Competitiveness of Fintech: An Investigation into Different Levels of Competitiveness Using Young Enterprises from the Financial Technology Industry

Inaugural-Dissertation

to obtain the degree of Doctor of Business Administration
(doctor rerum politicarum – Dr. rer. pol.)

submitted to the

Faculty of Business Administration and Economics
Heinrich Heine University Düsseldorf

presented by

Max Bömer, M.Sc.
Scholar at Manchot Graduate School
"Competitiveness of Young Enterprises"
Heinrich Heine University Düsseldorf

First supervisor:	Univ.-Prof. Dr. Christoph J. Börner, Faculty of Business Administration and Economics Chair of Financial Service Heinrich Heine University Duesseldorf
Second supervisor:	Univ.-Prof. Dr. Eva Lutz, Faculty of Business Administration and Economics Chair of Entrepreneurship and Finance Heinrich Heine University Duesseldorf

Düsseldorf 2020

Dedicated to my family.

Acknowledgements

First and foremost, I would like to express my deep gratitude to Prof. Dr. Christoph J. Börner for his guidance throughout the entire dissertation process. The dissertation has benefited enormously from his numerous precise suggestions and constructive criticism. I hope he can find traces of his teaching in this manuscript. It was a great enrichment to work under his supervision as he not only focuses on research but also on the human aspect.

Furthermore, I would like to thank Prof. Dr. Eva Lutz who kindly agreed to join the dissertation committee. Her research on entrepreneurial finance and her invaluable advice during the colloquia have enriched this dissertation.

I am indebted to the Manchot Graduate School "Competitiveness of Young Enterprises" and especially Thomas Manchot for the generous support that made this dissertation possible. I would also like to thank the spokespersons of the Graduate School, Prof. Dr. Eva Lutz and Prof. Dr. Stephan Süß, for their reliable administrative support during the entire time.

My sincere thanks also go to the scholarship holders of the Graduate School who provided a positive working atmosphere with many stimulating discussions. My special thanks go to Mirko Brunk and Tamara Naulin. Moreover, I owe earnest thankfulness to Prof. Dr. Armin Schwienbacher for his supervision and participation in the second research paper. The study has benefited greatly from his high-quality approach.

Finally, I would like to thank my family, especially Robert Bömer, Ingrid Bömer, Rolf Bömer as well as Christa and Günter Winkelkötter who have been an enormous support to me during the whole time. I express my gratitude to them for their unconditional support.

Max Bömer

Düsseldorf, May 2020

Table of contents

Table of figures

List of tables

List of abbreviations

APAC	Asia-Pacific
CDK	CoinDesk
CMC	CoinMarketCap
c.p.	ceteris paribus
CSA	Canada Securities Administrators
DAO	Decentralized Autonomous Organization
e.g.	for example
EMEA	Europe, Middle East, and Africa
et al.	and others
FINMA	Eidgenössische Finanzmarktaufsicht
GFSC	Gibraltar Financial Services Commission
GLS	Generalized least squares
ICO	Initial coin offering
OLS	Ordinary least squares
RENB	Random Effects Negative Binominal
RBV	Resource-based view
SEC	United States Securities and Exchange Commission
T&C	Terms and conditions
VC	Venture capital
UAE	United Arab Emirates
UK	United Kingdom
USA	United States of America
USD	United States Dollar

1. Introduction

1.1 Fintech

The term fintech is a portmanteau word made up of "finance" or "financial service" and "technology". Apart from this fundamental statement, there is no uniform definition for fintech in economic and scientific literature. However, it can be stated that the term has become popular as it has already found its way into several important dictionaries. For instance, the Cambridge Dictionary provides a basic definition that refers to fintech as "the business of using technology to offer financial services in new and better ways", while the Oxford Dictionary describes fintech more specifically as "computer programs and other technology used to provide banking and financial services."[1][2] According to Schueffel (2016, p. 32), fintech is "a new financial industry that applies technology to improve financial activities", while Nicoletti (2017, p. 3) understands fintechs as "organizations, mainly startups, [that] are reshaping the financial industry". Regardless of whether fintech is a business, a computer program, a startup, or an entire industry, the above definitions emphasize the dynamic component of fintech in such a way that (computer) technology may lead to a renewal or improvement in the world of finance.

1.1.1 History of fintech

Many people associate fintech with a development that has just taken place in recent years. However, several authors show that the financial industry has constantly been subjected to dynamic changes (Arner *et al.*, 2015; Lee and Shin, 2018; Leong and Sung, 2018; Alt *et al.*, 2018). Arner *et al.* (2015) and Leong and Sung (2018) differentiate between three eras of fintech. Following these scholars, the first period of fintech (fintech 1.0) begun in the late 19th century and can be considered as the start of financial globalization supported by technological infrastructure, such as the invention of telegraphs and the laying of the transatlantic cable (Lee and Shin, 2018). These inventions marked a turning point in the transmission of data as they enabled faster financial transactions and payments within a country and across borders. The next wave of innovations took place in the aftermath of the Second World War. In the 1950s, the first credit cards were issued in the USA by Diners' Club, Bank of America, and American Express, allowing consumers to build a continuing balance of debt (Arner *et al.*, 2015). In the 1960s, Xerox introduced the fax machine, which has further increased the speed of financial transactions.

[1] See: https://dictionary.cambridge.org/de/worterbuch/englisch/financial-technology.
[2] See: https://www.oxfordlearnersdictionaries.com/definition/english/fintech.

Additionally, companies such as IBM and Texas Instruments developed the first commercial computers, which marked the transition from the analog to the digital age in the financial industry. Based on new computer technology, Barclays developed the first Automatic Teller Machine (ATM) in 1967 (Leong and Sung, 2018). Furthermore, the first electronic clearing systems (e.g., BACS, CHIPS) and other multinational electronic networks, such as the Society for Worldwide Interbank Financial Telecommunication (SWIFT) were established at that time (Alt *et al.*, 2018). The end of fintech 1.0 is marked by the introduction of rudimentary online banking solutions and first computer software systems for financial trading (e.g., Bloomberg terminal) in the 1980s.

Following this, the second period of fintech (fintech 2.0) started at the end of the 1980s (Arner *et al.*, 2015). At that time, the financial services industry was already largely digitalized, with globally operating financial institutions processing transactions with counterparties electronically, e.g. by telex or fax. At the beginning of the 1990s, this development was further intensified by the advent of the Internet. In this context, Lee and Shin (2018) refer to the emergence of e-finance, which means that several financial services (banking, insurance, stock trading) became available online, based on the World Wide Web. The introduction of e-finance solutions affected the business of financial service providers in several ways. Following Lee and Shin (2018), the main effects were shorter turnaround times, real-time management information, more convenient communication with business partners and bank clients and, in particular, lower operational and transactions costs, since there was no longer a need for physical contact between the financial institution and its clients for the execution of basic services (e.g., bank transfers, standing orders, security trading). As a consequence, many banks introduced or enlarged their offering of online banking solutions by the end of the 1990s. At the same time, the first direct banks were established, which offered their financial products exclusively online without any physical branches (e.g., SNFB, ING Direct, HSBC Direct). The increasing digitization is also evident in the number of online users. In 2000, 11% of the German population had already used online banking solutions. This share rose to 36% in 2008 (Bankenverband, 2018). The gradual shift from stationary to e-finance had both positive and negative implications for financial service providers. On the one hand, the increased use of e-finance in the form of online banking posed the risk of virtual bank runs by customers transferring their deposits to other online accounts at short notice. Moreover, competition among banks increased sharply as customers were no longer bound by the

services offered by regional institutions. Instead, online banking opened the opportunity for customers to compare between a wide range of financial services from different providers. On the other hand, the digitally collected customer data enabled a better assessment of true credit risk and customer behavior. As mentioned before, financial services provider also benefited from cost savings and faster data transfer. Overall, fintech 2.0 is characterized by regulated financial institutions which increasingly digitized their services and internal processes by investing in IT infrastructure and personnel training (Arner *et al.*, 2015).

