a consequence, also market valuations. They find that this indirect performance effect does not depend on whether diversification was achieved through organic growth or through M&A activity.

SCALE AND SCOPE ECONOMIES IN FINANCIAL CONGLOMERATES

Optimal firm size and production mix in the financial services have been at the heart of strategic and regulatory discussions. One of the reasons commonly put forward to justify the creation of financial conglomerates relates to the potential gains that may result through larger size (economies of scale) and the ability to diversify (economies of scope). In fact, financial conglomerates are created because owners (or managers) of financial firms believe that they can achieve lower average costs by producing a higher number of products. Moreover, they believe that synergies among different businesses will make it more profitable to provide a range of services within an integrated corporate group than to provide each service through separately managed corporations. These synergies may arise from two distinct sources: the production (or supply side) and consumption (or demand side) of financial service.

Economies of scale refer to the lower average costs of larger banks from producing a higher number of products or services than the average costs of smaller banks. This could lead to lower costs for consumers of financial services of large banks. In an information and distribution-intensive industry with high fixed costs, such as financial services, there should be huge potential for scale economies – as well as potential for diseconomies of scale attributable to administrative overhead, agency problems and other cost factors once very large firm-size is reached. If economies of scale prevail, increased size will help create shareholder value. If diseconomies prevail, shareholder value will be destroyed.

The financial crisis of 2007 shifted the attention to large financial institutions and the role the ‘too big to fail' (TBTF) doctrine played in driving their size.

Financial reform has focused on limiting the costs that systemically important financial institutions impose on the economy. Banks should enjoy scale economies as they grow larger because the credit risk of their loans and financial services, as well as the liquidity risk of their deposits, becomes better diversified. This reduces the relative cost of managing these risks and allows banks to conserve equity capital, as well as reserves and liquid assets. In addition, textbooks point to the spreading of overhead costs, especially associated with information technology, as another source of scale economies. Network economies, such as those found in payments systems have been cited as another source of financial scale economies. However, the financial crisis has led many to question whether such efficiencies exist or whether scale has been driven primarily by institutions seeking to exploit the cost advantages of being too big to fail (Hughes and Mester 2013).

Cost scope economies, also called economies of scope in production, refer to the reduction of the average total production costs through the production of a wider variety of services. Economies of scope in production are realized whenever the cost of producing a given mix of products jointly is less than the sum of the costs of producing each product separately. Production synergies may lower the cost of providing financial services because banks are able to spread fixed expenses over a broader output mix, by exploiting complementarities in production, or by diversifying risks.

Economies of scope are likely to be important whenever a significant fixed cost can be shared across products. Several factors rise to economies of scope in the provision of financial services. The fixed costs of managing a client relationship, including human resources, information services, and establishing and maintaining a sound reputation, might be shared across a broad range of financial services. It might also be possible to use distribution channels established for one product to distribute other products at slight marginal costs, information used to produce one product might be adopted to produce other products at very little additional costs.

Diseconomies of scope in production might arise from such factors as inertia and lack of responsiveness and creativity that could arise with increased firm size and bureaucratization, and profit-attribution conflicts that increase costs or erode product quality in meeting client needs, or serious cultural differences across the organization that inhibit seamless delivery of a broad range of financial services. More broadly, if the existence or scale of output of one type of product affects the unit cost of another, then an integrated conglomerate firm might produce services at lower marginal costs than an autonomous, single-functional firm (Herring and Santomero 1990).

Revenue scope economies, also called economies of scope in consumption, exist when the total cost to the buyer of multiple financial services from a single supplier (including the price of the service, plus information, search, monitoring, contracting and other transaction costs) is less than the cost of purchasing them from separate suppliers. Consumption synergies arise from reductions in user transaction, transportation, and search costs associated with consuming financial services jointly from the same bank provider, often at the same location, rather than consuming these services separately from different providers at different locations (Berger et al. 1996). While actual user benefits cannot be observed, users should be willing, at the margin, to reward joint provision up to the amount of savings they obtain from joint consumption. This payment may be direct via higher fees or prices, which add to bank revenue, or indirect via lower interest paid on deposits, which reduces bank expenses. Thus, banks might increase revenues or lower interest expenses by supplying financial services jointly rather than separately.

Diseconomies of scope in consumption could arise, for example, through agency costs that develop when the multi-product financial firm acts against the interests of the client in the sale of one service to facilitate the sale of another, or because of internal information-transfers considered inimical to the client's interests.

Profit scope economies generally refer to the increased profits from producing a broader range of products or services. These economies simultaneously consider both costs and revenues and, therefore, reflect differences in product or service quality, which are not be measurable by considering cost or revenue scope efficiency in isolation. For example, customers show their preference for "one-stop shopping" by paying more for such consumption convenience, which leads to revenue scope economies. However, financial conglomerates incur additional expenses in joint production that leads to cost scope diseconomies.

Informational scope economies refer to the creation of private information that is generated by one division of a diversified firm that may be shared with another division operating in a related business or having shared customers. This synergy should be particularly valuable for firms operating in business lines with high levels and costs of information asymmetry, such as the financial services industry. When a financial institution provides one type of financial service to a firm, (e.g., making "information-sensitive" loans), it collects private information about the client that can be used when providing other financial services, (e.g., underwriting its "information-sensitive" securities). Therefore, internal information sharing from diversification can reduce information asymmetry and the costs of information collection, and should decrease the cost of production increase the value of diversified financial institutions (Pang et al. 2010).

Empirical research on scale and scope economies

Empirical research on scale economies is vast and dates back to studies in the 1980s. The peculiarity of this stream of literature is that researchers strive to overcome various complex technical problems, notably specification and statistical problems in the econometric estimation (Hughes et al. 2001, DeYoung 2010, Boot 2011, Wheelock and Wilson 2012, Hughes and Mester 2013), without reaching a consensus. Hence, finding benefits might be elusive, in the sense that they might exist but are difficult to detect. Moreover, there are identification problems, such as managerial inefficiencies related to scale that might mask positive economies of scale. In addition, benefits derived from advances in information technologies might have become more apparent only recently. Finally, the sample size of very large banks is small, which puts obvious restrictions on research (DeYoung 2010). This problem is exacerbated by the tremendous growth of banks in size, complexity and concentration over the past 15 years or so (Hughes and Mester 2014).

Research on financial institutions cost scope and product mix efficiencies were reported from the same research studies and applied the same cost functions as the scale efficiencies. Scope efficiencies were measured via financial services and a set of institutions that each specialize in producing a subset of these services. Scope efficiencies are often difficult to estimate because there are usually no specializing firms in the data sample, creating extrapolation problems. In the US during the 1980s and early 1990s, banks could not expand their portfolio mix in response to changes in the marketplace as it was bound by regulation. Some studies exist that estimated the cost scope efficiencies of providing multiple products within a single financial institution. These studies evaluated cost scope economies of within-sector products (commercial loans and consumer loans) rather than cross-sector products (commercial loans and life insurance policies). Within the US banking sector, the evidence has been mixed and the majority of studies reported no substantial evidence of cost scope economies in commercial banks. With regard the information scope economies, there is lack of papers examining the financial conglomerate’s production function but rather the research has been carried out by investigating the impact of internal information sharing on the market value of financial institutions.

THE EFFECT OF CORPORATE DIVERSIFICATION ON A FIRM'S MARKET VALUE

Financial conglomerates provide a broad array of financial services: they create loans, underwrite securities, underwrite insurance policies, securities assets, and sell an assortment of financial services.

Ideally, detailed data on the degree to which each bank underwrites securities, provides brokerage services, operates mutual funds, securitises assets, underwrites insurance, and so on are needed to measure banking diversification. Data availability, however, restricts the researcher's ability to measure the diversification of bank activities. It is not possible to measure bank diversification based on SIC codes and segmental accounting data as the main database sources, such as Bankscope, do not provide this information. On the other hand, databases such as Worldscope provide data on bank activities at the two-digit SIC code level (SIC 60: Depository institutions; SIC 61: Non-depository credit institutions; and SIC 62: Security, commodity brokers, and services).

These data, however, are self-reported by banks and are therefore subject to biases that we have previously discussed. Furthermore, there is not a clear match between reporting that an institution participates in an activity and the extent of this participation (i.e., Worldscope does not have segment data for the majority of banks).

Laeven and Levine (2007) showed very strong correlation between the Worldscope data and the Bankscope measures of bank activities. Specifically, the correlations between lending institutions (from Worldscope) and both loans/earning assets and interest income/operating income (from

Bankscope) are approximately 0.6 and significant at the 1% level. The correlations are similar for investment banks. Given the problems and limitations associated with the Worldscope data for financial institutions, the use of Bankscope data is suggested. Although Bankscope is more complete, it does have another limitation. For the majority of included countries, there is no information available on fee income on loans or a breakdown of interest income by asset category (loans versus other interest earning assets). Moreover, banks in the vast majority of countries only report net fee income, not gross fee income. In fact, to complete Bankscope data, for my analysis we use Bloomberg too. Given the above data constraints, diversification measurements in financial conglomerates must assume a simplified version of the underlying universal business model. Under this assumption, securities underwriting, brokerage services, insurance underwriting, and so on are not distinguished between and constitute the broad category of "investment banking activities". The other category is related to commercial activities. Hence, the above simplification leads to shrinking the typical set of business areas into two business lines that distinguish themselves by being interest-generating activities or fee-generating activities.

In general, the set of activities performed by financial conglomerates are distinguished between commercial banking activities vs. investment banking activities.

Measuring diversification discount in financial conglomerates

Generally, the diversification measurement is carried out from two complementary perspectives: the asset- and the income-based perspectives. The application of both these perspectives allows for a more precise diversification measurement as they compensate each other for possible bias estimation. For instance:

• the asset-based perspective considers stock variables while the income-based perspective considers flow variables;

• the income-based approach could be biased as it overestimates the degree to which some lending institutions engage in non-lending activities, since loans can yield fee income;

• the asset-based approach could be biased as it underestimates the degree to which financial institutions engage in off-balance sheets, since these activities can yield fee income.

Moreover, one limitation in applying the income-based approach is the fact that for some financial institutions, gross incomes are not available, and authors are forced to use net incomes. Hence, both approaches suffer from a measurement problem and their joint application improves the overall diversification measurement.

The Hirschman-Herfindahl Index (HHI) is the diversification measure more applied to measure diversification in banking literature (Acharya et al. 2006, Elsas et al. 2010). The HHI is identified as the sum of the squares of exposures as a fraction of total exposure under a given classification.

On the other hand, works based on Bankscope, such as Laeven and Levine (2007), suffer from more aggregated data. These use alternative measures of diversification, which are not too different from HHI, except in their interpretation. More specifically, Laeven and Levine (2007) defined two indexes depending on the business perspective, i.e. either asset -or income-based. They defined the following indexes:

Asset diversity (ADIV):

$$\text{ADIV} = 1 - \left|\frac{(\text{Net loans-Other earning assets})}{\text{Total earning assets}}\right|$$

where, other earning assets include securities and investments, and total earning assets is the sum of net loans and other earning assets.

Income diversity (IDIV):

$$IDIV = 1 - \left| \frac{(\text{Net interest income} - \text{Other operating income})}{\text{Total operating income}} \right|$$

where, net interest income is interest income minus interest expenses and other operating income includes net fee income, net commission income, and net trading income.

Both asset and income diversity take values between zero and one and their interpretation goes in the opposite direction to the HHI, i.e., higher values indicate greater diversification.

To examine whether diversification increases or decreases financial conglomerates value, the percentage difference between the total value of financial conglomerates and the sum of imputed values for its segments as stand-alone (specialized) entities should be measured. This difference is called the "excess value": it is a relative measure between the real market value of a financial conglomerate and the imputed value of a financial conglomerate artificially created by combining specialized banks. The fact that the excess value is a relative measure is the most important difference between this value and Tobin's q, which provides an absolute valuation of a financial conglomerate.

The approach of comparing the market-based performance of financial conglomerates with the market value that would exist if the bank were "chopped" into separated financial "shops" (specialized banks) is referred to as the *"chop-shop"* approach introduced by LeBaron and Speidell (1987) and Lang and Stulz (1994).

The measure used to estimate the market value is the Tobin's q. Tobin's q ratio is typically applied to infer the benefits of diversification (see Villalonga 2004a)

Given that it is important to control for the degree that financial conglomerates engage in different activities when comparing their valuation, Laeven and Levine (2007) proposed the activity-adjusted Tobin's q as an estimation of the Tobin's q that would prevail if financial conglomerates were divided into activity-specific financial institutions and priced according to q's associated with those specific activities. At the general level, consider financial conglomerate j that engages in n activities, the activity-adjusted Tobin's q for the financial conglomerate j is given by:

$$\text{Activity-adjusted } q_j = \sum_{i=1}^{n} \alpha_{ji}\, q^i$$

When studying financial conglomerates where the data source is Bankscope, the business model is proxied by two activities, i.e., lending operations versus non-lending operations, including trading, investments, and advisory services. For sake of simplicity, the first activity is referred to as commercial banking and the second activity as investment banking.

From an asset perspective, the distinction of the two business lines is translated as investments in loans versus investments in securities (or other companies). From an income perspective, the distinction is translated as interest income (mainly from loans) versus non-interest income, including fees, commissions, and trading income. Given the structure of the assumed business model (i.e., two activities), the activity-adjusted q for the financial conglomerate j is the linear combination of q^1 and q^2:

$$\text{Activity-adjusted } q_j = \left(\alpha_{j1} q^1 + \alpha_{j2} q^2\right) = = \left(\alpha_{j1} q^1 + \left(1 - \alpha_{j1}\right) q^2\right)$$

both the asset and income measures of the share of bank activity. Thus, α_{j1} equals either the ratio of net interest income to total operating income or the ratio of net loans to earning assets for bank j. The excess value equals the difference between a bank's actual q and the activity-adjusted q, so that the excess value for financial conglomerate j is:

$$EV_j = q_j - (\alpha_{j1}q^1 + \alpha_{j2}q^2) = q_j - (\alpha_{j1}q^1 + (1 - \alpha_{j1})q^2)$$

To measure activity-adjusted q's and compute excess values, we need the computation of two activity-adjusted q's: one q (i.e., q_1) that estimates the market value of banks specializing in commercial banking, and the other one (i.e., q_2) that estimates the market value of banks specializing in investment banking. Normally, banking literature classifies banks as being specialized when 90% of the assets are associated with one activity.

In constructing activity-adjusted q's and excess values, we need to compute α_{j1} and α_{j2}, which are the shares of pure commercial banking and investment banking in financial conglomerate j's activities, respectively. For the asset diversity measure, the weights are based on the relative importance of loans to total earning assets, whereas for the income diversity measures, the weights are based on the relative importance of interest income to total operating income[27].

To conclude, the excess value could be greater or less than zero. In particular, if the excess value is greater than zero, then the bank trades at a premium; if the excess value is equal to zero, then the bank trades at parity; and if the excess value is less than zero, then the bank trades at a discount.

THE FINTECH SECTOR

"The innovators of today may not necessarily be the innovators of tomorrow. The question companies need to ask themselves is "Are we innovating effectively?" While partnership is one of the preferred ways to catalyze innovation, to reap its benefits, companies need to be mindful that

[27] This approach is applied in the literature when databases such as Bankscope are utilized, like in Laeven and Levine (2007).

whomever they partner with, be it a tech company or financial institution, is a good fit.”[28]

Prior to the global financial crisis, established companies did not show any interest in FinTech startups, major banks considered the business scale of FinTech startups too small. However, the inefficiency and inconsistency of the financial system came to light after the financial crisis, growing distrust of the system led to a loss of customers. Banks had to act swiftly in response, but they could not transform on their own: not only were they too weak, they were simply too big to change. As a result, they turned to the FinTech industry. At the same time, FinTech startups were attracting many customers, who had begun to distrust and be disappointed with established players. These startups were being accepted as providers of new financial solution services, but even if they were attracting many customers, the size of their operations still paled in comparison with that of established companies. They lacked enough capital and customer trust necessary to create a financial system that could serve as social infrastructure. There were also many regulatory hurdles. Therefore, FinTech startups turned to established companies for a cooperation. So right now, especially in US, FinTech industry arose as a result of a joint effort between venture-capital companies, the government, and major corporations. Big banks started to invest in the FinTech business both acquiring platform companies and creating their own platform internally.

Despite regulation and other potential barriers to entry, we see tremendous demand for FinTech-related services in areas such as consumer banking and wealth management[29]. This will open up new opportunities for both incumbents and disruptors.[30] New players are using the online-only model to reach millennials and increasingly other segments too, at the same time traditional players

[28] Antony Eldridge, FinTech and Financial Services Leader, PwC Singapore
[29] PwC Financial Services Technology 2020 and Beyond (2016)
[30] Let’s consider the rise of “robo-investing platforms” offered by both online-only and traditional wealth management companies.

are employing this approach to significantly reduce their operational costs.[31]

FinTech, expected to deliver better, cheaper, and more transparent services, combined with a heightened customer experience (Menat 2016), holds the promise to create new value for commercial customers by applying modern technology solutions to financial services (Meola 2016). Altering costumers' expectations, FinTech poses threats to established banks and their institutionalized practices.

The post-crisis regulatory frameworks have been gradually settling into place, and financial institutions have been adjusting their business models accordingly. It is now becoming obvious that the accelerating pace of technological change is the most creative force, and also, the most destructive one, in the financial services ecosystem today.

Figure 3 shows the most important FinTech companies in the world.

Insert FIGURE 3 about here

This paragraph comes from a communication of the European Commission (09/14/2016) regarding the Capital Markets Union Reform: *"Technology is driving rapid change in the financial sector and has the power to increase the role of capital markets and bring them closer to companies and investors. It also benefits consumers by offering a wider choice of services which are more convenient to use or more easily accessible. This innovative potential should be harnessed. FinTech firms succeed by providing new services that meet consumers' needs better in many*

[31] They are also using it to find more cost-effective ways to comply with regulatory mandates such as the UK Retail Distribution Review rules. In Asia, a new wealth-management app was launched with almost one thousand products, all without commissions or fees.

financial fields including payments and lending. Technology is a driver of competition and helps to create a more diverse financial landscape. At the same time, the rapid development of FinTech poses new challenges in managing risks and ensuring consumers have adequate information and safeguards. In a number of Member States, regulatory authorities are developing new approaches to support the development of FinTech firms, including hubs providing regulatory guidance or teams focusing on policy implications of FinTech. The Commission will continue to promote the development of the FinTech sector and work to ensure the regulatory environment strikes an appropriate balance between building confidence in companies and investors, protecting consumers and providing the FinTech industry the space to develop. The Commission will work with the European Supervisory Authorities (ESAs), the European Central Bank, other standard setting bodies, and the Member States to develop a co-ordinated policy approach that supports the development of FinTech in an appropriate regulatory environment."