Unlike fintech 2.0, the focus is no longer on established financial service providers in the third period of fintech (fintech 3.0), but on young startups which often operate outside the reach of financial regulation. Business models from fintech 3.0 can be divided into several segments and offer a wide range of financial services, such as digital payment solutions, equity crowdfunding, online marketplace lending (peer-to-peer lending), robo-advising etc. (see Chapter 1.1.2).

While fintech 2.0 was mainly driven by the advent of the Internet, several drivers encouraged the development of fintech 3.0. First, the financial crisis of 2008 may be considered as a driver for two reasons. First, broad public lost confidence in the traditional financial industry (e.g., banks, insurance companies) due to highly speculative investments on the subprime market and their consequences for the entire economy (Zavolokina *et al.*, 2016). Thus, many people increasingly searched for alternative financial service providers and especially young and Internet-savvy users decided for new business models of fintech startups. Second, many well-trained bank employees who lost their jobs in the financial crisis hired at young fintech startups or even started an own fintech business (Haddad and Hornuf, 2019). For these reasons, Arner *et al.* (2015) considers the years after the financial crisis of 2008 as turning point and the beginning of fintech 3.0. Second, several technological innovations encouraged the development of fintech 3.0, such as new terminal equipment (e.g., smartphones, laptops, tablets) with higher computing power in conjunction with almost constant access to broadband Internet and other new innovations in computer science, such as artificial intelligence, distributed ledger systems (e.g., Blockchain), big data, cloud computing, near-field communication, QR-codes etc. (Dorfleitner *et al.*, 2017). On the one hand, fintech startups use these new technologies to improve established services by making them faster, cheaper, or more user-friendly (e.g., payments). On the other hand, they utilize technologies to develop entirely new financial services

that did not exist before. (e.g., cryptocurrencies). Third, another factor driving fintech 3.0 is the strong demand for financial services in developing countries, paired with a high scalability of digital business models. As most of the applications run on mobile devices without high usage requirements, many users who previously had no access to traditional financial services provided by established institutions can be reached now (Chuen *et al.*, 2015). In 2014, two billion people worldwide had no bank account or no access to financial services due to a lack of branches or as they did not meet the necessary requirements (e.g., minimum income level). Countries with a high share of unbanked population are China, India, Indonesia, and several countries in Africa, while developed countries witness a relatively low share of unbanked individuals. Remarkably, the population of unbanked individuals decreased by more than 20% thanks to the availability of fintech solutions (World Bank, 2018). One example is Kenya where more than 80% of the population had no access to services of regulated banks in 2017 (CNBC, 2019). However, two-thirds of Kenya's population used M-Pesa, a mobile payment service that provides a digital wallet and enables users to send and receive money (NZZ, 2018). Fourth, many regulatory authorities consider digitization in the financial world and the associated structural change as an essential factor for the future. For this reason, fintech startups receive public support in different ways. For instance, national regulatory authorities introduce so-called regulatory sandboxes where fintech startups work together with regulators to improve their business model. After setting up a market-ready business, startups usually get the permission to enter the market without complying with all regulatory requirements (Thomas, 2018).

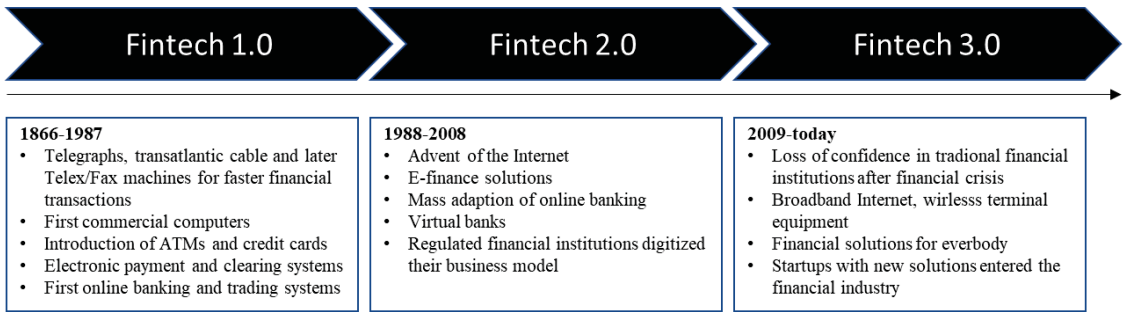


Figure 1.1 History of fintech.[3]

[3] Source: Own presentation.

1.1.2 Segments

In analogy to the classic business units of universal banks, fintech startups from the latest period can be divided into the segments *financing*, *asset management*, *payments*, and *other fintechs* (Dorfleitner *et al.*, 2017; Leong and Sung, 2018). First, the segment *financing* contains startups that provide funding to individuals and/or companies. This segment can further be subdivided into fintech models where the funding is based on the participation of a large number of supporters (i.e., the crowd) and business models that offer loans and other funding vehicles (e.g., factoring, collection) without crowd participation (Dorfleitner *et al.*, 2017). *Crowdfunding* usually takes place on online platforms that differ in terms of their remuneration model (Cumming and Hornuf, 2018). *Equity-based crowdfunding* (*Crowdinvesting)* is a certain form of *crowdfunding* where investors typically participate in projects through silent participations, profit participation rights, or participatory loans to generate a high financial return (Moritz *et al.*, 2015). In contrast, *rewards-based crowdfunding* refers to individuals donating for a project with the expectation of receiving a non-financial return, such as the finished good or service of the project, while *donation-based crowdfunding* models usually does not include any return at all (Kraus *et al.*, 2016). *Crowdlending* investors provide a personal credit and receive interest payments on top of the amortization amount as compensation (Maier, 2016). Apart from *crowdfunding*, other fintech startups from this subsegment offer innovative online credit and factoring solutions in cooperation with at least one financial partner. One typical business model contains brokerage services for financial products (e.g., loans, factoring) where individuals and/or firms receive different offers through an online platform from the platform's various financial partners (e.g., banks).[4]

Second, the segment *asset management* includes fintech startups that provide consulting, investment, and asset management solutions, including *social trading*, *robo-advising*, and *personal financial management* (Dorfleitner *et al.*, 2017). The sub-segment *social trading* includes services that offer the opportunity to replicate investment strategies or portfolios of other members participating in a social network. In this way, the investment process becomes more transparent as investment decisions are immediately published on a social network platform where they can be discussed by the members (Oehler *et al.*, 2016). *Robo-advising* describes algorithm-based computer applications that provide automatic investment decisions by considering the investor's investment preference and risk profile.