I founded also similar communications from Regulatory Authority in Canada, China, Australia and USA: the governments recognized the importance of the FinTech sector and are working to improve the banking regulatory system.

This allows me to think that in different countries are being drafted some rules and norms to discipline the FinTech sector and to set some boundaries in order to identify, in a clear way, what the banks are allowed to do regarding this business and which the FinTech startups can offer to costumers given that the banking sector is quite closed and regulated.

A PLATFORM-BASED BUSINESS MODEL FOR BANKS

The platform-based business model has taken hold in the digital economy, and the concept is starting to emerge in banking. Supported by global mobile access and easy distribution through mobile app stores, FinTech companies and some “progressive” banks have started to deal with the customers of traditional banks. This threatens the banks’ vertically integrated and product-focused business model, which is not always suited for building or integrating innovative FinTech services.

Therefore, banks that collaborate with fintech companies (i.e. diversify their activities in fintech services) can be considered platform-based banking. A banking platform establishes standards for third-party FinTech developers[32] to build products and services on behalf of bank customers while allowing the banks to deliver a unified banking experience. It also allows banks to own the end-to-end experience of traditional integration points such as bill pay and peer-to-peer (P2P) payment. The banks would contribute to the platform their expertise in security, authentication and compliance, while the FinTech companies would provide customer focused capabilities. Building or participating in a banking platform would require organizational and technological transformations, however these are well within the reach of a traditional bank. The cost of technology has also come down, allowing for these transformations to be feasible.

The result would benefit all stakeholders: FinTech companies would have better access to the mass market; customers would enjoy a transformed, personalized banking experience under the protection of the regulated banking industry; and traditional banks would have access to new revenue streams while maintaining their relevance in this era of digital disruption.

Financial institutions that become platforms rather than simple providers of services benefit from the intrinsic advantages of this business model.

[32] Banks can incubate FinTech companies, set up venture funds to finance FinTech companies, establish cooperation as partners, acquire FinTech companies or launch own FinTech subsidiaries.

A platform is a business based on enabling value-creating interactions between external producers and consumers (van Alstyne et al. 2016), it is an evolving organization or meta-organization that (Gawer 2014).

The platform should incentivize users and innovators to use and contribute to the platform. The result is ecosystem growth and the release of network effects. Strong network effects are an important value driver for platforms as they might create “winner-take-all” situations among competing platforms. There are two types of network effects:

• Direct network effects describe the increased value for platform users when more users join the ecosystem.

• Indirect network effects emerge when new applications for the platform get introduced. They increase the value for users to join the platform.

Both types of network effects have positive feedback loops. Each time the ecosystem grows by new users or applications, the value to be part of the ecosystem gets increased, which is what attracts new users and developers for new applications (Rochet & Tirole 2006). However, a good governance of the ecosystem through the platform owner is essential as network effects can also turn negative and ruin a platform and its ecosystem. Greater scale generates more value, which attracts more participants, which creates more value, in a self- reinforcing positive cycle[33].

Many businesses requiring significant upfront investments benefit from economies of scale since the more units are produced by a factory or plant, the lower the unit costs. These economies of

[33] The bad side is that it can also produce monopolies. Network effects gave us Alibaba, which accounts for over 75% of Chinese e-commerce transactions; Google, which accounts for 82% of mobile operating systems and 94% of mobile search; and Facebook, the world’s dominant social platform (for the time being). Source: https://hbr.org/2016/04/pipelines-platforms-and-the-new-rules-of-strategy

scale affect the supply side, that is to say the company producing the goods. Recently, however, the concept of 'demand-side' economies of scale has become quite widespread. In networks, the value of the service provided increases with the number of users because of the positive externalities already discussed. Economists therefore describe these network businesses as benefiting from “demand-side” economies of scale. Strictly speaking, this is no longer about the cost of production (supply) going down with volume, but about the value created for users (demand) going up with the number of users. The concept of “demand-side economies of scale” is also referred to as network effects.

WHAT IS HAPPENING: THE LINK BETWEEN ECONOMIES OF SCOPE

The diversification discount is a differential of market valuation attributed to firms that pursue a diversification strategy. Being a discount, such differential implies that diversified firms are valued less than focused firms are. In the banking literature, diversification discounts have been investigated with respect to business activities (corporate diversification).

Diversification can generate several (dis)economies that can create (destroy) value. More specifically, within financial conglomerates, this strategy can generate internal synergies by which firms may realize economies of scope. Sometimes these economies of scope in financial conglomerates are not sufficiently large to compensate for countervailing forces associated with diversification, such as agency problems, business and organizational complexity, along with the opaqueness of financial products so that investors and analysts have an above- average difficulty in evaluating such firms.

I argue that if a financial firm diversify into a business that is FinTech it can benefit from the features of the platform, that will produce economies of scope and of scale not only for the business itself, but also for the conglomerate in general; this would increase the economies of scope of diversification in spite of the related costs or diseconomies. The net effect of such operations could be positive rather than negative as in most cases of diversification investigated in prior empirical works.

The platform, with its value linked to installed base of users and network externalities, is not only a service provider, but is itself a product.

Possible value creation mechanism: a demand base view

Platform business models differs from traditional value chain models in that value creation takes place by linking directly the demand side to the supply side rather than focusing on value creation on the supply side only (Massa, Tucci & Afuah, 2017). Massa et al. (2017) argue that value on the demand side can be created by users either through their mere presence – for instance on a platform (see Cennamo & Santaló, 2013) - or if they actively contribute to the innovation process (von Hippel, 2005). Business models are often seen as being essential to connect technologies to the market environment (Chesbrough and Rosenbloom 2002). This is particularly relevant in many digital contexts, like Fintech, that are characterized by strong network effects and in which the installed user base, as well as the entry time play an essential role in determining which firms will succeed (Schilling, 2002).

This is what is new about Fintech: an investment in this business originates network effects and complementarities that must be valued from a demand perspective. Are the new resources available scalable by the company? It seems yes.

A financial conglomerate has a huge base of clients and, offering yet a lot of services, let the platform benefit from complementary products available. Thus, the amount of economies of scope that the introduction of such business line into a financial conglomerate could generate might be really exponential, and it could affect positively the business model of the whole structure

According to the diversification literature, an investment in Fintech business would be considered as unrelated, so we should expect diversification discount. But if we focus on the complementarities originated on the demand side (demand view), users (especially in the banking sector) consume things together: users benefit proportionately more from the investment.

A financial conglomerate that invests in Fintech, is creating value for the user. Managerial literature has always focused on the supply side, defining in general as value destroying the unrelated investments, but if we move to the demand side perspective the fintech investment should generate positive value.

The financial activities in which banks diversify could have been considered unrelated from the traditional point of view, but given that they create a related demand the investment is value enhancing, not value destroying. The demand side complementarities, together with the strong network effects originate a diversification premium.

Finally, I argue that financial conglomerates that diversify in FinTech businesses could benefit a premium rather than suffering the diversification.

RESEARCH QUESTIONS & HYPOTHESES

The issue of diversification and the creation of potential economies of scale and scope had been greatly studied in banking literature: despite expected benefits from economies of scope the literature suggests and largely show a diversification discount.

This paper aim to investigate, following Leaven& Levin (2007) whether the diversity of activities conducted by financial institutions influences positively or negatively their market valuations, i.e. if they face a diversification discount or premium.

Hypothesis 1: *The market values of financial conglomerates that engage in multiple activities, e.g., lending and non-lending financial services, are* ***lower*** *than if those financial conglomerates were broken into financial intermediaries that specialize in the individual activities.*

The financial industry is, globally, highly regulated involving licences, registration, membership, and adherence to strict norms from various banking, insurance, and securities regulators. But the disruption of digital technology and telecommunication caused the emergence of platform business in finance too, as data on FinTech companies demostrates.

Literature on platforms, and empirical evidence too, suggests that platform businesses like FinTech have several benefits: network effects on demand side generate economy of scope both on the consumption and production of bundled financial products and services.

In light of that, we want to see if when the financial conglomerates diversify into a business that is a platform (i.e. benefit from network externalities and economies of scope) the effect on market valuation is confirmed, mitigated, enlarged or has the opposite sign.

Hypothesis 2: *The market values of financial conglomerates that engage in multiple activities, e.g., lending and non-lending financial services, and diversify into one or more businesses that are* ***platforms****, are* ***higher*** *than if those financial conglomerates were broken into financial intermediaries that specialize in the individual activities.*

METHODS & DATA

Evaluating a board literature on the assessment (and recent reassessment) of the economic costs and benefits of financial conglomerates involved in both commercial banking activities and proprietary trading and other securities markets activities, this paper introduces a general framework to **investigate the financial conglomerate's value relative to focused banks** or so called "excess value".

In other terms, the framework enables to investigate whether the market would assign an increase in value to a financial conglomerate (which is multi-industry firm) as a whole rather than to its separated business lines. Elaborating on Laeven and Levine (2007) and Elsas, Hackethal and Holzhäuser (2010), this paper explains the theoretical aspects of this approach as well as the great diversity in the empirical outcome.

The dataset is composed by 1233 financial headquartered in 116 countries. We collected 5470 observations from 2013 to 2018 combining 2 different sources: Bankscope and Bloomberg. The number of countries is a consequence of data availability, not of an ex ante choice. We apply the Laeven and Levine (2007) approach to measure excess value and estimate the relation between excess value and diversification. Then, taking into account the possibility to invest in FinTech businesses, that is different across countries in terms of timing of introduction, I'll test if that influence the effect of diversification on performance.

Contrary to similar studies, our sample covers large banks from 116 developed and developing countries, filling the gap among other studies, that either consider US banks only (which may be special due to the Glass/Steagall-Act, that was effective over most of the available history of firm-level data in the US).

EMPIRICAL APPROACH

To analyze the diversification discount, We apply the Laeven and Levine (2007) measure of excess value of financial conglomerates relative to specialized banks. Thus, I'll compute the excess value as the difference between the Tobin's q of the financial conglomerate and its imputed value at the end of the year. The financial conglomerate's imputed value is the sum of its segments imputed values, which can be obtained by multiplying the financial conglomerate weight of assets (or income) by the mean Tobin's q multiplier of specialized banks in the same industry.

The Tobin's q multiplier for specialized firms is calculated as the Tobin's q of all comparables available. We didn't impose any threshold on the number of specialized banks and therefore the number of specialized banks in commercial banking might be different from the number of specialized banks in investment banking.

While Tobin's q incorporates the market's valuation of diversification as well as each bank's set of activities, excess value controls for the market's valuation of different bank activities by subtracting activity-adjusted q from Tobin's q and therefore provides a more direct way of assessing the impact of diversification per se on the market's valuation of the bank.

There are two excess value measures: one called the asset-based excess value and the other one called the income-based excess value.

The asset- based excess value is defined as:

$$AEVj = qj - \left(\frac{Loansj}{TEAj} * \frac{1}{m}\sum_{i=1}^{m} qi + \frac{Other\ earning\ assets\ j}{TEAj} * \frac{1}{d}\sum_{i=1}^{d} qi\right)$$

The income- based excess value is defined as:

$$IEVj = qj - \left(\frac{Interest\ incomej}{TOIj} * \frac{1}{m}\sum_{i=1}^{m} qi + \frac{Non\ interest\ income\ j}{TOIj} * \frac{1}{d}\sum_{i=1}^{d} qi\right)$$

Following prior studies of the diversification discount, we measured diversification using the modified version of HHI, as described in Laeven and Levine (2007), coming up with 2 measures of diversification: asset diversity and income diversity. investigate the existence of a diversification discount (or premium) for financial conglomerates in a multivariate framework.

Starting from this baseline specification we examine whether diversification status is related to excess value and how this relation change with an investment into a platform business. The specification model is:

$$EV_{jt} = \delta_j + \beta DIV_{jt} + \sum \gamma PD_{jt} + \sum \vartheta PD_{jt} \times DIV_{jt} + \varepsilon_{jt}$$

where EVjt is the excess value of financial conglomerate j at time t, DIVjt is the relative diversification measures, PDjt is the time period dummy variables (a dummy for the investment in a platform business), and the last term is the interaction between the two.

Hence, I'll estimate the pooled time-series cross- sectional regressions of excess value on measurements of diversification and time period dummy variables. To eliminate any potential omitted variabls bias and to control for the effect of unobserved variables that are constant over time, as well as unobserved variables that are constant over firms, we introduced firm fixed effects and time fixed effects. Moreover, since the observations for one specific financial conglomerate (for different years) were not independent (within the correlation), the standard errors will be adjusted for clustering at the bank level accordingly.

Here we provide only some descriptive statistics and the table of correlations of the main variables

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Insert TABLE 1 about here

Insert TABLE 2 about here

I included as explanatory variables Net Loans / Earning Asset, that represent the share of pure commercial bank activity, the asset diversity measure, the ratio of Net Interest Income / Total Operating Income for pure investment banking activity and the Income diversity measure.

Income and Asset diversity measures are not correlated, and also the income and asset perspective ratios that indicate the "specialization" of the banks seem not to have any relation. Also the Tobin's Q that represent the first part of our dependent variables, is not correlated with the independent variables.

I computed 2 measures of Excess value: the mean of EV computed through the income perspective is positive (0,0118), it means that the Tobin's Q of diversified banks is greater than the adjusted one. The opposite for the Asset Perspective, where the EV is negative (0.0439). Tables 3.1 and 3.2 show their significant relationship with the diversity measures. To compute Asset Diversity: total earning assets (as the sum of net loans and other earning assets) net loans, other earning assets. To compute Income Diversity: net interest income, other operating income and total operating income.

Insert TABLE 3.1 about here

Insert TABLE 3.2 about here

The effect of diversification on the Tobin's Q is positive, even if in terms of magnitude the income perspective one definitely larger, but none is significant, as shown in table 3.3.

Insert TABLE 3.3 about here

While Tobin's q incorporates the market's valuation of diversification as well as each bank's set of activities, excess value controls for the market's valuation of different bank activities by subtracting activity-adjusted q from Tobin's q and therefore provides a more direct way of assessing the impact of diversification per se on the market's valuation of the bank.

RESULTS

To verify the baseline Hypothesis 1, we run simple regressions following the model below, adding some firms' specific characteristics as controls: as a proxy for size log of total asset and log of total income, total equity, deposits to loan ratio, return on assets.

$$EV_{jt} = \delta_j + \beta DIV_{jt} + \varepsilon_{jt}$$

Introducing the controls, we find no significant evidence of the effect of diversification, as is shown in table 4.1

Insert TABLE 4.1 about here

The β of the diversity measures follow opposite directions. It is interesting to notice that an "heavy" diversification, that affects the patrimonial side of the company, produces a discount, while the measure of diversification referred to the income statement has a positive effect, even if no significant.

The empirical evidence that income diversity has a positive, rather that not significant impact on the Excess value let me suppose that the market consider more risky a variety in terms of asset composition, rather than a combination of different sources of income.

Fintech investments are "asset light", so they are not evident in the balance sheet, they will be seen in the income statement, embedded in the revenues, as new components of the income (and maybe also in cost reductions). It could be possible then that a variety in the sources of income could affect positively the market valuations (i.e. the Excess Value). The shift from a traditional business model to a platform one is not highlighted with a specific name like "Earnings from FinTech". The FinTech adoptions affect the way the bank sells services that already provides and the way it will deliver new (innovative) facilities to costumers.

Therefore, in order to identify the FinTech Investments, we collected data regarding the number of employees, the number of branches and the operating revenues. If a company faces, simultaneously, a decrease in the number of employees and branches, together with an increase in the total revenues, We could argue that it moved to a Fintech business., then we'll assign a dummy variable equal to 1 to the year of the investment. An increase in revenues, if combined with "negative" signals such as reduction of physical geographical presence and reduction of workers, must be due to an investment in digitalization, that had a positive effect in terms of revenues.

The explanatory model for the other regressions is the following.

$$EV_{jt} = \delta_j + \beta DIV_{jt} + \sum \gamma PD_{jt} + \sum \vartheta PD_{jt} \times DIV_{jt} + \varepsilon_{jt}$$

We introduced a Dummy for the firms that experienced the abovementioned 3 conditions and an interaction term between the dummies and the diversification measures. Results are shown in table 5.

Insert TABLE 5 about here

I expected to see a significant impact of the interaction term, but it didn't happen. It's interesting to see that the asset diversity measure has still a negative effect on diversification (-0.0113), but with the interaction (0.0302) it becomes positive. In terms of signs we can support Hypothesis 2 on the asset perspective: the fintech diversification more than compensate the negative discount of the diversification variable, with a positive net impact on the Excess Value.

Moving on the income measures, the income diversity index has a positive and significant impact on the excess value, i.e. the diversification increase the market value of the financial conglomerates, reinforcing the previous findings. Here the interaction effect is small in magnitude (-0.0135) but reduce the positive impact of diversification (0.0728).

To conclude, diversification in terms of income sources seems to give a premium to the firm, while the diversification in terms of asset typology conduct to a discount. If the asset composition is affected by an investment in FinTech the effect changes, becoming positive, supporting hypothesis 2, but for now there's no statistical evidence yet.

An initial argument for these findings could be that the market consider a penetration (diversification) into the FinTech business as a positive and powerful moderator for the risk associated with asset diversification, On the other side, a diversification related to income sources is seen (alone) as less risky, because it doesn't affect the patrimonial side and it doesn't require necessarily a risky exposure in terms of investments. Maybe, if this variety in associated with the attempt to enter in a new digital business such as Fintech, the market doesn't attribute an amplified positive effect on the value of the firm because perceives this diversification not supported enough by investments. In a condition where the income typologies are quite diversified the introduction of transversal digital innovations could add uncertainty, rather than reduce it. We argue that the income measure of diversification probably is not the best one to capture how strategic diversification choices could be affected by new business models.

There is no superiority in terms of quality of the measures between asset and income perspectives, these contrasting results can be studied and offer a fertile starting point for further research.

LIMITATIONS

This work suffers limitations in terms of data availability. Given that the phenomenon is quite recent the effective measurement of the potential investment into Fintech has been limited to the last years of the analysis, conducting to not completely satisfying results.