[4] Chapter 2 provides a detailed description for this type of fintech companies.

A *robo-advisor* usually manages small deposits and is relatively cheap in comparison to human asset management provided by banks (D'Acunto *et al.*, 2019). Next, *personal finance management systems* (*PFM* systems) are information systems that support customers in managing and controlling their financial assets. These so-called financial cockpits usually include basic functions, such as account aggregation, expense controlling, transaction execution, and the evaluation of personal data for individual decision support (Olafsson and Pagel, 2018).

Third, business models from the *payments* segment can be subdivided into *online payment solutions* and *cryptocurrencies* (Leong and Sung, 2018). Within the last decade, many companies developed digital payment services. Today, the most popular online payment service comes from *PayPal*, a US company that provides digital wallets for customers that can be used for e-commerce sales and peer-to-peer transactions between costumers. In the third quarter of 2019, the payment volume processed by *PayPal* equals almost 180 billion USD (PayPal, 2019). Beside various small providers that often operate on a national level only, other important global payment services are *Apple Pay* and *Google Pay*. Furthermore, *cryptocurrencies* are digital means of payment based on decentralized distributed ledger technologies (e.g. Blockchain) and digital signatures. They are usually not issued by public institutions and are not considered as currencies in the ordinary sense, since they are accepted in only a few places. However, cryptocurrencies are an innovative way for technology startups to raise capital via the Internet.[5] The most prominent cryptocurrency is Bitcoin, a payment system designed by Nakamoto (2019) which was issued in 2009. As of May 2020, the cryptocurrency has a market capitalization of 162 billion USD.[6]

Fourth, the segment *other fintechs* can be viewed as residual segment as it contains all fintech companies that do not fit in one of the other three segments. This segment contains companies which offer solutions that can, inter alia, be applied in the financial industry. These companies are not considered as pure fintech startups, however, they provide tools and software applications, such as text recognition, search engines, machine learning, and artificial intelligence etc. used to improve financial activities. In addition, startup companies that offer innovative insurance-related services (*insurtechs*) also belong to this segment. In contrast to traditional insurance companies that usually use broad actuarial tables

[5] Chapter 4 provides a detailed description for this type of fintech companies.
[6] See: https://coinmarketcap.com/de/coins/.

to assign policyholders to a risk category, *insurtechs* make use of the analytical potential provided by mobile devices (i.e., big data) to offer personalized policies at lower costs (Banham, 2017).

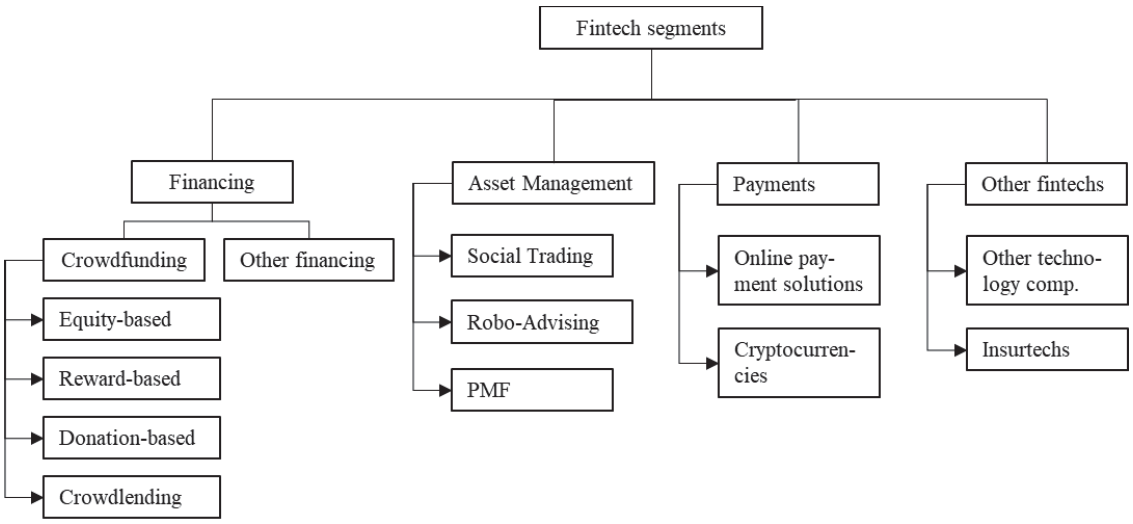


Figure 1.2 Segments of fintech 3.0.[7]

1.1.3 Global development of fintech 3.0

In the last decade, fintech has become one of the most prospering startup industries in many countries around the world. Using data from Crunchbase, Haddad and Hornuf (2019) find that the number of fintech startups worldwide increased from 302 in 2005 to 7,353 in 2015, while the funding amount raised from 6.7 billion USD to 94.2 billion USD within the same period. The rise of fintech is also reflected by the consumer adoption. According to EY (2019), the global consumer adoption rate of fintech services has moved from 16% in 2015 to 64% in 2019. This means that more than the half of the digitally active population has already used a fintech service at least once. With respect to fintech categories, most people in 2019 used services that deal with payment (75%), saving and investment (48%), budgeting and financial planning (34%), insurance (29%), and borrowing (27%) (EY, 2019).

Fintech is a global phenomenon with hotspots all over the world. Findexable (2019) builds a global fintech index to provide country and city rankings by focusing on several aspects (e.g., number of fintech startups in a location, fintech deals, strength of the local fintech industry, the number of fintech unicorns, industry events, accelerators &

[7] Source: Following Dorfleitner *et al.* (2017).

incubators, associations, fintech-friendly policies, and academic programs). The results indicate that the most important fintech centers are San Francisco (Bay), London, New York, Singapore, and Sao Paulo. Of note, the first two ranked cities have extraordinarily high score values (see Table 1.1). Furthermore, the report provides evidence for the growing importance of non-traditional finance cities for the development of fintech, since almost half of the world's top 20 financial centers are not under the top 20 fintech hubs. According to Findexable (2019), well-known financial centers as Shanghai, Beijing, Dubai, Shenzhen, Zurich, Frankfurt, Melbourne, and Montreal are not ranked as top fintech spots, while other cities that are traditionally not considered as leading financial centers developed strong fintech ecosystems (e.g., Sao Paulo, Bangalore, Boston, Berlin, New Delhi, Tel Aviv, or Miami).