More in details, for sure there is a simultaneity bias: since firms choose whether (or not) to diversify, the same characteristics that make the benefits of diversification greater than the costs of diversification might affect the market value too. The failure to control for firm characteristics that lead firms to diversify might wrongly attribute the discount to diversification instead of to the underlying characteristics.

There could be also some measurement error, with the use of specific databases altering the econometric estimations and potentially leading to measurement errors. Villalonga (2004a) argued that data problems are driving the entire corporate diversification literature.

The derivation of excess values might be biased by the choices of authors for the computations. Several studies analyzing financial conglomerate discounts have relied on mean and median aggregated specialized multipliers.

The composition in terms of country of origin of the group of specialized banks we chose could have affected the excess values. Ideally, one wants to calculate activity adjusted q for each country using banks in that specific country. This has the advantage that one can focus on within-country variation in q. Laeven and Levine (2007) proposed to use a global sample of specialized banks, which was utilized as a group of comparables for all financial conglomerates in every country. Alternatively, a sample of comparable specialized banks only from the US rather than from a global sample of banks could be utilized. Also, the number of comparables is crucial: Cooper and Cordeiro (2008) provided evidence that using approximately five comparables (with specific similarities) was optimal.

For sure there are several problems of endogeneity (in general, endogeneity is a pervasive issue in empirical corporate finance), especially regarding the choice of investing into the platform business. In fact, the decision to invest is internal to the firm, it is not an exogenous shock.

While being a commercial or an investment bank is clearly defined with SIC codes, the investment in platform business is not a clear and formal attribute as them, so has been treated as a moderator, not as a new business line that can be included into the diversification measure. Someone could argue that this is wrong, and that its treatment as a moderator weakens the analysis.

To build up the sample we choose to include banks that belong to different countries to obtain, first of all, generalizable results. Someone could argue that being focused on only one country could have been better, given the specificity of regulation and norms (not regarding FinTech but regarding all the banking activity – commercial or investment), even if we decided to include some country- specific effects. For sure we can build some subsamples based on countries

Finally, we used Laeven and Levine (2007) measure of diversification, while we could have used the one of Elsas, Hackethal and Holzhäuser (2010).

In empirical works, different approaches can be adopted to control for endogeneity of the diversification decision. Generally, a proper evaluation of the effect of diversification on a firm's value should take into account several aspects: firm-specific characteristics for both the firm's values and on the decision to diversify, country-specific characteristics, and restructuring activities (such as M&As), which could bias the diversification.

We didn't control for M&A activity because, given that the FinTech business is emerging and technology intensive often incumbents choose to acquire one (or more) start-up rather than start internally the business from zero. So, the M&A activity in this case is crucial to assess the research question. But given that the positive or negative impact of a merger are lagged and that this business is really recent we should have controlled for the other kind of M&A that could have involved our banks before. We didn't because Leaven & Levin (2007) in their analysis controlled for major M&A, finding that they don't not affect the diversification discount; income diversity and asset diversity continue to enter negatively and significantly. They contradicted Graham et al. (2002), who use data from Compustat and information on mergers to assess whether the diversification discount provides misleading inferences.

We used fixed-firm effects estimator, and time-fixed effects to capture the time trend beyond the relational diversification and excess value.

One method to control for endogeneity that we will implement is to control for the self-selection of firms that diversify using Heckman's (1979) two-stage procedure. The goal is to control for the self-selection bias created by banks' choosing to diversify by incorporating the diversification decision formally into the econometric estimation.

CONCLUSIONS

Information technology plays a leading role in the transformation of banking. The latest development of information technology has led to a 'fintech revolution' where banks face new competitors with different – more specialized – business models forcing a disaggregation of the value chain. With technology-driven solutions they offer alternatives to key banking services including payments and lending. An important question is to what extent existing financial institutions can be leading. Can they be at the forefront of new developments? For example, by absorbing fintech players and their innovations? Would banks and fintech collaborate in a complementary way? Or will banks fade away, with new technology-linked players assuming prominence in the financial sector? There are still many questions, but few answers yet.

This paper would contribute both to financial banking and platform businesses and ecosystems literature, providing an interesting framework that, through an empirical approach, crosses the boundaries of those disciplines, opening new possibilities of research.

The phenomenon of financial conglomerates is unquestionably one of the most important trends in the evolution of the worldwide financial services industry. Given their size and scope, financial conglomerates are considered by governments to be too big to fail because their failure could cause widespread panic.

Disruptive innovations always existed, but what is completely new right now is that in last years, entire industries of the economy have become obsolete in a few, or have been completely altered: it is the (digital) innovation disruptive effect, a revolution that is claiming casualties but that is also able to create new markets just as quickly, sometimes even with very low costs.

Given the dominant role of conglomerates in the current financial services industry scenario on one side, and the potential offered by the last wave of digital technologies and the changes in the lifestyles they induce on the other side, our question is: "Do financial conglomerates (still) create economic value? Should they invest into platform business and follow the digitalization wave to increase it?"

We examine whether there exists a financial discount in 1233 financial conglomerates worldwide and whether the value of corporate diversification varies with investments in technological platforms.

Financial conglomerates were mainly established to realize the potential synergies between banking, insurance and investment services. The economic literature, however, has not yet been able to clearly prove the existence of important economies of scale and scope in financial conglomerates and results are controversial.

This empirical research carried out recent data on 1233 financial conglomerates and could confirm previous results, moving a step forward in considering the FinTech sector as a new diversification segment, pervasive enough to modify the whole business models of banks.

Explanations for these results are that economies of scope in financial intermediation are not sufficiently large to compensate for countervailing forces associated with diversification, such as agency problems, business and organizational complexity, along with the lack of transparency of financial products so that investors and analysts have above-average difficulty in valuing such firms.

However, these previous researches, didn’t take into account the rise of FinTech companies, and the economic characteristics that these businesses have: externalities, economies of scale, network effects. The rise of these disruptive companies is changing the business model of incumbents and also is affecting their strategy of investment.

From a demand base perspective, with a focus on the value creation for the users, combining financial conglomerates diversification and their investment in platform business the net effect on the performance could be different. The attributes of FinTech platforms could mitigate or even compensate the economies related to diversification that have not been exploited by the conglomerates. The phenomenon is so recent, maybe the scarcity of data (especially for the categorization on Fintech investment) affected the lack of significance of the empirical results. In the next years researchers will be able to investigate better this field, coming up hopefully with answers.

More attention should be devoted by regulators to promote effective regulatory change, in order to manage in the best way, the wave of disruption in the financial sector, as well as by management to adopt value-enhancing strategies of firm organization.

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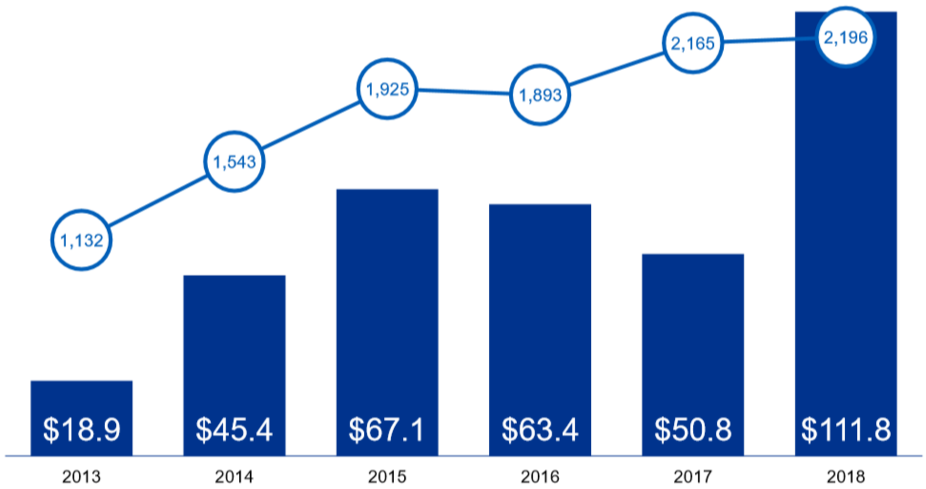
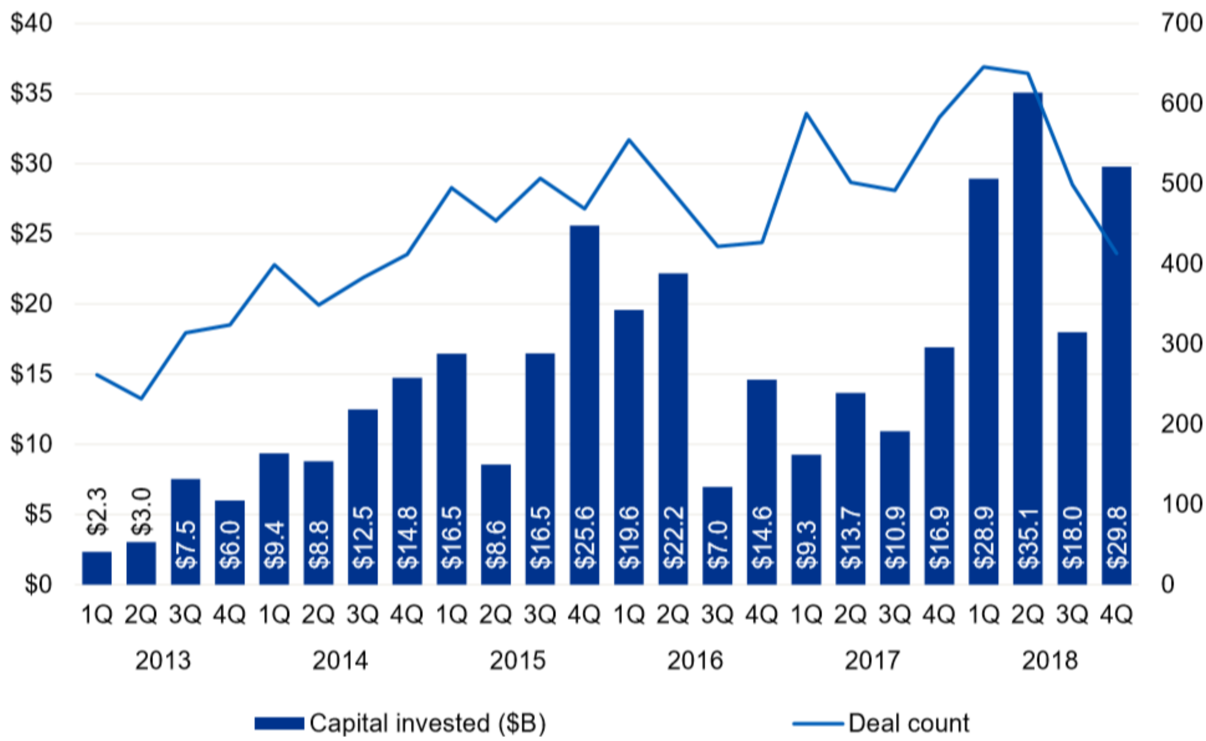
FIGURE 1
Global FinTech investment (2013-2018)



Source: KPMG, The pulse of FinTech

FIGURE 2
Total investment activity (VC, PE and M&A) in FinTech



Source: KPMG, The pulse of FinTech

FIGURE 3
FinTech companies clustered by services offered

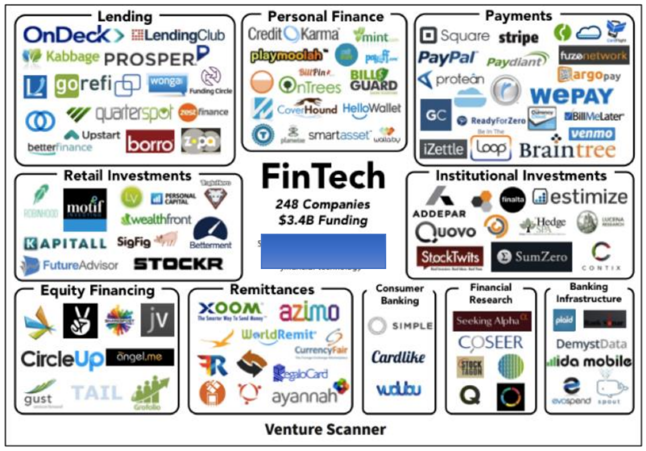


TABLE 1
Descriptive statistics of the main variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Tobin'Q	5,470	1.032033	.1712842	.08	10.98
Income diversity	5,470	.6047751	.1849104	0	.99
Asset diversity	5,470	.5933071	.2078655	.01	1
Loan to Total Earning assets	5,470	.7611718	.1015852	0	1
Net interest income to Total operating income	5,470	.6975856	.0924453	.5025491	.9980748

TABLE 2
Descriptive statistics of the main variables – focus on variations

Correlation	Tobin'Q	Income Diversity	Asset Diversity	Loan to Total Earning Assets	Net interest Inc to Total Operating Inc
Tobin'Q	1.0000				
Income diversity	0.0991	1.0000			
Asset diversity	-0.0544	0.0383	1.0000		
Loan to Total Earning assets	0.0668	-0.0185	-0.8909	1.0000	
Net interest income to Total operating income	-0.0988	-0.9999	-0.0384	0.0186	1.0000

TABLE 3.1
Excess Value

Variable	Obs	Mean	Std. Err.	[95% Conf.	Interval]
EV_ASS	5,470	-.0439657	.0023221	-.048518	-.0394134
EV_INC	5,470	.0118194	.0023109	.0072892	.0163496

TABLE 3.2
Diversity and Excess Value

	(1) EV_INC	(2) EV_ASS
INCOME diversity	0.0650*** (3.99)	
ASSET diversity		-0.0289* (-1.78)
N	5470	5470

TABLE 3.3
Diversity and Tobin's Q

	(1) Tobin'Q	(2) Tobin'Q
Loan to Total Earning assets	0.0772 (1.24)	
Asset diversity	-0.00665 (-0.21)	
Income diversity		1.141 (1.64)
Net interest income to Total operating income		2.106 (1.52)
N	5470	5470

TABLE 4
Diversity and Excess Value: controlling for bank- level characteristics

	(1) EV_ASS	(2) EV_INC
ASSET diversity	-0.00393 (-0.14)	
INCOME diversity		0.0259 (0.74)
ROA	0.0484*** (7.29)	0.0449*** (6.51)
TotalEquity	-0.000000583 (-0.77)	-0.000000535 (-0.77)
Deposits to Loan	0.00157*** (3.45)	0.00154*** (3.41)
LogAssets	-0.00119 (-0.11)	
LogIncome		-0.00984 (-0.94)
N	5470	5470

TABLE 5
Diversity and EV – with fintech

	(1) EV_ASS	(2) EV_INC
ASSET diversity	-0.0113	
	(-0.40)	
Dummy_tot	-0.0229	0.00256
	(-0.72)	(0.08)
Interaction_ASS	0.0302	
	(0.61)	
TotalEquity	-0.000000642	-0.000000618
	(-0.84)	(-0.82)
Deposits to fund	0.00175***	0.00169***
	(3.84)	(3.74)
LogAssets	-0.00724	
	(-0.65)	
INCOME diversity		0.0728**
		(2.94)
Interaction_Inc		-0.0135
		(-0.28)
LogIncome		-0.0118
		(-1.12)
N	5470	5470

MARKET VALUE VS INTRINSIC VALUE. DOES LIQUIDITY MATTER?

It is a widespread belief that the free negotiation of shares in financial markets originates prices that correctly represent, at least in terms of trends, the value of companies.

The roots of this belief are so strong that analysts and practitioners, through so-called "multipliers", determine the value of the companies according to parameters in significant part related to prices marked by other securities companies, deemed "comparables."

This paper aims to show that only criteria solidly based on the analysis of fundamentals and scenario, sector and business perspectives, can correctly lead to full appreciation of value.

An empirical international analysis also highlights the reasons why prices and multipliers can lead to value in some unsubstantiated cases. Finally, it explains the reasons why it is preferable in any area to adopt criteria based on the logic of discounted cash flows (DCF).

> *Financial markets should not be treated as a physics laboratory but as a form of history.* —
> George Soros, "Anatomy of a Crisis" April 9, 2010 (at King's College, Cambridge)

INTRODUCTION

Tesla is now worth over $450 billion after an extraordinary growth spurt. But in the era of inflated market figures, does that really mean anything at all?

Elon Musk has just done something incredible. Despite setting unrealistic production targets and butting heads with Wall Street, Tesla topped $300 billion for the first time in July to become the most valuable car manufacturer in the world, surpassing Toyota too[34].

Insert FIGURE 1 about here

Apple is a groundbreaking stock. It was the first company to be worth $1 trillion, and after a giant loss it lost the membership in the trillion-dollar club. This was a bit of a shock, but with big earnings come the risk of major losses. And despite these recent earnings hit, the fact is that Apple is chronically undervalued[35]. How did this happen with such a popular company? In large part because its investors expect so much of it in terms of creativity (since Steve Jobs' death in 2011, the company hasn't made any major design moves), reputation (a whole set of Mac-specific viruses have cropped up, leaving users vulnerable) and growth (the company has room for growth and has a sizeable cash hoard).

A company like Tesla never sticks to the positive predictions that are made on its account. It is constantly overrated. Apple, on the other hand, always makes profits that beat forecasts. It is constantly underestimated.

Why is it? There's a bias in analyst ratings. And it's not just Tesla's and Apple’s case.

Most financial economists agree that a stock’s intrinsic value is the present value of its expected future dividends or, more precisely, of the expected future cash flows available to common

[34] Source: Forbes (2020), Bloomberg (2020)
[35] Source: finance.yahoo.com (2018)

shareholders, based on the currently available information. However, there are practical problems in measuring the intrinsic value by looking at a company's fundamentals. The limited attention paid to this critical topic reflects the standard academic view that a security's price is the best available estimate of intrinsic value (Lee et al. 1999). In this context, the value determined using market information is also known as market value.

Nonetheless, sometimes there are conditions for which the market value can diverge significantly from the intrinsic value of a company. In turbulence periods, the prices may experience significant changes and, accordingly, the market value fluctuates, amid no changes in the company's fundamentals, operating conditions, and future growth opportunities that could justify a proportional variation in the intrinsic value.