Table 1.1 Global fintech city ranking.[8]

Rank	City	Score	Rank	City	Score
1	San Francisco Bay	80.136	11	Hong Kong	14.778
2	London	54.888	12	Toronto	14.616
3	New York	36.889	13	Sydney	14.470
4	Singapore	23.621	14	Chicago	14.419
5	Sao Paulo	18.805	15	Paris	14.293
6	Los Angeles	17.867	16	New Delhi	13.958
7	Bangalore	16.093	17	Tokyo	13.783
8	Boston	15.795	18	Tel Aviv	13.628
9	Berlin	15.616	19	Atlanta	13.150
10	Mumbai	15.063	20	Miami	13.097

Although fintech is a global phenomenon with hotspots in several countries, most of fintech activity takes place in North America and the United States, respectively. This is reflected by different figures. For instance, the USA witness the highest number of investments and the largest funding volume in financial technology. According to KPMG (2018), US fintech companies received 52.5 billion USD in 1,061 investment deals in 2018, which equals almost 50% of the global funding volume. By way of comparison, Europe (Asia) witness only 536 (372) deals with a value of 34.2 (22.7) billion USD in the same period (KPMG, 2018). Furthermore, the total number of fintech companies is highest in North America (8775), followed by EMEA countries (7385) and APAC countries

[8] Source: Following Findexable (2019).

(4765) (Statista, 2020). North America is also leading in terms of quality of fintech companies. In 2019, there were 58 fintech unicorns in the world, alone 33 headquartered in North America (CBInsights, 2019). Regarding the ten most valuable fintech companies, it can be stated that half of them are also based in the USA (see Table 1.2). However, the most valuable fintech company is LU.com, a Shanghai-based online marketplace for financial assets trading with a valuation of 39.4 billion USD (CBInsights, 2019).

Table 1.2 Most valuable fintech companies.[9]

Rank	City	Country	Founding year	Valuation
1	LU.com	China	2011	$39.4 bn
2	Stripe	USA	2010	$35.3 bn
3	Nubank	Brazil	2013	$10.0 bn
4	Paytm	India	2010	$10.0 bn
5	One97	India	2000	$10.0 bn
6	Coinbase	USA	2012	$8.0 bn
7	Robinhood	USA	2013	$7.6 bn
8	Klarna	Sweden	2005	$5.5 bn
9	SoFi	USA	2011	$4.8 bn
10	Credit Karma	USA	2007	$4.0 bn

1.2 Levels of competitiveness

The term competitiveness is derived from the Latin word *competer* which can be translated as "to enter or be put in rivalry with".[10] In economic literature, the term has become common to describe the economic strength of an entity with respect to its competitors in the global markets (Lamond *et al.*, 2008). Furthermore, competitiveness has been considered in research as a multidimensional concept that changes with respect to the reference unit. For instance, scholars have investigated the competitiveness of products, firms, industries, sectors, cities, regions, nations, commercial blocks etc. (Anca, 2012). This dissertation investigates the competitiveness on micro (firm), macro (national), and regional level with a focus on the financial technology industry.

[9] Source: Following CBInsights (2019).
[10] See: https://www.etymonline.com/word/compete.

1.2.1 Micro (firm) level competitiveness

Taking the micro perspective, competitiveness can be understood as a firm's ability to compete, to grow, and to be profitable (Fougner, 2008). Following Lamond *et al.* (2008), the concept of firm level competitiveness is closely linked to the concept of competitive advantage. The latter can be described as an outstanding position of a firm within an industry or market in comparison to its competitors that results from a firm's ability to design, manufacture, and market products and services in a superior way (Ajitabh and Momaya, 2004). The superiority can be evaluated on the basis of various factors, such as price, quality, technological progress, etc. (Lamond *et al.*, 2008). In this context, central research questions in the field of strategic management are: how can firms achieve competitiveness and what are its sources?

One strand of literature concentrates on factors internal to the firm (e.g., strategy competencies, capabilities, tangible and intangible resources), arguing that they are the fundamental drivers for firm success. In this context, one of the most popular contributions is the resource-based view (Barney, 1991; Dierickx and Cool, 1989; Wernerfelt, 1984). According to this theory, a firm can generate a sustainable competitive advantage (typically measured by abnormal rents) by exploiting superior internal resources that are rare, valuable, imperfectly imitable, and non-substitutable (Barney, 1991). Barney (1991) defines firm resources as all assets, capabilities, organizational processes, firm attributes, information, and knowledge controlled by a firm. The knowledge-based theory of the firm expands the resource-based view by arguing that knowledge is the central strategic resource of a firm, since it is usually difficult to imitate and socially complex (Alavi and Leidner, 2001; Grant, 1996). In particular with the advent of computer-based information technology, knowledge-specific resources have become major determinants of competitive advantage and firm performance (Halawi *et al.*, 2005). Of note, these theories assume that a competitive advantage can only be achieved if firm resources are heterogeneous and imperfectly mobile. The latter condition implies that resources are non-tradable or at least less valuable to external firms that do not control the resources and thus only the holder of a set of resources can generate a competitive advantage (Wernerfelt, 1984; Barney, 1991). The logic behind this assumption implies that firms can maintain rents by protecting their proprietary and value-creating resources (Lavie, 2006).

In contrast, more recent literature departs from the vision of firms as independent entities and emphasizes the importance of exchange relationships and access to external resources

for a firm's success (Lavie, 2006; Huggins and Johnston, 2010; Gulati *et al.*, 2011; Duschek, 2004; Álvarez *et al.*, 2009; Gulati, 1999; Stuart *et al.*, 1999; Pfeffer and Salancik, 1978). In that respect, Gulati (1999) defines network resources as external resources that reside in the interfirm networks in which they are embedded (e.g., information about potential deals and partners). Following Gulati (1999), network resources have a substantial impact on the alliance formation process of a firm and thus affect its strategic opportunities.[11] Apart from that, Lavie (2006) provides a broader definition of network resources that goes beyond social factors. He differentiates two forms of alliances in which network resources are important. First, a pooling alliance in which firms bundle their similar resources to benefit from the economy of scale effect. In this way, the alliance can achieve a more powerful position in the market with respect to the larger resource base. Second, firms may form a complementary alliance in which firms attempt to generate synergies by connecting complementary resources that are difficult to obtain in combination for any of the involved firms (Lavie, 2006). One typical case of complementary alliances are exchange relations between corporates and startups (e.g., incubation, corporate venturing) where incumbent companies, on the one hand, sit on a large resource base but often lack of innovative concepts and startups, on the other hand, provide innovative solutions but often have no resources available to enter the market or grow fast enough (Stuart *et al.*, 1999). In this context, the resource dependence theory states that all firms depend to a given extent on other firms for the provision of various resources, and that this dependence is often reciprocal as shown in the former example (Drees and Heugens, 2013; Hillman *et al.*, 2009; Pfeffer and Salancik, 1978).

In light of this dissertation, micro level competitiveness is described as the ability of a company to reach an advantageous market position by exploiting superior resources which are available within the company and/or are provided by alliance and cooperation partners.