In general, the intrinsic value is an objective measure linked to the cash flows generated by the management activity and to the capital size of the company, which are only in part influenced by factors outside the control of the firm (Guatri 1981). Regarding the market value, if the company is listed, it is the expression of the price in the stock market; otherwise, if the company is not listed, it is the price observed in comparable firms or transactions. Since market prices originate from negotiations, the market value should reflect the contingent phenomena of supply and demand and the conditions of the counterparties involved in the transactions. The market value is, therefore, a variable outside the full management control, as it is also strongly influenced by the structure, efficiency and economic performance of financial markets.

To measure the intrinsic value, Guatri (1981) highlighted the need to adopt an evaluation process with characters of generality, rationality, demonstrability, and stability[36], features that typically

[36] To evaluate the intrinsic value, the valuation technique must be general, so it must disregard specific and contingent factors capable of conditioning the trend of supply and demand. Secondly, it must result from a rational estimate and

characterize the discounted cash flows approach. Indeed, in this valuation method, the value of an asset is given by leveraging on its fundamentals such as future cash flows, growth, and risk characteristics. In contrast, the definition of market value relies on market information and leverages on relative approaches. There are two components to relative valuation. The first is that to value assets on a relative basis, prices have to be standardized by converting prices into multiples of earnings, book values or sales. The second is to find similar firms in terms of business model, risk, growth potential, and cash flows.

In efficient markets, the market value should converge to the intrinsic value (Fama 1965), so the two expressions of value should be identical. Market efficiency theories assume that prices incorporate all relevant information when they are made available, so, at any point in time, the market price represents the best estimate of the intrinsic value of the firm. Any attempt to exploit perceived market inefficiencies will cost more than it will make in excess profits. The basis of capital market efficiency theories was formulated at the end of the nineteenth century by A. Marshall (1892). Markets are systems that guarantee continuous balance between supply and demand, risk and return, price and quantity. Therefore, in the case of an exogenous shock, the system absorbs the shock and immediately returns to equilibrium.

Market efficiency theories do not state that prices are constantly correct, but they support the fact that the difference between market and intrinsic values is not systematically or unpredictably abnormal. Other than market efficiency, the theory of the capital market, developed over the last fifty years, is based on another important hypothesis37: rationality of investors.

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based on a clear and acceptable logical scheme. It must be demonstrable and objective, thus the valuation tool must rely on credible values, reducing the uncertainty to the minimum degree. Finally, it must be stable, i.e., it must exclude temporary factors that significantly influence the results of the company in the short-term.

[37] Among the pioneering work on the balance of capital markets, it should be noted:

The assumptions about market efficiency have been the cornerstones of the models of world finance in recent decades. This theory, however, expresses predictions that often do not find confirmation in empirical investigations. In line with Mauboussin's deductions (2002), numerous studies have documented anomalies that are poorly adapted to the efficiency trends of the market and the consequent predictability of prices and returns. First, market returns cannot be approximated by a normal distribution function effectively. Indeed, return distributions exhibit high kurtosis, so the tails of the distribution are fatter, and the mean is higher than those predicted by a normal distribution (Mauboussin 2002). Furthermore, the conclusions of the random walk theory, which suggests that it is not possible to make timely predictions based on the analysis of the historical performance of securities yields, are not always confirmed by empirical surveys. In particular, Campbell et al. (1997) demonstrated that financial asset returns are predictable to a certain extent. Other researchers, who have relied on the work of Mandelbrot (1963), demonstrated the existence of a long-term memory component in market behaviors. Third, risk and return are not linked by a linear relationship. In their empirical tests of the CAPM model, Fama and French (1992) concluded that there was no evidence to support the basic prediction of the SLB (Sharpe-Lintner-Black) model. Besides, they also reported that two other non-CAPM factors - firm size and market-to-book value - were systematically correlated with stock returns during the measured period. Fernandez (2001) stated that multiples often have broad dispersion, making the valuations performed using multiples subject to intense debate. Finally, investor behavior does not always appear to be rational. Numerous empiric investigations show that individuals systematically make errors of judgment. The Prospect Theory (Kahneman 2003) demonstrates how the degree of risk

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H.M. Markowitz, "Portfolio Selection", Journal of Finance, vol. 7, n. 7, March 1952. W.F. Sharpe, "Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk", Journal of Finance vol. 19, n. 3, September 1964. J. Lintner, (1975). The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. In Stochastic optimization models in finance (pp. 131-155). Academic Press.

aversion of individuals is profoundly influenced by the way information is presented and organized. Investors trade more than the theory suggests and operate through an inductive, rather than a deductive, logical process.

Moreover, there are internal and external phenomena that can make the company's market price deviating from intrinsic values, going against the presumptions of market efficiency theories. Among the endogenous factors of the company emerges its effective and transparent communication on the ability to create value (Li et al. 2012), as well as the credibility of the strategies (Holmstrom & Tirole, 1993), which represent the capacity of the firm to generate future income. The main exogenous factors relate to the efficiency of financial markets, as well as the phase in the economic cycle (Born & Pyhrr (1994), Park & Chen (2006)) and their liquidity (Maug 1998). In particular, on this last point, we identify as liquidity, the ability of a market to turn an asset into cash quickly at its fair market value (Saunders and Cornett 2017). Accordingly, we expect that if for long periods the markets are characterized by thin trading volumes and a low amount of floating shares compared to a company's total share outstanding, the relationship between the fundamental determinants and the market value may significantly differ compared to more liquid markets.

In a context where the market is not infallible, this paper intends to show whether liquidity variables such as trading volume and governance variable like floating shares influence multiple valuations. **The objective is to demonstrate that under certain liquidity and dilution conditions, market value can change potentially converging or rather diverging from the intrinsic value.** The research questions are thus the following:

- **Does the concentration (dilution) of ownership (represented by the number of floating shares) play a key role in determining the market value of a company?**

- **Does a liquidity variable such as trading volume influence the behavior of fundamental indicators in determining the market value in the share listed in Stock Exchanges at a global scale?**

The original value of this paper is, therefore, twofold. From an academic standpoint, there is still a relatively little body of managerial research on this topic, although market multiples are a widespread method of valuation. From an empirical perspective, given the relevance of market multiples as a valuation method, this would provide a clearer picture of the exogenous market conditions such as liquidity elements that should exist to effectively employ market multiples as a method of valuation.

THEORETICAL BACKGROUND

The Phenomenon

Unlike private companies, the value of any public company is meant to be easy to calculate; after all, it is governed by share price. That share price is carefully monitored by market analysts, who evaluate the trajectory of stock prices to gauge a company's general health. They recommend a buy or sell based on earning histories, and price-to-earnings ratios, which signal whether a company's share price adequately reflects its earnings. All this data aids analysts and investors in determining a company's long-term viability.

But the decision-making behind what a company is worth is more visceral than numbers. In the case of Tesla, market insiders claim Musk has the "Steve Jobs" factor, with the company riding a wave of goodwill as eco-conscious customers turn to electric vehicles. More importantly, Tesla has a massive cult-like customer following, and historically very little competition in the space[38].

That is what is moving the dial in Tesla's favor, market insiders say – and that is likely to continue. Against the cult of Musk other car manufacturers like General Motors, Ford, or VW – who have baggage in the petrol and diesel space – are finding it tough to compete.

This influence of brand reputation, earning forecasts and market appetite can easily overhype a company's valuation - and Tesla's $300bn mark-up might soon be a prime example of this.

Damodaran says that the best measures to use to understand when companies are overhyped are whether a business valuation is "possible, plausible or probable". If the market size makes that growth possible, if the figures make it plausible and if the future forecasts make it probable – then it will survive the hype. So, is Tesla really worth $300bn?

Probably not: the big catch has always been production targets, which are expected to grow to half a million in the coming months. That will involve a lot of time and investment.

Unless that production number multiplies drastically, it will be difficult for the sales figures to back up what the market believes Tesla is worth.

Valuing using multiples

Public markets are the generally accepted mode for valuing securities, but the prices they set may miss the mark when it comes to true value. Lord John Maynard Keynes famously characterized the process of valuing publicly traded securities as a beauty contest. He noted that investors are

[38] Source: Weird.com, January 2020

highly intelligent people trying to guess what the average person thinks.[39] And in 1993, Peter Drucker wrote:

"And one of the basic problems is that management has no way to judge by what criteria outside shareholders value and appraise performance — the stock market is surely the least reliable judge or, at best, only one judge and one that is subject to so many other influences that it is practically impossible to disentangle what, of the stock market appraisal, reflects the company's performance and what reflects caprice, affects the whims of securities analysts, short- term fashions and the general level of the economy and of the market rather than the performance of a company itself.[40]

The low aptitude of prices to reflect the dynamics of the fundamental phenomena determining the value is demonstrated; however, it is undeniable that the use of the market multiples method, by operators and analysts, is now consolidated practice. It is therefore advisable to investigate the reasons behind the widespread use of market methodologies with respect to flow-based methodologies, of which methodological superiority has been repeatedly emphasized.

A first order of reasons certainly lies in the simplicity and immediacy of application of the multipliers. It should in fact be remembered that the correct application of the DCF still involves considerable analysis efforts; leaving out the simple technicality that allows the preparation of multi-year plans and flows, the quality and transparency of the evaluations depends on the sustainability, completeness and consistency of the basic assumptions. Let's think about the commitment necessary to formulate hypotheses with reference to the general economic and

[39] John Maynard Keynes, The General Theory of Employment, Interest, and Money (London: Macmillan, 1936), p. 156.

[40] Letter from Peter Drucker to Robert A. G. Monks, June 17, 1993

financial context, to the sector in which the company being valued operates, as well as of a more specific nature affecting the company itself.

Secondly, financial analysts, in their capacity as "judges" of company performance, frequently tend to adopt imitative behaviors, often dictated by the well-known "benchmark" logic. They tend to base their judgments preferably on extrapolations of current prices, rather than on solid fundamental analyzes. It is therefore more usual and widespread for analysts to follow the trends expressed by the market when formulating equity reports, rather than anticipating them[41].

Although analysts base their beliefs on the theoretical assumption that provides for the complete reliability of market indications in the long term, the excessive variability of the data transmitted by the latter invalidates the legitimacy of their judgments. Furthermore, since the efficiency of the markets is directly influenced by the quantity and reliability of the information available, it could be assessed that the information transmitted to the market by the analysts is unlikely to have a positive impact on the efficiency itself.

To conclude, external analysts do not focus deeply the fundamentals of the industry, but understand what can inflate the market value or not; it doesn't matter if the goals set and communicated by the companies are achievable or not.

Who evaluate a company from the inside, instead tend to depress the value of the company, or at least to be conservative concerning growth prospects in the fundamentals, they base their analysis on numbers without catching the market value drivers.

But why is it a problem?

A firm whose real value is not correctly communicated to the market and to potential investors can suffer because of stakeholders' constraints to investment choices, the strategy of the

[41] We conducted some interviews with financial analysts: Jean Francois Astier, Head of Global Capital Markets, Barclays Investment Bank; Giulio Greco, Director, Equita Group; Jean Pierre Mustier, CEO, Unicredit Group.

management can be “blocked” and those companies do not attract the resources needed to implement their strategy.

The volatility of multiples

A further confirmation of the scarce ability of multiples to lead to the determination of reliable values for listed companies is represented by their variability over time. In fact the multipliers show a strong variability in general and, in particular, a greater dispersion with respect to the past, highlighting the absence of a direct and proportional causal relationship between changes in the fundamentals underlying the company's performance, and price variations.

We collected data on the most important stock indexes[42] in US and Europe and then conducted an analysis on their main multiples: the multiples of turnover (Sales), gross operating margin (Ebitda) and operating income (Ebit) were calculated with respect to the Enterprise Value. Reference was made to the economic data of the companies that make up each index, relative to 31 December of each of the years under analysis. In cases where some economic data were not available, the overall Enterprise Value has been appropriately adjusted.
In the period analyzed, multipliers’ value shows consistent oscillations, and an amplified dispersion in the middle of the time horizon.
Since the financial crisis of 2007- 2008 impacted dramatically the financial market, we divided the reference time horizon into two sub-periods, more precisely from 2007 to 2011 and from 2012 to 2018.

[42] FTSE MIB, DAX30, CAC40, IBEX35, FTSE100, S&P 500.

Firstly, we analyzed the trend of the multiple EV/Sales (see Figure 2.1): the multiples were decreasing after the crisis, then they faced three years of oscillation until 2011; after that, they start again to slightly grow, reducing the overall dispersion. While all the countries included in the database share the same overall trend[43], the magnitude of the impact varies across them.

Insert FIGURE 2.1 about here

Secondly, we analyzed the trend of multiple EV/Ebit (see Figure 2.2). In 2007, the average multiple was 15 with a moderate variability across the countries (the maximum value was 16.6 for the FTSE 100 while the minimum was 13.3 for the CAC 40). In 2018 the situation is different: on the one hand, the average value is still similar (16) but, on the other hand, the range of the values observed across the countries is significantly larger (the maximum value was 20.8 for the FTSE MIB while the minimum was 12.1 for the DAX 30). European countries[44], except for Germany, followed the same path between 2007 and 2018: a reduction of sales not compensated by a correspondent decrease of the EV.

Insert FIGURE 2.2 about here

Finally, similar conclusions can be deduced by analyzing the graphs of the multiple EV/Ebitda (See Figure 2.3). As for the previous cases, the multiple fluctuates considerably and the range at

[43] IBEX 35 is influenced by some outliers such as Inmobiliaria Colonial
[44] FTSE 100 is influenced by some outliers such as JustEat

the beginning of 2007 is lower than the one at the end of 2018. For the CAC 40, Ebitda, differently from the Ebit, at the end of 2018 decreased by 5% while EV by 6%, therefore they seem to be more correlated. However, if we analyze their trend it possible to note that in some periods (2012-2015) they did not follow the same trend: EV increased while Ebitda decreased. Another case of possible not correlation between EV and fundamentals is shown by the tendency of EV/Ebitda in the UK Average Ebitda in 2018 is similar to the one of 2007 but EV is 36% lower. Again, in the US, the EV seems not to be highly correlated with the tendency of fundamentals (Ebitda increased by 56% while the EV by 70%).

Insert FIGURE 2.3 about here

The fluctuations of the indicators depend, to a large extent, on the increases in the Enterprise Value. In particular, the volatility of the values is a function of reasons not related to the performance of the fundamentals: Sales, Ebitda and Ebit grow more[12] contained than the total value of the relative company. The variation coefficients, calculated over a time horizon from 2007 to 2011 and from 2014 to 2017, relating to turnover, Ebitda and Ebit are always lower than those relating to Enterprise Value. This therefore confirms that price changes do not accurately reflect the company's economic performance.

Prices therefore grew at considerable rates, based on future growth expectations, subsequently deemed to be excessively optimistic or pessimistic, rather than on the basis of a solid prospective analysis.

[12] or decrease according to the year

The objective of the study is to show the limits of relative valuations in representing the intrinsic value of a company. Moreover, we show how the impact of certain fundamental indicators changes in determining the market value of a company in different liquidity condition of the market, with a focus on the major markets in Western Europe and the US.

First of all, we show how the volatility in the market collides with long-term stability, which is a fundamental element to measure the intrinsic value of a firm (unless motivated by changes in the strategic direction); accordingly, we studied the fluctuations in the major market indexes. Figure 2 shows that the market index trend in the major developed countries is not constant and, instead, they are subject to high monthly fluctuations. In this circumstance, it is difficult to compare the close variations of the indexes with correspondent changes in the intrinsic value of the companies, especially in the short-term. Even in turbulent contexts, only the changes in a firm's strategic vision can impact the business fundamentals and, therefore, the intrinsic value[45].

Insert FIGURE 3.1 about here

The studies of Table 1 and Figure 3 highlight that the phenomenon that emerged with increasing strength in recent years is the volatility in the stock market prices.

Insert TABLE 1 about here

[45] Monks & Lajoux, 2012 "Corporate Valuation for Portfolio Investment: Analyzing Assets, Earnings, Cash Flow, Stock Price, Governance, and Special Situations"

Insert FIGURE 3.2 about here

The variation coefficient is high, testifying just a partial significance of the values of the indexes and, more in general, of the prices of the companies; especially, if we use these values as proxies for rational, verifiable and independent economic values.

Since 2007 the variation coefficient in all the main European stock exchanges has experienced rapid growth and reached, in certain cases, values close to 0.3.

This trend finds an explanation in the significant volatility introduced by the outburst of the financial crisis in 2007, even if it is also motivated by the temporary volume imbalances in the Stock Exchanges.

Regarding the intrinsic value, as we already pointed out, it is difficult to assume how the large variations in the market indexes (Figure 3.1) correspond to equivalent changes in the value of the underlying companies. Therefore, we need to adopt certain precautions when using market prices in the evaluation of economic capital.

First, we must pay attention to the general performance of the markets and the main characteristics of the indexes' results. The second warning concerns the significance of the individual prices and their comparability over a broader time horizon.

Our research will focus how prices are formed, measuring the incidence of the floating on the number of total shares, and the number of shares traded daily compared to the total number of shares issued.

Previous research (Hanna (1978), Harris and Gurel (1986), Karpoff, J. (1987) already demonstrated that price significance links to the exchanged volume of a security, both in terms of the total number of shares and the free float. At this point, we need to assume that the results are more significant, the greater and more consistent are the stock' exchanges; undoubtedly, below a minimum threshold, the market price ceases to signal the intrinsic value of the company.

Literature Review

While textbooks on valuation (e.g., Copeland, Koller, and Murrin (1994), Damodaran (1996) and Palepu, Healy, and Bernard (2000)) devote considerable space to discussing multiples, papers that study multiples conduct limited analysis, in term of time- horizon and typology of ratios and are quite different in methodology. Despite their widespread use in practice, accounting-based multiples are subject of few academic studies. Among the first studies, Boatsman and Baskin (1981) compare the valuation accuracy of P/E multiples based on two sets of comparable firms from the same industry. They find that valuation errors are smaller when comparable firms are chosen based on similar historical earnings growth, relative to when they are chosen randomly. Alford (1992) studied the effects of different methods for identifying comparable firms based on industry membership and proxies for growth and risk on the accuracy of valuation estimates. Findings show that valuation accuracy increases when the quality of the industry definition used to identify comparable firms is narrowed, while adding controls for earnings growth, leverage, and size does not significantly reduce valuation errors. In contrast, Kim and Ritter (1999) demonstrate that relevant adjustments for differences in growth and profitability are necessary, given the wide variation of such multiples within an industry. Liu, Nissim and Thomas (2007), instead, show that forecast market multiples are more accurate than trailing numbers.