1.2.2 Macro (national) level competitiveness

Following Krugman (1994), the definition of firm level competitiveness cannot simply be transmitted to the national level due to major differences between firms and nations. For instance, an uncompetitive firm in an adverse market position will go out of business

[11] Strategic alliances can be described as voluntary arrangements between independent firms to exchange or share resources for a common goal. There are different forms of alliances, such as joint ventures, licensing agreements, equity alliances, etc.

at a given point if the firm cannot generate enough money to pay debtholders and/or other stakeholder groups. Nations, on the other hand, may have a negative economic performance, suffer from high debt services, or even declare bankruptcy, but they do not simply leave the markets as firms do. This means that nations, in contrast to firms, have no explicit "bottom line" (Krugman, 1994, p. 31). Moreover, the competition between firms is not the same as the competition between nations. According to Krugman (1994), the competition between rivaling firms is similar to a zero-sum game in which the success of the one firm has a negative impact on the success of the other firm. For instance, if there is a market with only two competing firms and one firm extends its market share, the other firm automatically loses market share. In contrast, nations may be competitors in terms of a certain product, however, they often have multiple reciprocal relations, since they have political ties and/or are exchange partners regarding the international trade (Krugman, 1994).

Due to these differences, the competitiveness of nations constitutes an own strand of literature. However, there has been disagreement in the literature about definition and indicators of national competitiveness. Basically, the historic approaches can be divided into four categories. First, scholars use price indices to proxy national competitiveness. In the international context, an increase of the real exchange rate can be considered as a signal of greater competitiveness, since it indicates a higher demand for domestic products (Berger, 2008). Second, national profitability measured by labor-cost per unit of production, total input cost per unit of product, or entrepreneurial reward per unit of product is another widely-used indicator (Cellini and Soci, 2002; Delgado *et al.*, 2012). Third, scholars consider the trade performance of a country (e.g., trade balance, balance of payments, current account balance) to evaluate whether a country is competitive (Cellini and Soci, 2002). In this context, a positive trade balance (i.e., value of exports is higher than value imports) is associated with greater competitiveness. Fourth, newer concepts go beyond price/performance/profitability measures as they focus on social aspects, such as welfare, quality of life etc. For instance, Tyson (1993, p. 7) defines national competitiveness as "ability to produce goods and services that meet the test of international competition while (…) citizens enjoy a standard of living that is both rising and sustainable".

Apart from historic definitions that focus on single factors, there are indices that consider multiple factors to provide a broader picture of national competitiveness. One of the most prominent is the *Global Competitiveness Report* (GCR), a yearly published ranking by

the World Economic Forum that provides insights into the economic prospects of more than 140 economies (World Economic Forum, 2019). The ranking takes twelve pillars from four categories into account: enabling environment (institutions, infrastructure, ICT adoption, macroeconomic stability), human capital (health, skills), markets (product market, labor market, financial system, market size), innovation ecosystem (business dynamism, innovation capability). The pillars are further divided into subcategories and the final score of an economy is calculated as a weighted average of the aggregated categories.[12] Firstly published in 1979, the ranking has historically been dominated by the USA, Northern Europe, and some Asian countries (i.e., Singapore, Hong Kong, Japan).

No matter if definitions focus on certain single or on multiple indicators to evaluate macro level competitiveness, scholars agree that governments have, in principle, an impact on the country's competitiveness through targeted political actions. In the context of digitization and new technology fields, the innovation capability of a country has become increasingly important (Blind, 2016; Bourreau and Doğan, 2001; Firth and Mellor, 1999). For this reason, many policymakers have passed regulations to foster national competitiveness by stimulating the innovation process of domestic (startup) ecosystems (Firth and Mellor, 1999). Blind (2016) distinguishes six types of economic regulation that affect innovation. First, regulation passed to enhance competition often aims to increase incentives of a company to invest in innovation. But if competition is too strong and imitation becomes more beneficial than innovation, the positive aspects of competitive pressure turns into a negative effect where rents for innovators decrease (Aghion *et al.*, 2005). Second, antitrust regulation may be a suitable policy instrument in markets where a monopoly position of a company comes from radical innovation. This type of regulation allows competitors to enter the market more easily to challenge the monopoly company (Spulber, 2008). Third, another type of regulation deals with mergers & acquisitions. On the one hand, soft regulation allows efficient takeovers of innovative companies. On the other hand, antitakeover provisions protect small companies from short term market pressure and enable to concentrate on long term projects. Furthermore, takeover restrictions increase the incentives for incumbents to foster inhouse innovations (Bena and Li, 2014). Fourth, regulation may also reduce competition for incumbents by setting market entry conditions for innovative newcomers. This may be beneficial for incumbents as they can maintain their market share. However, it is not beneficial for the overall performance

[12] See: World Economic Forum (2019, p. 611) for further information on the methodology.

situation in the market, since competition is perceived as accelerator for innovation (Blind, 2016). Fifth, price regulation in the form of price caps reduces the incentives for innovation as innovation is perceived as costly and it becomes more difficult to amortize these costs (Bardey *et al.*, 2010). Last, the regulation of natural monopolies and public utilities in the form of liberalization and privatization leads to more innovations and productivity in markets without any competition before (Blind, 2016).

The success of national regulation on the innovative capacity of a country may vary. Basically, three different outcomes can be assumed. First, regulation can be considered as successful if the state interventions have a positive impact on innovation, no further negative consequences are associated with the regulation, and the regulatory measures are effective in the sense that regulation cannot be circumvented or abused. This may be achieved with certain regulatory actions that immediately foster innovation, such as intellectual property rights (e.g., regulation of patents) etc. (Blind, 2016). Second, regulation can have a negative impact on innovation. For instance, negative effects may appear due to high regulatory burdens for young companies that stifle the innovation process. This is particularly the case with the regulation of new technologies, since policymakers often introduce (stricter) regulatory standards to protect market participants (e.g., adopters, creditors, investors etc.). Third, regulation can be considered as ineffective if market players can easily circumvent regulation due to conceptual weaknesses and loopholes.

Against this background, this dissertation deals with the ability of a nation to adopt effective regulatory provisions that promote innovativeness as a relevant component of macro level competitiveness.

1.2.3 Regional competitiveness

Following Cellini and Soci (2002), regional competitiveness is neither equal to the macro level nor to the micro level, since regions are neither simple aggregations of firms nor scaled versions of nations. This means that regional competitiveness cannot simply be described as a product of a stable macroeconomic framework or valid entrepreneurship on the firm level (Annoni and Kozovska, 2010). Similar to the other levels of competitiveness, scholars provide various definitions and concepts for regional competitiveness. A widely-cited definition comes from Storper (1997, p. 20) who describes regional competitiveness as “the ability of an (urban) economy to attract and maintain firms with stable

or rising market shares in an activity while maintaining or increasing standards of living for those who participate in it".

Apart from various definitions, there has been extensive discussion on the sources of regional competitiveness. According to Steinle and Schiele (2008), there are common assets within a region that are only available to local firms and help to achieve a better performance than isolated firms. In this context, Porter (2000, p. 15) refers to regional clusters as "geographic concentrations of interconnected companies, specialized suppliers, service providers, firms in related industries, and associated institutions (e.g., universities, standards agencies, trade associations) in a particular field that compete but also cooperate".