Some studies accredit the weaknesses of market multiples in corporate equity valuation to the fact that generally investments in private firms perform differently from publicly traded companies (Palea and Maino 2013). Quigley and Woodward (2002) and Moskowitz and Vissing-Jorgensen (2002), for instance, report lower returns for private companies than for public ones. Cochrane (2005) documents an extraordinary skewness of returns for private firms, with most returns that are modest and a long right tail of extraordinary good returns. Ljungqvist and Richardson (2003), in general, document that investment in private firms generates excess returns on the order of five to eight percent per annum relative to the aggregate public equity market.

Studies on the accuracy of transaction multiples are even scarcer. Among these, Kaplan and Ruback (1995) examine the valuation properties of the discounted cash flow (DCF) approach for highly leveraged transactions. While they conclude that DCF valuations approximate transacted values reasonably well, they find that simple EBITDA multiples result in similar valuation accuracy. Berkman et al (2000) corroborates the findings of Kaplan and Ruback (1995) with their study; it suggests that the best discounted cash flow method and the best price earnings comparable have similar accuracy.

Palea (2016) instead demonstrate that transaction and market multiples perform very poorly under stressed conditions. The research focuses on the core period of the recent financial crisis, showing that transaction and market multiples performed bad at least during financial turmoil, i.e. under the most uncertain information condition, and that relevant firm-specific adjustments are necessary. Specifically, equity valuation based on multiples entails measurement errors which tend to overestimate and to lead to more volatile values. Consistent with previous research, findings show that both transaction and market multiples do a very poor job in assessing the fundamental value of a firm, suggesting that specific risk factors matter significantly.

Taken as a whole, empirical research suggests that corporate equity valuation based on market and transaction multiples cannot provide sufficient reliable information. This is not a trivial issue if one considers that market and transaction multiples are used to assess the fair value of financial instruments for financial reporting purposes[46].

Liquidity and corporate governance

Bhide (1993) argues that enhanced market liquidity comes at an expense for efficiently governed firms. In the U.S. regulations are designed to promote liquidity for passive stockholders. However, these same regulations limit the liquidity for active stockholders. Burkart et al. (1997) find support for this argument and document excess monitoring by large shareholders. Kahn and Winton (1998) also support the notion that increases in liquidity can have a negative effect on monitoring. Holmstrom and Tirole (1993), instead, point out that concentrated ownership, which in essence decreases liquidity, reduces the benefits of market monitoring. Maug (1998) argues that the trade-off between liquidity and control does not exist. A more liquid market allows a large shareholder to sell stocks more easily, but, by the same token, also makes it easier for him to accumulate large stakes. Maug's theoretical model implies that liquid stock markets tend to support effective corporate governance.

[46] According to IFRS 9, Financial Instruments, equity instruments must be valued at fair value. IFRS 13, Fair Value Measurement, states that fair value is the price that would be received to sell an asset in an orderly transaction between market participants at the measurement date. Fair value is therefore an exit price, i.e. the market price from the perspective of a market participant who holds the asset. If observable market transactions or market information are not directly observable, fair value is determined by using valuation techniques, which can be based on transaction and market multiples. According to IFRS 13, market and transaction multiples must have the highest priority in valuation techniques, as they are corroborated by market data and thereby supposed to be highly unbiased.

Liquidity and firm value

The literature on the relationship between liquidity and corporate value is much less controversial. Based on standard asset pricing models, empirical research has concluded that the lower the liquidity, the higher the required rate of returns. This higher required rate of return is to compensate investors for bearing the illiquidity risk. This higher required rate of returns implies a lower market value for illiquid firms. Amihud and Mendelson (2008) and Odegaard (2007) demonstrate that the liquidity of a firm's security impacts the value of the firm. Amihud and Mendelson (2008) conclude that corporate policies that enhance liquidity positively impact market value. In a recent paper, Fang et al. (2009) find that the positive relationship between liquidity and firm value is due to higher operating profitability and performance-sensitive managerial compensation. They further investigate the causality effect between liquidity and firm performance and confirm the positive impact of liquidity on firm value.

Some recent literature on the impact of liquidity on firm value (Bharath et al. (2013), Edmans and Manso (2011)) has begun to look at the impact of multiple blockholders on firm valuation. Bharath et al. (2013) find that U.S. firms with multiple blockholders have higher valuations (measured by Tobin's Q) than firms with a single blockholder. Edmans and Manso (2011) develop a model to determine the blockholder structure that maximizes firm value: they show that multiple blockholders can discipline management through trading. In their model multiple blockholders trade competitively for profit. The enhanced trading impounds more information into prices and reveals the fundamental value of a firm. This induces management to exert more effort and thus increases firm value. In the multiple-blockholder framework, these two studies demonstrate the important positive role of liquidity on firm valuation.

There are plenty of theoretical reasons to suspect that market liquidity will positively affect firm performance. Because stock shares are the currency which commands both cash flow and control rights, the tradability of this currency plays a central role in the governance, valuation, and performance of firms. In theoretical analyses, liquid markets have been shown to permit non-blockholders to intervene and become blockholders (Maug, 1998), facilitate the formation of a toehold stake (Kyle and Vila, 1991), promote more efficient management compensation (Holmstrom and Tirole, 1993), reduce managerial opportunism (Edmans, 2009; Admati and Pfleiderer, 2009; Palmiter, 2002), and stimulate trade by informed investors thereby improving investment decisions through more informative share prices (Subrahmanyam and Titman, 2001; Khanna and Sonti, 2004). Thus, a priori, a positive relation between liquidity and performance is quite plausible. However, despite the large number of theoretical papers with predictions related to liquidity's effect on performance, empirical researchers have not made this relation the center of systematic empirical investigation on how "adjust" the market valuation in non- liquid markets and on why is it crucial for the economy as a whole. Our paper aims to fill this gap in the literature by examining whether and why liquidity affects firm performance, together with the role of ownership concentration, highlighting the importance of a fair market valuation consistent with the fundamentals.

WHY STOCK MARKETS ARE SO IMPORTANT

Stock markets are one of the factors that affect the economy, but there are others as well. Interest rates affect the economy because rising rates mean higher borrowing costs. Consumer spending and business investment slows down, which reduces economic growth. Falling interest rates can stimulate economic growth.

The trading of stock in public companies is an important part of the economy. Stocks are a type of security that represent ownership interest in a company. Stock trading allows businesses to raise capital to pay off debt, launch new products and expand operations. For investors, stocks offer the chance profit from gains in stock value as well as company dividend payments. Stock prices influence consumer and business confidence, which in turn affect the overall economy. The relationship also works the other way, in that economic conditions often impact stock markets.

Stock Market Trends

The prices of individual stocks are dynamic, giving the entire stock market a dynamic and even volatile character. Stock prices tend to trend, and these trends have a psychological impact on individuals and businesses. Rising stock markets, or bull markets, can create a sense of confidence about the direction of the economy. As prices continue to rise, more investors come into the market, which builds on the momentum. Falling stock markets, or bear markets, usually have the opposite effect. People feel pessimistic about the economy. Media reports about market trends can create a sense of panic. People start moving funds away from stocks into low-risk assets, which can depress stock prices even further.

Stock Trends and Consumer Spending

Bull markets can create a wealth effect. People feel more confident as their investment portfolios rise in value. They spend more on big-ticket items, such as homes and cars. Conversely, falling stock prices create a reverse wealth effect. Falling portfolio values can create uncertainty about the future of the economy. People hold back on their spending, especially on nonessential items.

This slows down economic growth because consumer spending is a key component of the gross domestic product.

Effect on Business Investment

Stock prices can affect business investments. Businesses are likely to make capital investments when they feel that these investments will lead to rising market values, such as during rising or bull markets. Management has more operational flexibility if sustained stock price increases lead to increased consumer spending. Merger and acquisition activity tend to increase during bull markets because companies can use stock as currency. Initial public offerings increase as new companies take advantage of market optimism to raise capital. Bear markets have the opposite effect. Businesses become less confident about investing in new infrastructure projects or expansion plans. Merger activity slows down, as does the number of new company listings. This reduction in business investment activity slows down the economy.

How to capture value

A firm's value is driven by the underlying economics, such as its production function, investment opportunity set, and risk. But another indicator of securities' value — a deceptively simpler one — is their current price: but what does price, by itself, really tell? It indicates only what other investors are willing to pay during the time of the price: it sets a temporary floor for buying today. A security's price shows the market's expectations about the company right now. The valuation based on security prices is a matter of estimation, requiring as many tools of knowledge and thought as possible.

There are many more obstacles in using market prices. The current market price does not reflect the actual value of a company, since any attempt to buy a significant amount of shares may immediately affect the share price. Market prices fluctuate, sometimes violently. The market price cannot be ignored, but analysts should make an attempt to answer the question of how much the company is really worth. In particular, in case of imperfect markets (low liquidity), the value of a company may be easily over or under- estimated. Recognizing this fact is crucial for buyers, sellers, or investors taking any long-term positions.

It may also be important for a company when planning a new issue. Finally, when a company is a start-up, or exists but is about to take a strategic decision that may appear to be a big leap, we are devoid of market-based information, when estimating the value of a company is a must.

Setting the proper company value may also facilitate remuneration of managers. Any system that is based on book values may be vulnerable to manipulation. For example, the management may easily increase ROA of a company by taking a decision to cease investing in fixed assets. As an investment in R&D may mean losses that the company will incur for a few years, the management that is rewarded based on net profit will never take such decisions.

In some conditions, we will see, the predictability of the market multiples is stronger than in others, and it is important not only for investors but also for companies to have a clear picture of how their business activity value creation can be perceived by the market and then translated into ratios. For firms is important to generate greater long-term value, and for them is strategic to understand the levers firms can use to attain to such value.

The solution could be a combination of fundamental valuation and market valuation, that allow a company to express its real value in the financial markets, talking with long- term investors, interested in the real underlying value of a company, in supporting its growth and projects, and not only in making short- term profits following the market sentiment.

METHODS

First empirical evidence

Here we focus on all the companies that make up the FTSE MIB index. Figure 4, thus, shows the monthly average number (in 2018) of free float and the volume of exchanges compared to the total number of shares that constitute the share capital.

Insert FIGURE 4 about here

From the graphs shown in Figure 4, it is evident that the incidence of monthly average floating capital and volume exchanges over total share is particularly reduced. The average ranges between a minimum of 24% and 3%, respectively, and a maximum of 100% and 37% relative to the total share capital. On average, the free float represents about 62% of the total number of shares issued in the FTSE MIB index, while the monthly negotiation is about 10% of the share capital. If the data are adjusted to take out the effects of the financial institutions which, due to the specific governance that distinguishes them, are not directly comparable with the other companies belonging to the index, the float and the monthly volume negotiations drops, respectively, to 58% and 9% of the total number of shares issued.

In Europe and the US, and Italy, the monthly average negotiations are mostly concentrated below the 15% threshold of the share capital (see Figure 5.A and 5.B). However, Figure 6 shows contrasting results; on the one hand, the % of Free Float over total share capital has slightly increased during the analyzed period, moving from 83% in 2007 to 85% in 2018; on the other hand, the monthly average negotiations over total share capital has almost halved going from 18% to 9%, a condition that distinguished almost all countries uniformly. Spain and the UK have been the worst-performing nations on this indicator recording, respectively, a -18% and -9% drop during the analyzed period.

Insert FIGURE 5.A about here

Insert FIGURE 5.B about here

Insert FIGURE 6 about here

From the previous figures it clearly emerges that the trading volumes are of modest dimensions. Although it is possible to identify securities with higher exchanges, it seems misleading to say that the significance of the prices marked by the markets is consistent. Furthermore, given the scarcity of trading recorded on the securities, the signal validity of the price is inevitably reduced, with reference to the intrinsic value of the company.

Data

For our analysis, we used web-scraping techniques to collect data from Datastream (Thompson Reuters)[47], leveraging the following market indexes: FTSE MIB, for the Italian Stock Exchange, DAX30, for the German stock exchange, CAC40, for the French Stock Exchange, IBEX35, for the Spanish Stock Exchange, FTSE100, for the British Stock Exchange. Furthermore, for specific comparative purposes, reference was made to the S&P 500, representative of the US Stock Exchange, which generally characterizes for greater thickness. We collected data about the indexes as a whole and about all the companies listed that belong to those indexes, with a time horizon of ten years: since 2007 the indicators have been constructed extending the reference time horizon up to September 2018.

An overview over the variables that we use in this paper and their source can be found in Table 2:

Insert TABLE 2 about here

In order to deal with missing variables and outliers we winsorized the dataset at the 5%, coming up with a sample that contains information on 752 companies.

Prior to estimating our system of equations, we report in Table 3 some descriptive statistics and in Table 4 the correlation of major variables. We find no interesting features in the relationship between major variables of interest.

[47] Datastream contains all the information we needed and given that a lot of variables have been computed later, to have homogeneity among the initial data of companies and across the countries is very important for the consistency of the analysis.

Insert TABLE 3 about here

Insert TABLE 4 about here

The main variables of interest in our analyses are the current and the forward multiples EV/SALES, EV/EBITDA and EV/EBIT, computed yearly for every company in the dataset. The EV/SALES is calculated as EV divided by last/forward 12 months SALES, similarly the EV/EBITDA and the EV/EBIT are computed dividing the EV by the EBITDA and the EBIT respectively.

We analyze how these variables are related to different level of liquidity, to the ownership concentration (dilution) and to their fundamentals. We are interested in the significance of the fundamentals in determining the value of the multiples and in their magnitude. As we explained before, we distinguish between different types of companies depending on their level of liquidity (i.e. whether the Company Average Traded Volume of last 30 days / Number of shares is higher than the median of the competitors for each year of observation)[48]. Following the theoretical reasoning outlined in Damodaran (2012) we regressed every multiple on the fundamentals that are supposed to determine it, together with the shares outstanding and the interaction between the liquidity of the stock (represented by a Dummy) and the fundamentals, to see if the liquidity matters, moderating the effect of the fundamentals on the dependent variable. Additionally, we

[48] The Log of the $ trading volume is a widespread used measure of liquidity, together with the Amihud (2002) liquidity ratio and the proportion of zero returns day. We decided to take the scalar values of the volume (not the Log) in order to create a dummy variable.

also used some controls: *LogTotAssets* for the size as literature suggests, *ForeignSales,* computed as a percentage of total sales[49], the historical *Beta,* as a measure of risk, and the *Tax Rate,* to neutralize discrepancies among the fiscal regimes across counties. We introduced time and firm fixed effects.

Analysis

To understand if liquidity and free float really matter in the computation of the multiples, we introduced a Dummy Variable for the Free Float (Calculated as Number of shares which can be publicly traded / Number of shares, that takes the value of 1 if higher than the median of the year and 0 if it is lower) and the Dummy variable for the Liquidity, that takes the value of 1 if the Company Average Traded Volume of last 30 days / Number of shares is higher than the median of the year, and 0 if it is lower.

In this way we differentiated the sample in companies with low and high liquidity, and in companies with high and low shares outstanding.

We conducted a t-test on the difference of the means for each year, and not surprisingly we find that all the differences were significant. The t-test results for all our 4 variables can be found in Table 5.

Insert TABLE 5 about here

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[49] Several studies, (Morck and Yeung (1991), Bodnar et al. (1999), Doukas and Travlos (1988)) showed that internationalization is positively correlated with value. To capture this effect we use the ratio of foreign sales to total sales.

The evidence is that when a company has a high free float trades at discount in comparison with those companies whose ownership is more concentrated. While enterprises whose shares are frequently traded (high volume) trades at premium in comparison with those companies that have low volumes suggesting the presence of a liquidity discount.

To better investigate the linkage between liquidity, control, and firm value, we develop an OLS model with a dummy for the liquidity and interaction effects**.** We added some time and industry fixed effects. We had a strong balanced panel sample, therefore we decided to use a fixed effect model and not a pooled OLS, since according to Wooldridge (2010), fixed/random effects models are preferable when you observe the same sample across time. Furthermore, we performed the Breusch–Pagan test for checking the heteroschedasticity. We could not reject the alternative hypothesis according to which the error variances are not equal. In order to choose between the random effect and the fixed effect model, we performed the Hausman Test, which is statistically significant confirming the choice of the fixed effect model. We also verified if the dummy volume is time variant, since time invariant factors and can affect the fixed effect model. In order to test for multicollinearity, we also performed the VIF test. In any case the variance inflation factor was not higher than two, therefore, we did not have any signs of serious multicollinearity requiring correction.

The model is the same for all the six regressions, of course, according to the case we change the independent variables with their forward version.

(1) $EV/SALES_{it} = \beta_1 * DummyVolume_{it} + \beta_2 * FreeFloat_{it} + \beta_3 * DummyVolume_{it} * FreeFloat_{it} + \beta_4 * \frac{EBIT}{SALES}_{it} + \beta_5 * DummyVolume_{it} * \frac{EBIT}{SALES}_{it} + \beta_6 * \frac{CAPEX}{SALES}_{it} + \beta_7 * DummyVolume_{it} * \frac{CAPEX}{SALES}_{it} + \beta_8 * \frac{WC}{SALES}_{it} + \beta_9 * DummyVolume_{it} * \frac{WC}{SALES}_{it} + \gamma_t + \rho_i + u_{it}$

(2) $EV/EBITDA_{it} = \beta_1 * DummyVolume_{it} + \beta_2 * FreeFloat_{it} + \beta_3 * DummyVolume_{it} * FreeFloat_{it} + \beta_4 * ROIC_{it} + \beta_5 * DummyVolume_{it} * ROIC_{it} + \beta_6 * \frac{CAPEX}{EBITDA}_{it} + \beta_7 * DummyVolume_{it} * \frac{CAPEX}{EBITDA}_{it} + \beta_8 * \frac{WC}{EBITDA}_{it} + \beta_9 * DummyVolume_{it} * \frac{WC}{EBITDA}_{it} + \gamma_t + \rho_i + u_{it}$

(3) $EV/EBIT_{it} = \beta_1 * DummyVolume_{it} + \beta_2 * FreeFloat_{it} + \beta_3 * DummyVolume_{it} * FreeFloat_{it} + \beta_4 * ROIC_{it} + \beta_5 * DummyVolume_{it} * ROIC_{it} + \beta_6 * \frac{CAPEX}{EBIT}_{it} + \beta_7 * DummyVolume_{it} * \frac{CAPEX}{EBIT}_{it} + \beta_8 * \frac{WC}{EBIT}_{it} + \beta_9 * DummyVolume_{it} * \frac{WC}{EBIT}_{it} + \gamma_t + \rho_i + u_{it}$

The results of the six regressions are summarized in Table 6 and Table 7

Insert TABLE 6 about here

Insert TABLE 7 about here

The impact of the free float, which in the regression is inserted as a scalar variable, confirms what emerged in the initial t- test for both the volume and the free float. The dummy variable volume is statically significant for both current and forward multiples with a positive coefficient in all cases, except for model 3 (EV/EBIT). This confirms the existence of a liquidity discount: investors apply a discount to companies that are not traded frequently since they are considered as illiquid instruments. The variables free float has also a relevant negative impact on multiples. Therefore, in general, the more a company is diluted the less the value of all the multiples, however, the effect is different across the typology of multiples. The free float does not have an impact on the EV/SALES while it is statistically significant with a negative coefficient for the EV/EBITDA. This effect is amplified when we combine this variable with the interaction effect of the volume: the impact on the size of the free float is higher for those companies that are more frequently traded. It seems that market liquidity comes at the expense of the less concentrated firms, confirming Bhide (1993). The more the governance is diluted the more the liquidity has a negative impact on value.