In fact, it can be observed that certain companies and sectors are performing particularly well in certain agglomerations, which suggests that there is indeed "something in the air" (Kitson *et al.*, p. 994). This can be illustrated by various examples. Probably the best-known location for high-tech industry is Silicon Valley in California, USA. Nowhere else exists such a high density of successful companies from this industry. In addition, London and New York are among the most important financial centers in the world with leading banks and financial technology companies. In Germany, successful clusters for the automotive sector with numerous specialized supplier companies have developed in the south of the country. In addition, there are also smaller and less well-known clusters, such as Glashütte, located in eastern Germany, which has developed into an important location for the watch manufactory.

According to Maskell and Malmberg (2002), there are three historical explanations why the spatial clustering of similar or related companies is beneficial. First, an agglomeration of similar and related companies has the power to adjust local conditions in its own interest, such as the education system or other collective resources. This leads to shared and thus reduced costs for building and maintaining an industry-specific infrastructure, compared to isolated companies (Maskell and Malmberg, 2002). Second, the concentration of related firms goes together with the development of a local labor market for specialized skills. In other words, employers prefer to locate where they find a good selection of workers with specialized skills, while workers seeking employment tend to go where many employers with skills like theirs are needed. This behavior is particularly advantageous for employees, since even if an employer goes bankrupt, there are enough others who also offer a suitable job (Maskell and Malmberg, 2002; Krugman, 1991). Third, the

spatial clustering of related firms reduces the costs of interfirm transactions, such as shipping and transport. Through the repeated exchange of companies that are geographically close to each other, coordination and trust are strengthened and solid trading structures are formed (Maskell and Malmberg, 2002; Scott, 1983; Porter, 1998).

Apart from these historic explanations, there is a knowledge-based approach to spatial clustering (Maskell and Malmberg, 1999a, 1999b; Porter, 1990). In this context, Maskell and Malmberg (2002) differentiate between horizontal and vertical dimensions of clusters. If firms produce a similar output on the same market, they have a horizontal relationship. These companies primarily compete rather than cooperating. However, they often develop a remarkably detailed understanding of each other's business activities. In this way, they understand and learn from what they observe in their next-door neighborhood. Moreover, related firms from the same spatial cluster tend to compare their success with other firms. In doing so, suitable approaches developed by a certain company will subsequently be available to other local companies. In other words, similar companies in the horizontal dimension of a cluster are constantly learning from mistakes and they imitate the current or predictable success of others while appending some own ideas. Therefore, a great advantage of clusters is that horizontal companies can monitor each other permanently without much effort or cost (Maskell and Malmberg, 1999b). Next, if firms produce at different stages of a production process, they have a vertical relationship. In contrast to firms from the horizontal dimension, these firms often are business partners or have collaborations as the output of one firm is the input for the other. The vertical dimension of the cluster could be developed through a division of tasks in terms of specialization. Very specialized firms often find new solutions and notice subtleties that are otherwise ignored. Specialization in unobserved product niches leads to new insights and opportunities and helps to promote knowledge growth in the cluster (Maskell and Malmberg, 1999a).

In addition, regional clusters are also excellent breeding grounds for startups and entrepreneurial activity. According to Porter (2000), most of new startups emerge in regional clusters rather than in isolation or less frequented areas due to several reasons. The incentive to start a new business is greater in clusters as potential founders have better information about business opportunities. People who have worked in other market-leading companies get an impression whether there is a need for new products or services. Due to these insights, individuals are more likely to leave existing companies and start a new

business (Porter, 2000; Delgado *et al.*, 2010). Another reason are relatively low entry barriers in clusters as resources, input factors, and trained personnel are already available, which are urgently needed to build up a company. Local financial institutions and investors with industrial experience usually require lower cost of capital than elsewhere and founders often have an established network with various stakeholders from an industry. In addition, the perceived barriers to entry are lower as many other local founders have created successful startups. Finally, a further advantage of clusters is the proximity to established companies which often have more difficulties than young companies in developing innovations, but they provide valuable resources and capital for access to technology (Porter, 2000).

For the purpose of this dissertation, regional competitiveness is defined as the ability of a region to attract (young) companies by providing an attractive environment in which networks of pre-existing institutions from different industries allocate important resources for newcomers.

1.3 Synopsis

Table 1.3 provides an overview of this dissertation. This dissertation comprises three studies to investigate different levels of competitiveness in the field of financial technology. The first study "Why fintechs cooperate with banks – Evidence from Germany" (Chapter 2) plays on the micro level and analyzes how fintech firms can improve its competitiveness by entering into cooperation with banks. The study presents collaboration motives of fintech startups and explains the impact of resource availability on the business model of fintech startups. Examining 14 German fintech startups that entered into cooperation with banks, this study is based on semi-structured expert interviews with founders and top team members. The second study "Resource-based perspective of VC investments in fintech" (Chapter 3) refers to the regional level and investigates what regional industries are needed to build an ecosystem of (successful) fintech startups. In doing so, the study assumes that networks of pre-existing institutions from different industries allocate important resources for fintech newcomers. Furthermore, the study analyzes how the location of fintech startups affect the funding behavior of venture capital firms. To investigate these research questions, a panel setting with a mostly balanced data structure is used, covering 2918 US counties over 13 years. Finally, the third study "The impact of national regulation on cryptocurrencies" (Chapter 4) considers the macro level of competitiveness. In this context, macro level competitiveness refers to the ability of a nation

to adopt regulations that promote innovations. In particular, the study analyzes the impact of national regulation on the market evaluation of cryptocurrencies to determinate whether regulation can be effective for decentralized assets and to investigate whether markets perceive regulation as beneficial or disadvantageous. To answer these questions, I apply an event study approach that relies on daily prices of 521 cryptocurrencies from 38 different jurisdictions and 140 relevant regulatory events.

In the following, I highlight the current state of the papers and conference contributions.

Study 1: Bömer, Max and Maxin, Hannes, "Why fintechs cooperate with banks – Evidence from Germany", German Journal of Risk and Insurance, 2018, Vol. 107 No. 4, pp. 359–386.

Conference presentations:

- HVB doctoral seminar, Oldenburg, Germany, 03.11.2017
- EURAM conference, Reykjavik, Iceland, 21.06.2018
- G-Forum, Stuttgart, Germany, 12.10.2018

Study 2: Bömer, Max and Schwienbacher, Armin, "Resource-based perspective of VC investments in fintech", unpublished working paper (first round revise and resubmit in Technological Forecasting and Social Change, 07.12.2019).

Conference presentations:

- Crowdinvesting Symposium, München, Germany, 20.07.2018
- G-Forum, Stuttgart, Germany, 11.10.2018

Study 3: Bömer, Max, "The impact of national regulation on cryptocurrencies", unpublished working paper.

Table 1.3 Structural overview of the dissertation.

Study	Level	Definition	Research question	Method	Sample
Study 1	Micro (firm)	The ability of a company to reach an advantageous market position by exploiting superior resources that are available within the company and/or are provided by alliance and cooperation partners.	-Which resources are the reason why fintech startups enter into cooperation with incumbent banks? -How does the access to incumbent banks' resources help the fintech startups to reach a better market position?	-Handbook-supported expert interviews -Inductive/deductive coding	-14 cases of German fintech bank collaborations
Study 2	Regional	The ability of a region to attract (young) companies by providing an attractive environment in which networks of pre-existing institutions from different industries allocate important resources for the newcomers.	-Which regional industries are needed to build an ecosystem of (successful) fintech startups? -How does the location of fintech startups affect VCs' funding behavior?	-Random effects negative (RENB) panel regression -Pooled OLS regression	Panel data structure: -2,918 US counties -1,120 fintech startups -7,185 transactions -yearly data (13 yrs.)
Study 3	Macro (nation)	The ability of a nation to adopt regulatory provisions that promote innovativeness as a relevant component of national competitiveness.	-Can (national) regulation of Blockchain-based cryptocurrencies be effective given their particular characteristics (decentralized, international, anonymous issuing procedure)? -What effect does the regulation of cryptocurrencies have on their market valuation?	-Event study with binary dummy variable	Time series structure: -521 cryptocurrencies from 48 jurisdictions -140 regulatory events -daily data

2. Why fintechs cooperate with banks – Evidence from Germany

2.1 Introduction

Young companies often have no access to important resources to enable their success. However, a large body of literature emphasizes that young companies are more innovative in terms of creating new knowledge and are more likely than incumbents to develop radical innovations (Rothwell, 1983). The incumbents usually have several comprehensive and cost-intensive resources to produce their goods. Thus, intuitively, an incumbent can contribute to a young company on several dimensions (e.g., funds, knowledge, network) to increase the young company's success rate (Kelly *et al.*, 2000; Lee *et al.*, 2012). Clearly, the incumbents' motivation for this support is to obtain access to the young companies' innovations (Keil, 2000). Therefore, both young companies and incumbents seek to cooperate with each other.

Fintechs are young Internet-based companies that develop products that enable or provide innovative financial services (Deutsche Bank Research, 2014). They are new entrants to the financial industry and compete with incumbent banks and insurance companies (Lacasse *et al.*, 2016; Jakšič and Marinč, 2015). However, in line with the above literature, Kalmykova *et al.* (2016) and Burgmaier and Hüthig (2015) emphasize that fintechs and incumbents from the finance sector would be better off cooperating rather than competing. Although cooperation between young companies and incumbents has received much attention in the literature, we argue that it is interesting to focus on collaborations in the financial industry due to some of the special characteristics:

First, the financial crisis of 2008 led to an increase in regulation requirements (e.g., regulatory capital and documentation obligation) for financial institutions, especially in Europe and the USA (Magnuson, 2018). This increase in regulation was intended to guarantee the stability of the financial market (Schleussner, 2017). In fact, the regulation of the financial industry had a great impact on the incumbent banks and insurance companies, as well as on fintechs. Second, the finance sector is characterized by a special business-to-consumer relationship (Sapienza and Zingales, 2012). In particular, Germany is usually described as an example of a bank-based system with long-term relationships between banks and their customers, which are based on trust and loyalty (Elsas and Krahnen, 1998; Boot and Thakor, 2000). Csiszar and Heidrich (2006) state a similar result for the insurance industry. Thus, the success of the incumbent financial intermediaries and fintechs depend to a high degree on the customers' belief in their quality. Last, other

markets (e.g., pharma/biotech) are confronted with greater innovation pressure historically, while the financial industry has not had to face radical innovations during the last several decades (Corea, 2015; Arner *et al.*, 2015). This situation changed due to several technical innovations by the mid-2000s, such as the launch of smartphones and the availability of broadband Internet (Haddad and Hornuf, 2019). Young companies (i.e., fintechs) used these technologies to develop innovative products. Hence, the financial industry experienced a sudden collision with these new entrants.

To our knowledge, fintechs and cooperation between fintechs and incumbents, in particular, have received only limited attention in the research literature. Moreover, the existing cooperation literature mainly focuses on the incumbent's perspective in terms of their innovation objectives as well as on their screening process (Corea, 2015; Bodek and Matinjan, 2017; Maxin, 2018). Therefore, we argue that the understanding of the cooperation between young companies and incumbents can be enhanced by answering the following research question: Why do fintechs cooperate with incumbents?

Since Dorfleitner *et al.* (2017) found that 87 percent of their surveyed German banks either already cooperate with a fintech or seek to cooperate with a fintech in the future, we believe the German finance industry is an interesting object of research to investigate this question.

Fintechs can be divided into different groups, whereby the main group consists of companies that are related to the banking market. A second important group belongs to the insurance industry. These fintechs are often specified as insurtechs (Alt *et al.*, 2018). However, there exist only a relatively small number of these companies in Germany nowadays. Ernst & Young (2017) state that a total of 25 insurtechs were founded, which corresponds to eight percent of all fintechs.

Due to this limitation and to address our research question, we focus on the banking market where we identify a sufficiently large number of collaborations. Nevertheless, especially the insurance industry often experiences a similar development as the banking sector (Alt *et al.*, 2018). In this way, we follow Alt and Puschmann (2016) and argue that insurtechs can also strongly benefit from this study. Additionally, our results can be interesting for incumbent insurance companies in terms of dealing with insurtechs in the future (Tiberius and Rasche, 2017). Here, it is important to point out, that, despite their

current small number, the insurtech sector is strongly increasing and it is likely that these young companies take a more important role soon (KPMG, 2017; Ernst & Young, 2017).

In detail, we conducted a multiple case study and investigated fourteen German fintech-bank collaborations from 2016 to 2017. The data set mainly consists of interviews with the fintechs' CEOs. In addition, we consulted bank managers and industry experts and analyzed different data sources, such as homepages, industry reports, press releases, marketing material, and newspaper articles.

The primary results of our paper consist of the following: we develop a resource-based framework that aims to explain why fintechs cooperate with banks. This conceptual framework contains three components:

- Banks enable fintech's market entry.
- Banks increase fintech's profits (by accelerating growth).
- Banks enable new fintech products.

These components are related to different label approaches and resources that fintechs can obtain when they cooperate with banks. We discuss this in detail in Section 2.4. Additionally, propositions are developed that can be tested in future research. In this context, we also highlight possible predictions for the insurance sector.

The remainder of the paper is organized as follows: after discussing the literature in the relevant fields of research in Section 2.2, we present in Section 2.3 the method of our study. Next, we provide the analysis of our data in Section 2.4. The Section 2.5 concludes the paper.

2.2 Literature review

We proceed with the literature that we consulted either before or during the course of the study. Starting with the wider theme of cooperation between incumbents and young companies, we reviewed existing fintech literature with particular regard to cooperation with banks.

2.2.1 Cooperation between incumbents and young companies

Cooperation is defined as a long-term process of two or more companies working or acting together for a mutual benefit (Rotering, 1993). The literature distinguishes between different types of cooperation.

One typical form is an alliance. Gulati (1998) describes alliances as a voluntary arrangement between independent companies that share and exchange resources because they cannot generate all the necessary resources on their own (Child, 1974; Pfeffer and Salancik, 1978). For instance, resource sharing can comprise co-development or provision of products, services, and technologies. Alliances have specific objectives that are negotiated and then pursued by all alliance partners (Dushnitsky, 2006). Hence, the partners jointly invest resources and engage in the project for which they formed their alliance. In case of success, all partners obtain a fraction of the monetary profits.