In the first regression we have a significant and positive impact of the fundamental variable (EBIT/SALES) on the multiple, but in case of high liquidity the effect is the opposite, negative and significant for both the current and the forward multiples. Also, the variable CAPEX/SALES has a positive and significant impact on the multiple but it is not affected by the trading volume for the current EV/SALES while it has a positive significant effect for the forward multiples.

Regarding the second and the third regression the impact of a key variable such as the ROIC is, surprisingly, negative and significant. The high trading volume compensate a little in the case of EV/EBIT, but not enough to change the sign of the net impact, while the effect is negative for forward multiples. It is strange because the multiple should have been positively affected by an increase in the ROIC.

The ratios CAPEX/EBITDA and WC/EBITDA impact significantly the correspondent multiple, respectively positively and negatively. The interaction factor of the volume partially offsets the effect of the CAPEX/EBITDA, while the negative impact of the WC/EBITDA, in the case of high liquidity, is completely compensated by the coefficient of the interaction term.

The CAPEX/EBIT ratio influence positively the multiple EV/EBIT, with a significant negative interaction factor for the current version of the multiple. On the contrary, we don’t have any other statistical evidence concerning the interaction term for the forward EV/EBIT and the other dependent variable WC/EBIT.

What emerges clearly is that the free float and the volume, which depends on market conditions, have a relevant impact on the value of a company while not all the fundamentals affect positively the value of the multiple, as expected by the theory. We can argue that the computation of the market multiples often is not positively affected by the behavior of the fundamentals, as we said they are expression of external behavioral dynamics that cannot be embedded ex ante in the numbers. Sometimes a high liquid market can compensate for the impact that the fundamental has, creating the conditions for a more accurate estimation; a high free float, i.e. a very diluted market is in every situation not positive for the value of a company. The existence of analysts bias in elaborating companies' information and investors' cognitive bias suggest that stock misvaluation cannot be fully eliminated by high (low) liquidity and dilution of the ownership.

There's not an unequivocal empirical evidence about the positive (negative) impact of liquidity on firm value, but we can say that under high liquidity conditions the relation between the fundamentals and the multiple are amplified or mitigated; liquidity is a determining factor that acts as a moderator.

Maybe we will find more strong conclusions when we will extend the study to developing countries.

Robustness checks

Since the use of the median as the cut point for the dummy variable volume, we also re-run the regression using as cut point P25 and P75.

The results for the current multiples are summarized in Table 8 (P75) and Table 9 (P25).

Insert TABLE 8 about here

Insert TABLE 9 about here

The results are considerably different between the two cases. The impact of the dummy variables remains significant and positive for P75 while it disappears in the case of P25, confirming the existence of a liquidity effect. A similar effect can be found for the interaction terms. The interaction factor for profitability drivers like ROIC remains statistically significant with an opposite sign to the one of the variables for both cases. The effect on Capex and WC indicators is stronger and statistically significant for P75, also in comparison to P50 (for the variable WC/SALES and WC/EBIT), while, except for the variable CAPEX/EBIT, no interaction term is significant in the case of P25.

Similar effects can also be found for forward multiples. The results for the forward multiples are summarized in Table 10 (P75) and Table 11 (P25).

Insert TABLE 10 about here

Insert TABLE 11 about here

Also, in this case, the results show the existence of a liquidity effect on multiples, in fact, the dummy variable volume and the interaction terms are significant for P75, like P50, while they are not statistically significant for P25.

The results of the robustness checks confirm that liquidity affects the multiples and their relationship with the fundamentals, therefore it is a factor that analysts should consider when they try to determine the intrinsic value of a company.

LIMITATIONS AND FURTHER RESEARCH

Our study is focused only on developed countries, it should be interesting to extend the analysis to developing countries' firms, to see if under different regulatory and cultural conditions the results will be still the same.

The empirical part has been conducted with an asset-side approach, including only firm multiples. Moreover, we computed the asset side multiples with historical values. The next step could be the computation of the multiples with forward values, including equity side ratios too. In fact, one of the more intuitive ways to think of the value of any asset is the multiple of the earnings that it generates. In the shoes of an investor, when buying a stock, he/she commonly look at the price paid as a multiple of the earnings per share generated by the analyzed company. Therefore, the investor determines the so-called price/earnings ratio. The price-earnings multiple (PE) is the most widely used and misused of all multiples: if it appears straightforward to calculate this ratio, it is worth noting that its estimation can follow different approaches that may lead to conflicting and inconsistent results. An investor may want to use current earnings per share, yielding a current PE, or those accrued over the last four quarters, resulting in a trailing PE; finally, he/she can use the expected earnings per share in the next year, providing a forward PE. On top of the computational aspects, there are industry specific elements to consider when using PE multiples. Especially with high growth firms, the PE ratio can be very different depending upon which measure of earnings per share is used. Moreover, sometimes the use of such multiples is prevented. First, when the company is a newly listed one, it may not have recorded any earning yet, thus making it impossible to calculate the PE ratio. Secondly, the earnings may be lower than zero leading to a negative PE ratio. Although this result is acceptable by a mere mathematical viewpoint, it does not make financial sense.

In further research we would like to deepen the study areas, to include in the analysis the equity side multiples, such as the P / E, with a good chance of fair comparison and explanatory power. Despite the broad analysis conducted here, where there were no conditions for an exhaustive and homogeneous computation of the P / E multiple, clustering the sample at the industrial level we can create the fundamental conditions for a reliable and comparable computation of earning multiples.

Our empirical tests confirm the existence of a liquidity discount: investors apply a discount to companies that are not traded frequently since they are considered as illiquid instruments. The variable free float has also a relevant negative impact on multiples. Therefore, in general, the more a company is diluted the less the value of all the multiples, even if the effect is different across the typology of multiples.

This effect is amplified when we combine this variable with the interaction effect of the volume: the impact on the size of the free float is higher for those companies that are more frequently traded. It seems that market liquidity comes at the expense of the less concentrated firms, confirming Bhide (1993). The more the governance is diluted the more the liquidity has a negative impact on value.

There's a stream of literature that analyses the interaction between ownership concentration and liquidity in a special context, where the underpricing plays a role too: the market after an IPO. Booth and Chua (1996) hypothesize that IPOs are underpriced to promote ownership dispersion, which in turn increases aftermarket liquidity of IPO stocks. According to them the relation between underpricing and aftermarket liquidity is achieved through a broad ownership. However, underpricing may affect liquidity directly without the central link of a broad ownership. It can be argued that underpricing attracts investor attention and creates a broad base of possible traders, which leads to active trading for the underpriced IPOs.

Here we tested the joint effect of liquidity and ownership dilution on the value of a firm. Building on their work we can restrict our time horizon focusing only on a short window after the IPOs and replicate our test of the joint effect of liquidity and free float on firm value (without trying to relate liquidity and ownership structure).

Another possibility is instead to take a cue from their work and to conduct a 2SLS regression, without changing the time horizon: first we can test the ownership impact on liquidity, then we can study the liquidity effect on firms' value.

As we already pointed out the Log of the $ trading volume is a widespread used measure of liquidity, together with the Amihud (2002) liquidity ratio and the proportion of zero returns day. We decided to take the scalar values of the volume (not the Log) to create a dummy variable. To reinforce our conclusions, in the next study we can conduct the same regression also with the other liquidity measures[50]

[50] Zheng & Li (2008) use other measures of liquidity for their study on IPOs: Log trading volume (Log V), Log Quoted Spread, Log Effective Spread, Log Quoted Depth, and a comprehensive liquidity index (Liquidity Index) based on Butler et al. (2005).

CONCLUSIONS

This work is an attempt to demonstrate that there are objective conditions that justify a divergence between the prices expressed by the market and the intrinsic value of a company, despite that in recent times the market role in defining the value of a company has increased. Therefore, we tried to identify the reasons behind this process, through a literature review that show the advantages and disadvantages of the market methods to evaluate a company, and the link between liquidity, governance and firm value.

The basic principles of the financial criteria offer values that are reliable in themselves, as well as allowing valid comparisons because they are supported by homogeneous logics. The DCF method rely on a strong, inseparable link between the financial flows and the strategic and operational plans of the companies being evaluated.

However, it is common practice for many to conceive the market price as a correct representation of the company value, at least in line with the trend. Furthermore, financial analysts have found in the multipliers - largely based on price observations and other market parameters - a useful and simple tool for evaluation and comparison. Precisely this preference of analysts is at the origin of the success that the multipliers unconditionally found in the international context.

The initial empirical analysis conducted, however, has shown that the markets do not behave substantially as the classical theory suggests and that consequently prices and parameters on the latter may lead to erroneous assessments. In particular, the phenomenon that has emerged with increasing clarity in recent years is that of the price volatility proven by the general increase in the volatility of the majority indexes of the main Western exchanges (and the US one). The verification of the significance of the prices recorded on the market for the valuation of the economic capital has led to non-comforting results considering the consistent volatility and the unavailability of "comparable" prices for a sufficiently wide time horizon.

Our empirical analysis, moreover, demonstrate that the inefficiency of the market, in general, cannot be compensated by ownership concentration policies or increasing the liquidity of the market. The predictive capacity of the fundamentals is not so reliable as they are supposed to, especially regarding the most important ratio (the EV/EBITDA), where the ROIC have a negative impact on its value.

The idea that the application of simple formulas with ineffectively weighted economic and asset data means evaluating a company is a pure illusion. It is now impossible to resort to any evaluation methodology without an in-depth knowledge of the different business models of the companies being evaluated. The evaluation of a company requires knowledge attentive to all aspects of its internal life, to its relations with markets and with the external environment in general, to its history and its prospects. With the adoption of financial criteria, the main focus of the enhancement is business strategy and development projects, which is the set of choices that determine the success or failure of companies. The widespread view that, applying market methods, it is possible to avoid the formulation of assumptions about the performance of economic results and their translation into projections of cash flows therefore seems unfounded. The use of multiples therefore requires the support of the financial method in order to provide a solid and reliable valuation.

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FIGURE 1

Comparison between Tesla's market value and other car manufacturers' ones

(source: Bloomberg)

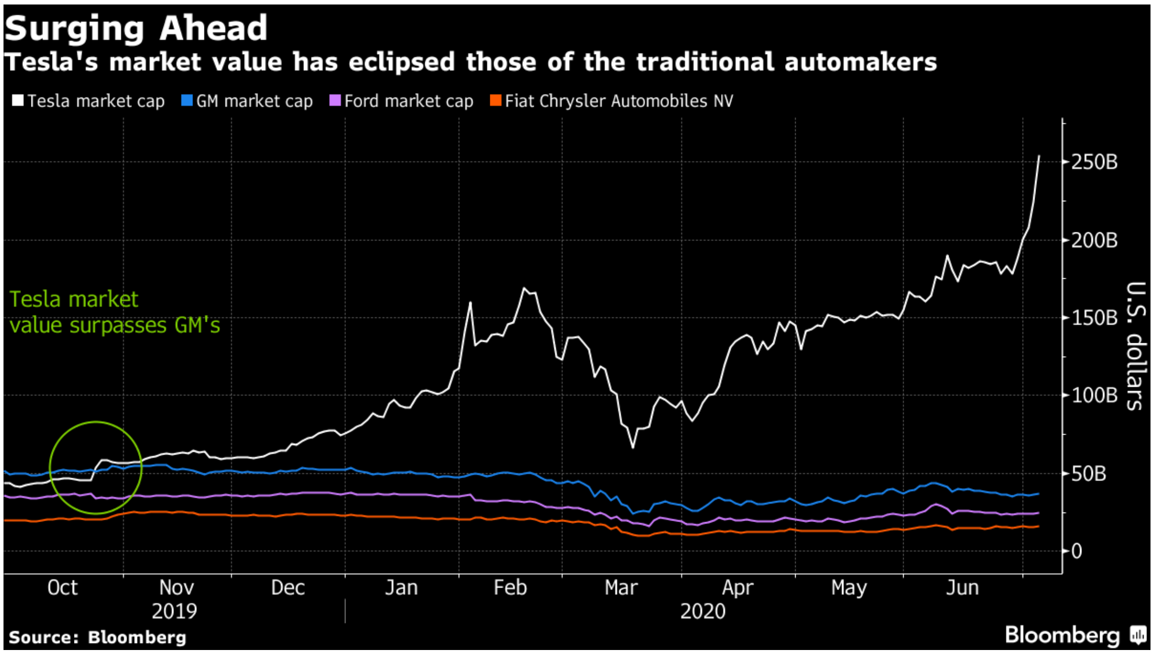


FIGURE 2.1

Trend of EV/SALES

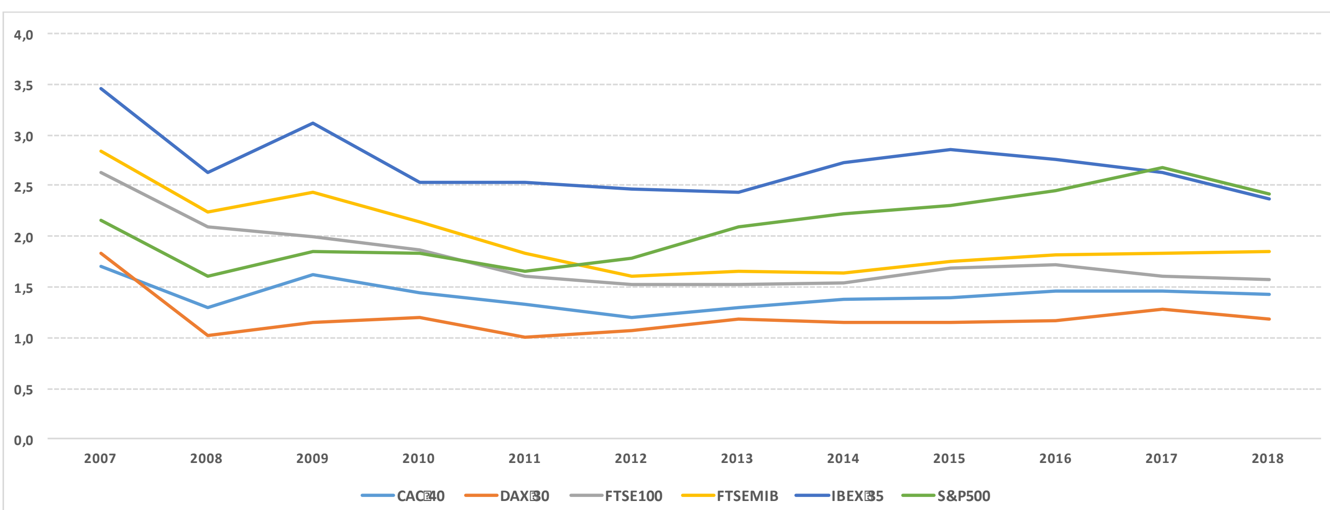


FIGURE 2.2

Trend of EV/EBIT

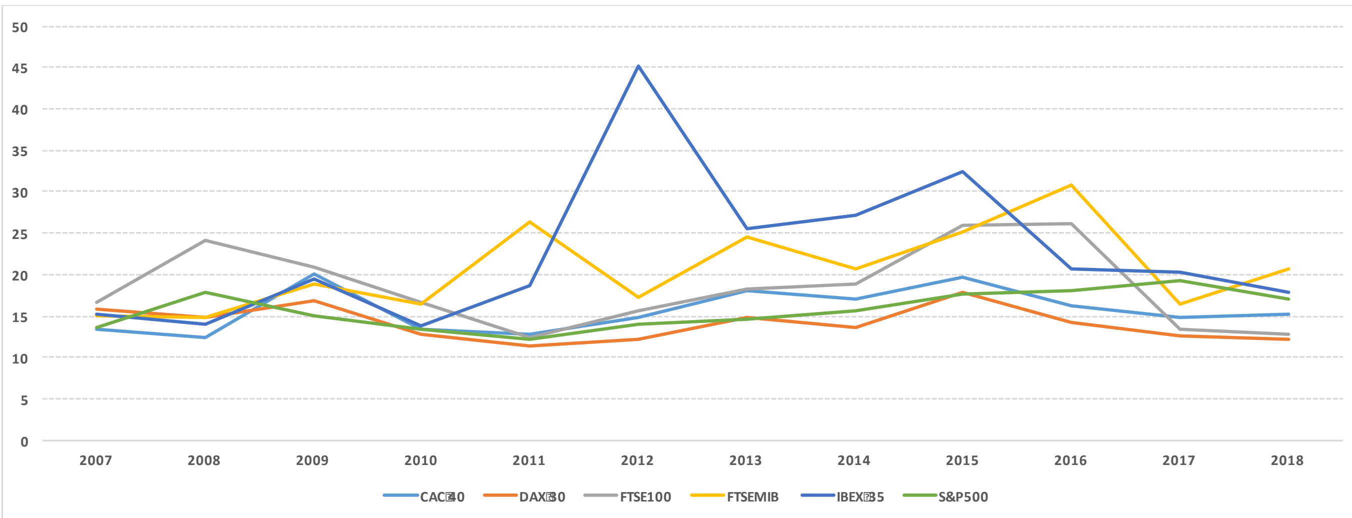


FIGURE 2.3

Trend of EV/EBITDA

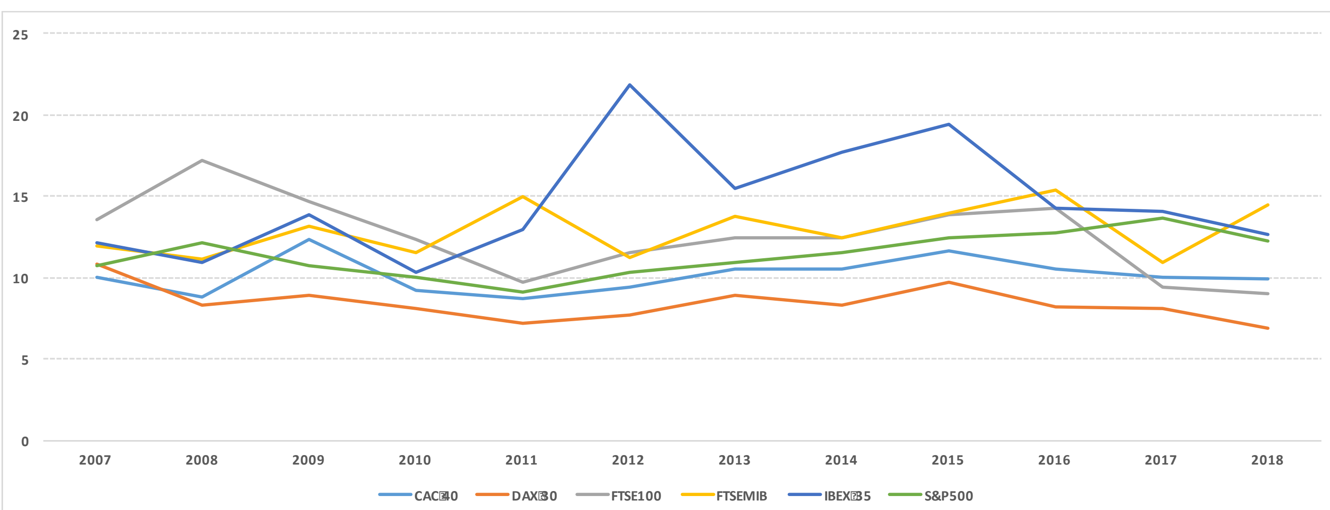


FIGURE 3.1

Performance of main European and American Indexes

(source: Thomson Reuters)

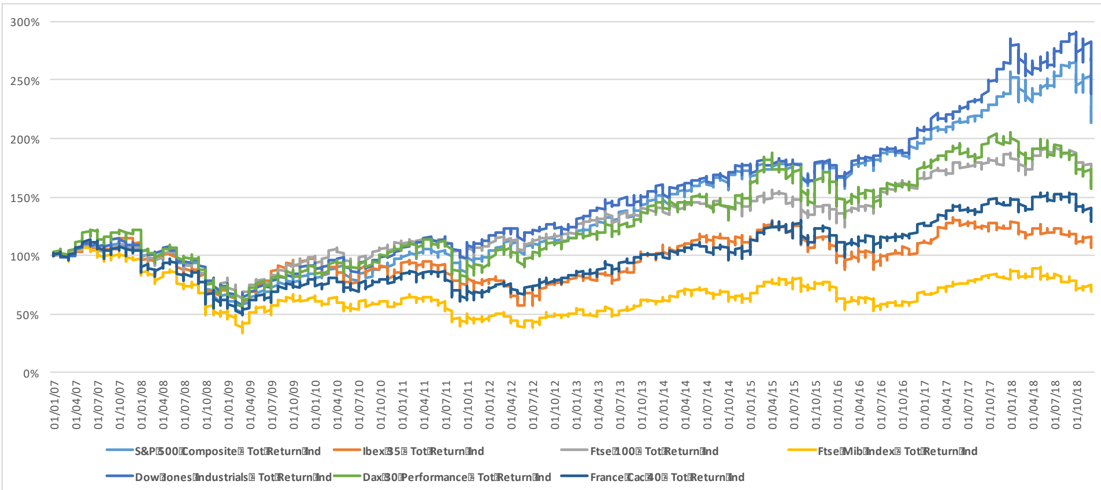


TABLE 1

Cumulated Coefficient of Variation for main world indexes

(source: Thomson Reuters)

CV Cumulated	S&P 500	Ibex 35	Ftse 100	Ftse Mib	Dax 30	Cac 40
2007	0,03	0,03	0,03	0,04	0,06	0,04
2008	0,14	0,15	0,13	0,21	0,14	0,17
2009	0,21	0,20	0,17	0,31	0,20	0,24
2010	0,19	0,19	0,15	0,32	0,17	0,23
2011	0,17	0,20	0,13	0,34	0,16	0,23
2012	0,16	0,23	0,12	0,38	0,15	0,23
2013	0,18	0,23	0,13	0,38	0,17	0,21
2014	0,22	0,22	0,13	0,36	0,20	0,20
2015	0,25	0,21	0,13	0,34	0,25	0,20
2016	0,26	0,21	0,13	0,34	0,25	0,19
2017	0,29	0,20	0,14	0,33	0,28	0,19
2018	0,32	0,19	0,14	0,32	0,29	0,19

FIGURE 3.2

Trend of Cumulated Coefficient of Variation for main world indexes

(source: Thomson Reuters)

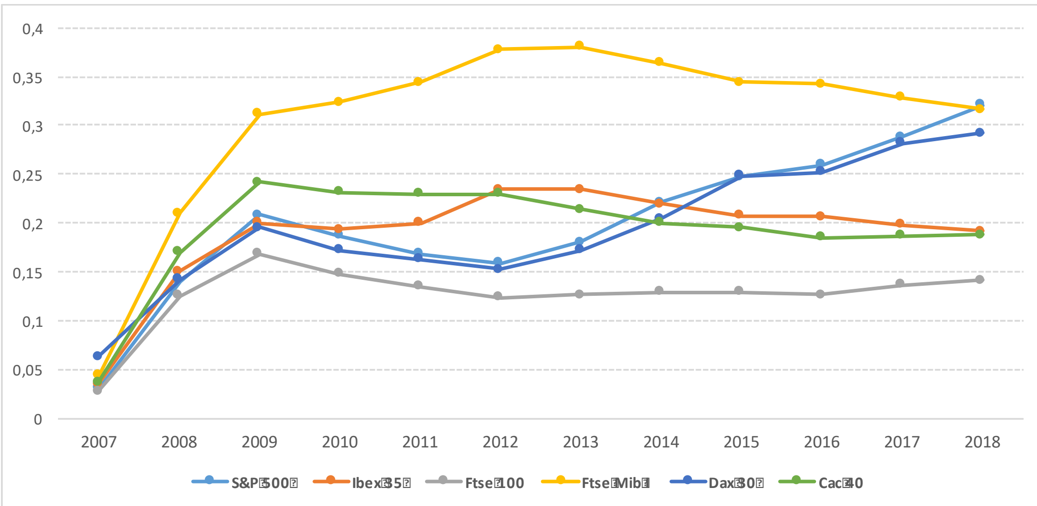
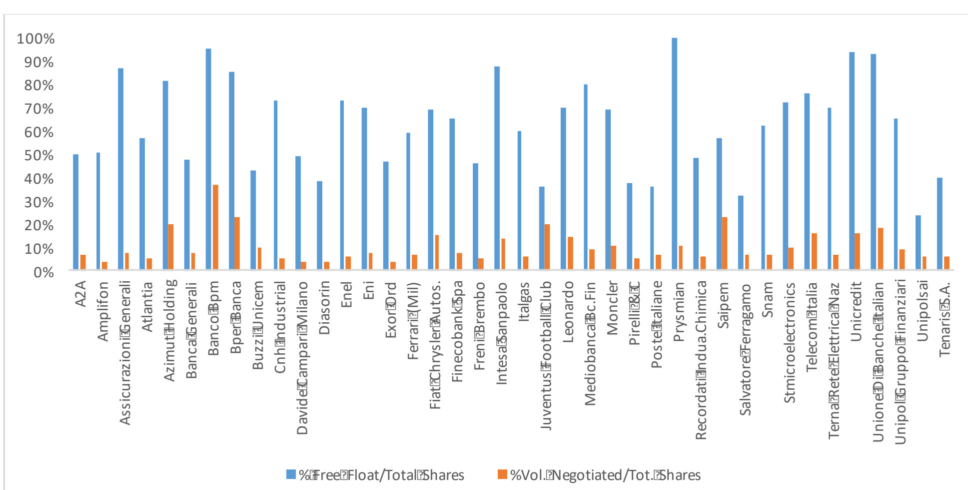


FIGURE 4

FTSE MIB Index. Percentage of free float over total shares and percentage of traded volume over total shares. Monthly data of 2018.



Source: elaboration on Factiva, 2018

FIGURE 5.A

Frequency of percentage of traded volume over total shares for European and US stocks. Monthly data from 2017 to 2018

(<=15% means between 10 % and (equal to) 15%)

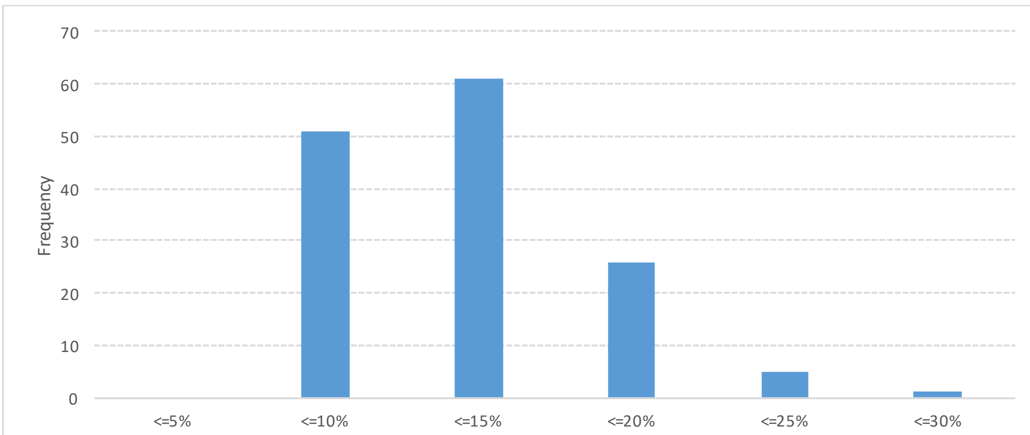


FIGURE 5.B

Frequency of percentage of traded volume over total shares for Italian stocks. Monthly data from 2017 to 2018

(<=15% means between 10 % and (equal to) 15%)

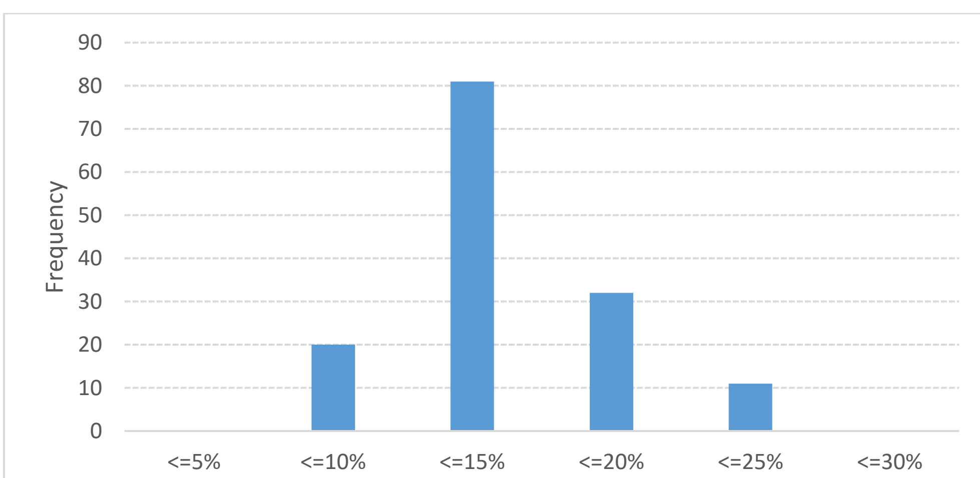


FIGURE 6

European and US stocks. Trend of percentage of free float over total shares and percentage of traded volume over total shares. Monthly data.

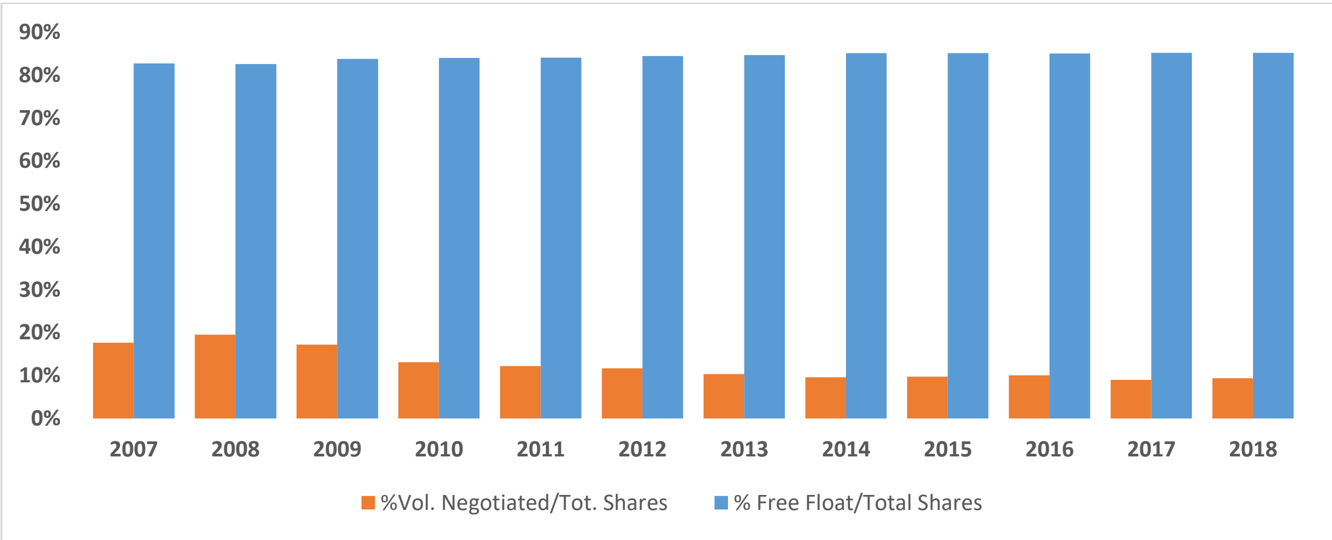


TABLE 2

Variable Definition and Source

Variable Name	Definition	Source
EV/SALES	Calculated as EV divided by last 12 months SALES	Datastream (Thomson Reuters)
EV/EBITDA	Calculated as EV divided by last 12 months EBITDA	Datastream (Thomson Reuters)
EV/EBIT	Calculated as EV divided by last 12 months EBIT	Datastream (Thomson Reuters)

EV/SALES Fwd	Calculated as EV divided by forward 12 months SALES	Datastream (Thomson Reuters)
EV/EBITDA Fwd	Calculated as EV divided by forward 12 months EBITDA	Datastream (Thomson Reuters)
EV/EBIT Fwd	Calculated as EV divided by forward 12 months EBIT	Datastream (Thomson Reuters)
Dummy Volume	Dummy variable that takes the value of 1 if the Company Average Traded Volume of last 30 days / Number of shares is higher than the median and 0 if it is lower	Datastream (Thomson Reuters)
Free Float	Calculated as Number of shares which can be publicly traded / Number of shares	Datastream (Thomson Reuters)
EBIT/SALES	Parameter calculated as EBIT divided by SALES	Datastream (Thomson Reuters)
ROIC	Calculated as (Net Income – Bottom Line + ((Interest Expense on Debt - Interest Capitalized) * (1-Tax Rate))) / Average of Last Year's and Current Year’s (Total Capital + Short Term Debt & Current Portion of Long Term Debt)	Datastream (Thomson Reuters)

CAPEX/SALES	Calculated using Capex downloaded from Datastream ("funds used to acquire fixed assets other than those associated with acquisitions") divided by SALES	Datastream (Thomson Reuters)
CAPEX/EBITDA	Calculated using Capex downloaded from Datastream ("funds used to acquire fixed assets other than those associated with acquisitions") divided by EBITDA	Datastream (Thomson Reuters)
CAPEX/EBIT	Calculated using Capex downloaded from Datastream ("funds used to acquire fixed assets other than those associated with acquisitions") divided by EBIT	Datastream (Thomson Reuters)
WC/SALES	Calculated using the increase/decrease in Working Capital downloaded from Datastream ("the difference between current assets and current liabilities") divided by SALES	Datastream (Thomson Reuters)
WC/EBITDA	Calculated using the increase/decrease in Working Capital downloaded from Datastream ("the difference between current assets and current liabilities") divided by EBITDA	Datastream (Thomson Reuters)

WC/EBIT	Calculated using the increase/decrease in Working Capital downloaded from Datastream ("the difference between current assets and current liabilities") divided by EBIT	Datastream (Thomson Reuters)
FOREIGN SALES	Calculated as International Sales / Net Sales or Revenues * 100	Datastream (Thomson Reuters)
TAX RATE	Calculated as Income Taxes / Pre-tax Income * 100	Datastream (Thomson Reuters)
BETA	Historic Beta downloaded from Datastream	Datastream (Thomson Reuters)
TOTAL ASSET	TOTAL ASSETS is the natural logarithm of the sum of total current assets, long term receivables, investment in unconsolidated subsidiaries, other investments, net property plant and equipment and other assets.	Datastream (Thomson Reuters)

TABLE 3

Descriptive Statistics

	N	Mean	Std. Dev.	P1	P99
All Firms					
Sales	8.691	15.600.000	20.900.000	584.275	77.300.000
EBITDA	8.542	2.700.319	3.529.167	83.892	13.700.000
EV	8.443	29.100.000	36.700.000	1.872.014	141.000.000
EV/Sales	8.690	3.09	2.81	0.26	10.95
EV/EBITDA	8.542	11.55	6.89	0	29.15
EV/EBIT	8.580	15.79	11.67	-4.75	46.41
EV/Sales Fwd	8.428	3.23	3.04	0.43	12.02
EV/EBITDA Fwd	8.205	10.52	4.81	4.36	22.54
EV/EBIT Fwd	8.283	14.06	7.06	5.98	34.52
ROIC (%)	8.514	10.95	8.29	-1.84	30.71
EBIT/Sales	8.579	0.17	0.12	-0.2	0.44
Tax Rate (%)	8.662	23.15	14.10	0	45.77
Volume/Number	8.488	0.19	0.14	0.02	0.56
WC/Sales	8.261	0.01	0.08	-0.15	0.19
WC/EBITDA	8.122	0.04	0.38	-0.77	0.92
WC/EBIT	8.156	0.05	0.49	-0.99	1.18
Foreign Sales/ Total Sales (%)	8.663	35.17	31.32	0	90.7
Free Float (%)	8.637	84.45	17.15	25.67	100
Beta	8.662	1.00	0.52	0	2.00
Capex/Sales	8.380	0.08	0.10	0	0.41
Capex/EBITDA	8.236	0.33	0.32	0	1.19
Capex/EBIT	8.273	0.48	0.56	-0.06	2.09
Ln Total Asset	8.452	16.45	1.48	13.91	19.38

TABLE 4

Correlation matrix

	EV/Sales	EV/EBITDA	EV/EBIT	EV/Sales Fwd	EV/EBITDA Fwd	EV/EBIT Fwd	ROIC	Tax Rate	Volume/Number	Free Float (%)	Capex	Working Capital	Beta	Foreign Sales (%)	Ln Total Asset
EV/Sales	1.00														
EV/EBITDA	0.57***	1.00													
EV/EBIT	0.48***	0.70***	1.00												
EV/Sales Fwd	0.94***	0.53***	0.44***	1.00											
EV/EBITDA Fwd	0.71***	0.69***	0.53***	0.75***	1.00										
EV/EBIT Fwd	0.68***	0.62***	0.56***	0.70***	0.82***	1.00									
ROIC	-0.06***	-0.11***	-0.15***	-0.11***	-0.07***	-0.23***	1.00								
Tax Rate	-0.24***	-0.17***	-0.09***	-0.26***	-0.22***	-0.31***	0.22***	1.00							
Volume/Number	-0.00	-0.03**	0.00	-0.01	0.03	0.03***	0.06***	0.04***	1.00						
Free Float (%)	-0.01	-0.03**	-0.04***	-0.02	-0.4***	-0.06***	0.03***	0.02*	0.04***	1.00					
Capex	-0.11***	-0.14***	-0.04***	-0.11***	-0.21***	-0.07***	-0.14***	0.07***	-0.08***	0.07***	1.00				
Working Capital	-0.11***	-0.06***	-0.07***	-0.14***	-0.12***	-0.14***	0.11***	0.03***	-0.01	0.08***	0.23***	1.00			
Beta	0.03**	0.07***	0.06***	-0.01	-0.02	0.02	-0.13***	-0.04***	0.10***	-0.03**	-0.01	0.12***	1.00		
Foreign Sales (%)	-0.21***	-0.07***	-0.06***	-0.25***	-0.18***	-0.19***	0.10***	-0.02*	-0.09***	-0.09***	0.13***	0.28***	0.13***	1.00	
Ln Total Asset	-0.06***	-0.02	-0.00	0.02	-0.03***	-0.02	-0.33***	-0.00	-0.16***	0.16***	0.56***	0.18***	0.08***	0.00	1.00

standard error in parentheses; ***, **, and * indicates statistically significant levels of 1%, 5% and 10%, respectively.

TABLE 5

T- test on the difference of the means

	High Free Float	Low Free Float	Difference	T-Stat
EV/Sales	2.85	3.33	-0.47***	7.81
EV/EBITDA	10.95	12.17	-1.22***	8.16
EV/EBIT	14.72	16.91	-2.19***	8.70
EV/Sales Fwd	3.08	3.37	-0.29***	4.35
EV/EBITDA Fwd	10.24	10.79	-0.56***	5.29
EV/EBIT Fwd	14.73	13.39	1.34***	8.70

***, **, and * indicates statistically significant levels of 1%, 5% and 10%, respectively.

	High Volume	Low Volume	Difference	T-Stat
EV/Sales	3.16	3.01	0.16***	-2.59
EV/EBITDA	11.72	11.37	0.35***	-2.37
EV/EBIT	16.02	15.53	0.49**	-1.96
EV/Sales Fwd	3.33	3.12	0.21***	-3.13
EV/EBITDA Fwd	10.75	10.28	0.47***	-4.47
EV/EBIT Fwd	14.53	13.59	0.94***	-6.13

***, **, and * indicates statistically significant levels of 1%, 5% and 10%, respectively.

TABLE 6

Regressions results – P50

Dependent variable	EV/SALES	EV/EBITDA	EV/EBIT
Models	(1)	(2)	(3)
Independent variables			
Dummy Volume	0.675***	1.819**	0.584
	(0.192)	(0.886)	-1.438
Free Float (%)	-0.002	-0.019**	-0.038***
	(0.002)	(0.008)	(0.013)
Impact Factor Volume_Free Float (%)	-0.007***	-0.025***	-0.008
	(0.002)	(0.010)	(0.016)
EBIT/SALES	3.069***		
	(0.240)		
Impact Factor Volume_EBIT/SALES	-0.649**		
	(0.267)		
Capex/Sales	2.954***		
	(0.369)		
Impact Factor Volume_Capex/Sales	0.550		
	(0.341)		
WC/Sales	-0.254		
	(0.226)		
Impact Factor Volume_WC/Sales	0.190		
	(0.303)		
ROIC		-0.064***	-0.089***
		(0.014)	(0.022)
Impact Factor Volume_ROIC		0.017	0.064**
		(0.017)	(0.027)
Capex/EBITDA		11.975***	
		(0.376)	
Impact Factor Volume_Capex/EBITDA		0.143	
		(0.438)	
WC/EBITDA		-0.480**	
		(0.202)	
Impact Factor Volume_WC/EBITDA		0.893***	
		(0.272)	
Capex/EBIT			15.555***
			(0.305)
Impact Factor Volume_Capex/EBIT			-0.777**
			(0.369)
WC/EBIT			0.036
			(0.217)
Impact Factor Volume_WC/EBIT			0.336
			(0.298)
Foreign Sales/Total Sales	-0.003***	-0.004	0.000
	(0.001)	(0.006)	(0.009)
Tax Rate	-0.012***	-0.025***	0.030***
	(0.001)	(0.005)	(0.008)
Beta	0.071*	0.133	0.614**
	(0.039)	(0.175)	(0.288)
Ln Total Asset	0.316***	0.723***	1.560***
	(0.037)	(0.169)	(0.277)
Constant	-2.215***	-1.060	-14.842***
	(0.618)	-2.812	-4.622
Year Dummies	Yes	Yes	Yes
Observations	7943	7829	7859
R Squared	0.203	0.298	0.444

standard error in parentheses; ***, **, and * indicates statistically significant levels of 1%, 5% and 10%, respectively.

TABLE 7

Regressions results – P50

Dependent variable	EV/SALES Fwd	EV/EBITDA Fwd	EV/EBIT Fwd
Models	(4)	(5)	(6)
Independent variables			
Dummy Volume	0.320*	1.538***	2.570***
	(0.179)	(0.502)	(0.780)
Free Float (%)	0.002	-0.011**	-0.008
	(0.002)	(0.004)	(0.007)
Impact Factor Volume_Free Float (%)	-0.003*	-0.013**	-0.020**
	(0.002)	(0.005)	(0.009)
EBIT/SALES	2.907***		
	(0.223)		
Impact Factor Volume_EBIT/SALES	-0.539**		
	(0.248)		
Capex/Sales	1.798***		
	(0.341)		
Impact Factor Volume_Capex/Sales	0.728**		
	(0.312)		
WC/Sales	-0.545***		
	(0.208)		
Impact Factor Volume_WC/Sales	-0.121		
	(0.279)		
ROIC		0.023***	-0.042***
		(0.008)	(0.012)
Impact Factor Volume_ROIC		-0.032***	-0.055***
		(0.009)	(0.014)
Capex/EBITDA		0.842***	
		(0.213)	
Impact Factor Volume_Capex/EBITDA		-0.320	
		(0.249)	
WC/EBITDA		-0.330***	
		(0.112)	
Impact Factor Volume_WC/EBITDA		0.361**	
		(0.151)	
Capex/EBIT			0.528***
			(0.165)
Impact Factor Volume_Capex/EBIT			0.040
			(0.200)
WC/EBIT			-0.086
			(0.117)
Impact Factor Volume_WC/EBIT			0.206
			(0.161)
Foreign Sales/Total Sales	-0.003***	-0.008**	-0.014***
	(0.001)	(0.003)	(0.005)
Tax Rate	-0.012***	-0.021***	-0.058***
	(0.001)	(0.003)	(0.005)
Beta	-0.010	-0.230**	-0.042
	(0.038)	(0.104)	(0.164)
Ln Total Asset	0.365***	0.691***	0.521***
	(0.035)	(0.096)	(0.151)
Constant	-3.052***	1.225	8.758***
	(0.580)	-1.598	-2.525
Year Dummies	Yes	Yes	Yes
Observations	7824	7543	7666
R Squared	0.204	0.209	0.161

standard error in parentheses; ***, **, and * indicates statistically significant levels of 1%, 5% and 10%, respectively.

TABLE 8

Regressions results – P75

Dependent variable	EV/SALES	EV/EBITDA	EV/EBIT
Models	(7)	(8)	(9)
Independent variables			
Dummy Volume	0.891***	1.612	3.602**
	(0.231)	-1.071	-1.738
Free Float (%)	-0.002	-0.021***	-0.027**
	(0.002)	(0.007)	(0.012)
Impact Factor Volume_Free Float (%)	-0.011***	-0.038***	-0.066***
	(0.003)	(0.012)	(0.019)
EBIT/SALES	3.041***		
	(0.207)		
Impact Factor Volume_EBIT/SALES	-1.035***		
	(0.275)		
Capex/Sales	3.008***		
	(0.325)		
Impact Factor Volume_Capex/Sales	0.775**		
	(0.350)		
WC/Sales	-0.394**		
	(0.185)		
Impact Factor Volume_WC/Sales	0.754**		
	(0.318)		
ROIC		-0.074***	-0.096***
		(0.012)	(0.019)
Impact Factor Volume_ROIC		0.058***	0.124***
		(0.017)	(0.027)
Capex/EBITDA		11.413***	
		(0.321)	
Impact Factor Volume_Capex/EBITDA		1.965***	
		(0.466)	
WC/EBITDA		-0.406**	
		(0.166)	
Impact Factor Volume_WC/EBITDA		1.253***	
		(0.286)	
Capex/EBIT			14.740***
			(0.259)
Impact Factor Volume_Capex/EBIT			1.189***
			(0.387)
WC/EBIT			0.018
			(0.180)
Impact Factor Volume_WC/EBIT			0.579*
			(0.319)
Foreign Sales/Total Sales	-0.003***	-0.005	-0.000
	(0.001)	(0.006)	(0.009)
Tax Rate	-0.012***	-0.027***	0.028***
	(0.001)	(0.005)	(0.008)
Beta	0.068*	0.122	0.607**
	(0.039)	(0.175)	(0.287)
Ln Total Asset	0.311***	0.730***	1.567***
	(0.037)	(0.168)	(0.277)
Constant	-2.106***	-0.613	-15.173***
	(0.614)	-2.787	-4.584
Year Dummies	Yes	Yes	Yes
Observations	7943	7829	7859
R Squared	0.206	0.302	0.446

standard error in parentheses; ***, **, and * indicates statistically significant levels of 1%, 5% and 10%, respectively

TABLE 9

Regressions results – P25

Dependent variable	EV/SALES	EV/EBITDA	EV/EBIT
Models	(13)	(14)	(15)
Independent variables			
Dummy Volume	0.201	-0.132	-1411
	(0.177)	(0.823)	-1.322
Free Float (%)	-0.003	-0.023***	-0.049***
	(0.002)	(0.009)	(0.014)
Impact Factor Volume_Free Float (%)	-0.005**	-0.009	0.013
	(0.002)	(0.009)	(0.015)
EBIT/SALES	2.056***		
	(0.317)		
Impact Factor Volume_EBIT/SALES	0.846**		
	(0.332)		
Capex/Sales	2.887***		
	(0.479)		
Impact Factor Volume_Capex/Sales	0.445		
	(0.457)		
WC/Sales	0.139		
	(0.328)		
Impact Factor Volume_WC/Sales	-0.367		
	(0.370)		
ROIC		-0.081***	-0.111***
		(0.018)	(0.030)
Impact Factor Volume_ROIC		0.034*	0.074**
		(0.020)	(0.032)
Capex/EBITDA		11.763***	
		(0.494)	
Impact Factor Volume_Capex/EBITDA		0.364	
		(0.542)	
WC/EBITDA		-0.312	
		(0.282)	
Impact Factor Volume_WC/EBITDA		0.420	
		(0.321)	
Capex/EBIT			15.757***
			(0.402)
Impact Factor Volume_Capex/EBIT			-0.862*
			(0.448)
WC/EBIT			0.250
			(0.299)
Impact Factor Volume_WC/EBIT			-0.034
			(0.345)
Foreign Sales/Total Sales	-0.003***	-0.005	0.001
	(0.001)	(0.006)	(0.009)
Tax Rate	-0.012***	-0.025***	0.030***
	(0.001)	(0.005)	(0.008)
Beta	0.070*	0.138	0.627**
	(0.039)	(0.175)	(0.288)
Ln Total Asset	0.314***	0.718***	1.561***
	(0.037)	(0.169)	(0.277)
Constant	-1.978***	-0.064	-13.752***
	(0.622)	-2.825	-4.641
Year Dummies	Yes	Yes	Yes
Observations	7943	7829	7859
R Squared	0.202	0.297	0.444

tandard error in parentheses; ***, **, and * indicates statistically significant levels of 1%, 5% and 10%, respectively

TABLE 10

Regressions results – P75

Dependent variable	EV/SALES Fwd	EV/EBITDA Fwd	EV/EBIT Fwd
Models	(10)	(11)	(12)
Independent variables			
Dummy Volume	0.245	1.542**	2.318**
	(0.217)	(0.611)	(0.961)
Free Float (%)	0.001	-0.012***	-0.010
	(0.002)	(0.004)	(0.006)
Impact Factor Volume_Free Float (%)	-0.003	-0.016**	-0.020*
	(0.002)	(0.007)	(0.011)
EBIT/SALES	2.975***		
	(0.192)		
Impact Factor Volume_EBIT/SALES	-1.219***		
	(0.258)		
Capex/Sales	2.021***		
	(0.300)		
Impact Factor Volume_Capex/Sales	0.605*		
	(0.323)		
WC/Sales	-0.656***		
	(0.170)		
Impact Factor Volume_WC/Sales	0.141		
	(0.293)		
ROIC		0.016**	-0.054***
		(0.007)	(0.010)
Impact Factor Volume_ROIC		-0.032***	-0.055***
		(0.010)	(0.015)
Capex/EBITDA		0.783***	
		(0.181)	
Impact Factor Volume_Capex/EBITDA		-0.386	
		(0.267)	
WC/EBITDA		-0.232**	
		(0.092)	
Impact Factor Volume_WC/EBITDA		0.306*	
		(0.160)	
Capex/EBIT			0.644***
			(0.140)
Impact Factor Volume_Capex/EBIT			-0.305
			(0.211)
WC/EBIT			-0.045
			(0.097)
Impact Factor Volume_WC/EBIT			0.216
			(0.172)
Foreign Sales/Total Sales	-0.003***	-0.008**	-0.015***
	(0.001)	(0.003)	(0.005)
Tax Rate	-0.011***	-0.021***	-0.057***
	(0.001)	(0.003)	(0.005)
Beta	-0.001	-0.225**	-0.038
	(0.038)	(0.104)	(0.164)
Ln Total Asset	0.362***	0.680***	0.526***
	(0.035)	(0.096)	(0.152)
Constant	-2.978***	1.679	9.143***
	(0.576)	-1.587	-2.511
Year Dummies	Yes	Yes	Yes
Observations	7824	7543	7666
R Squared	0.206	0.210	0.160

standard error in parentheses; ***, **, and * indicates statistically significant levels of 1%, 5% and 10%, respectively.

TABLE 11

Regressions results – P25

Dependent variable	EV/SALES Fwd	EV/EBITDA Fwd	EV/EBIT Fwd
Models	(16)	(17)	(18)
Independent variables			
Dummy Volume	0.096	-0.017	0.533
	(0.165)	(0.469)	(0.713)
Free Float (%)	0.002	-0.012**	-0.012
	(0.002)	(0.005)	(0.008)
Impact Factor Volume_Free Float (%)	-0.003	-0.006	-0.004
	(0.002)	(0.005)	(0.008)
EBIT/SALES	2.439***		
	(0.295)		
Impact Factor Volume_EBIT/SALES	0.209		
	(0.310)		
Capex/Sales	1.591***		
	(0.441)		
Impact Factor Volume_Capex/Sales	0.779*		
	(0.420)		
WC/Sales	-0.394		
	(0.300)		
Impact Factor Volume_WC/Sales	-0.275		
	(0.339)		
ROIC		0.013	-0.042***
		(0.010)	(0.016)
Impact Factor Volume_ROIC		-0.009	-0.041**
		(0.011)	(0.017)
Capex/EBITDA		0.214	
		(0.280)	
Impact Factor Volume_Capex/EBITDA		0.591*	
		(0.308)	
WC/EBITDA		-0.232	
		(0.156)	
Impact Factor Volume_WC/EBITDA		0.122	
		(0.178)	
Capex/EBIT			0.487**
			(0.216)
Impact Factor Volume_Capex/EBIT			0.062
			(0.243)
WC/EBIT			-0.053
			(0.160)
Impact Factor Volume_WC/EBIT			0.094
			(0.185)
Foreign Sales/Total Sales	-0.003***	-0.009***	-0.015***
	(0.001)	(0.003)	(0.005)
Tax Rate	-0.012***	-0.021***	-0.058***
	(0.001)	(0.003)	(0.005)
Beta	-0.009	-0.233**	-0.032
	(0.038)	(0.104)	(0.164)
Ln Total Asset	0.363***	0.698***	0.506***
	(0.035)	(0.096)	(0.151)
Constant	-2.916***	1.949	9.763***
	(0.582)	-1.604	-2.534
Year Dummies	Yes	Yes	Yes
Observations	7824	7543	7666
R Squared	0.203	0.209	0.159

standard error in parentheses; ***, **, and * indicates statistically significant levels of 1%, 5% and 10%, respectively.