Especially for young companies, there is a lack of important resources to enable the companies' success. Therefore, they seek to cooperate with incumbents that have access to the required resources. For instance, Gans *et al.* (2002) analyze a survey of more than 100 young companies. They reported that cooperation between a young company and an incumbent (through licensing, alliances, or acquisition) is the preferred approach when the incumbent has a particular resource that is crucial for the young company's success. In addition, Dushnitsky (2006) states the different resources that young companies usually obtain when they cooperate with an incumbent. Beside funds, infrastructure, and know-how, the young companies can also exploit a reputation effect (or endorsement effect) due to cooperation with an incumbent, which reduces uncertainty about the firms' quality. In other words, cooperation may enable a reputation spillover effect for young companies (Stuart *et al.*, 1999).

Corporate venture capital (CVC) can be seen as a specific type of alliances that is based on minority equity (or equity-type capital) investments of incumbent companies in legally independent firms (Keil, 2000; Maula, 2001; Weber and Weber, 2011). It plays an important role in financing young companies with uncertain but high growth expectations. CVC investments pursue two different goals in order to maximize the large companies' values: beside high financial returns, there are often more diverse and complex innovation objectives (e.g., access to new products, a window on new technologies, or generating demand). Remarkably, an important part of CVC is the non-financial support (corporate

infrastructure, network, or other resources) provided by the investors. Hellmann (2002) points out that a new venture's success or failure depends on this non-monetary support.

2.2.2 Fintech

The term fintech is a contraction of financial technology and encompasses young companies that develop Internet-based technologies that enable or provide financial services. Puschmann (2017) reports that the term is most likely first mentioned in the early 1990s. However, (Zavolokina *et al.*, 2016) state that the number of publications on fintechs has only recently increased. Thus, fintechs can be described as a relatively new field of research.

We identify four main topics, which are discussed in the existing literature. First, several publications have concentrated on developing definitions for the term fintech. Schueffel (2016), for example, states that fintechs are companies that apply technology to improve financial activities. Accordingly, Deutsche Bank Research (2014) describes the term fintech as modern technologies for enabling or providing financial services, such as Internet-based technologies in the e-commerce field, mobile payments, or early-stage crowd-based financing of young companies.

Second, other papers have considered the success factors and determinants of fintechs. According to Chuen *et al.* (2015), there are five factors that affect a fintech's success rate: low margins, light assets, scalability, innovation, and ease of compliance. Furthermore, Haddad and Hornuf (2019) investigate the economic and technological determinants of fintechs in 69 countries. They show that countries witness more fintechs when the latest technology is available in the economy because young companies require these technologies for their products. They also find that fintechs occur more frequently in countries with a more fragile financial market.

Third, since the financial sector is highly regulated, another strand of literature has focused on legal requirements of fintech products (Douglas, 2016; Philippon, 2016; Knight, 2017). For instance, Knight (2017) analyzes the regulatory requirements for the financial industry in the USA. The author shows that fintechs from the same product segment can be regulated differently across the states. This situation leads to an inefficient allocation of funds in the fintech sector. Other authors have focused on the legal requirements in particular fintech segments, such as equity crowdfunding (Hornuf and Schwienbacher, 2017).

Lastly, some publications have analyzed the relationship between banks and fintechs. Jakšič and Marinč (2015) state that fintechs and other IT companies would cause drastic changes in the financial industry due to their innovative products. In line with this, Lacasse *et al.* (2016) predicts that "new services will meet or exceed expectations and will often provide a product that is superior to that of the traditional industry." Tiberius and Rasche (2017) show the disruptive potential of fintechs by conducting a multiple-case study, which states the advantages of new services in several different product segments. Accordingly, PWC (2017) reports that more than 80 percent of their interviewees (i.e., experts from incumbent financial institutions) believe that their business is at risk due to fintech disruption. Moreover, Bunea *et al.* (2016) study annual SEC filings of U.S. bank holdings and find evidence that banks consider fintechs as serious threat.

However, other research has focused on the advantages of cooperation between fintechs and incumbents (Kalmykova *et al.*, 2016; Burgmaier and Hüthig, 2015). We hereby found that authors mainly investigate reasons why incumbent banks seek for cooperation with fintechs. Accordingly, several financial institutions and consulting companies consider fintech-bank cooperation as a new opportunity for incumbent banks to obtain access to external innovation (BNY Mellon Treasury Services, 2015; Deutsche Bank Research, 2014; Santander, 2016).

Klus *et al.* (2019) differentiate five different motives why banks form strategic alliances with fintechs. First, banks outsource projects to fintechs within the framework of strategic alliances due to resource and cost saving, respectively. Second, banks seek for fintech alliances to accelerate their innovation processes. Third, banks consider investments in fintechs as M&A activities that may have a positive impact on their own business models. Fourth, banks are keen to cooperate with fintechs to increase revenues by offering the innovative fintech services. Fifth, banks want to have an access to the fintech's technical knowledge and to learn from the fintech's way of executing processes. Beside this, another aspect is that banks cooperate with fintechs to create a more innovate image for external stakeholders, such as clients and shareholders (Deutsche Bank Research, 2014).

Other literature focuses on particular cooperation approaches between banks and fintechs (Thwaits, 2016; Bodek and Matinjan, 2017; Meinert, 2017; Maxin, 2018). For instance, some publications have focused on CVC: Corea (2015) states that the importance of CVC increases for banks. In line with this, Maxin (2018) conducts a single case study on

Commerzbank's main incubator, which is the first CVC firm for fintechs in Germany. He shows that regulatory requirements have a great impact on the CVC firm's selection process and support for the fintechs. In addition, Bodek and Matinjan (2017) provide a case study on Comdirect's startup garage, which is one of the first accelerator programs executed by a German bank. They focus on the screening process, the support, and the bank's innovation objectives.

2.3 Method

This study is exploratory in nature because little is known regarding cooperation between fintechs and banks. We used a case study approach to develop a conceptual framework that enables a general understanding of our research topic.

We hereby define a concept as an abstract or generic idea generalized from particular instances. A conceptual framework, in turn, can be understood as a "network of interlinked concepts that together provide a comprehensive understanding of a phenomenon or phenomena" (Jabareen, 2009, p. 51). It can be applied in different fields of science where an overall picture is required. For instance, economists developed the conceptual framework of "supply" and "demand" to explain the behavior of companies and consumers. In contrast to a theoretical model, a conceptual framework is based on flexible conceptual terms rather than rigid theoretical variables and strict causality (Jabareen, 2009). We argue that this methodical approach is suitable to explore why fintechs cooperate with banks.

Case studies often provide interesting insights and they can motivate a more rigorous analysis of a research problem. However, it is important to point out that case studies cannot provide a conclusive answer to this research problem.

2.3.1 Sample

We adopted a multiple-case study design because it allows us to enable cross-case analysis in contrast to the single-case study approach and hence, it provides a stronger theory basis. Moreover, Ridder (2019) reports that cross-analysis can strengthen possible results, verify relationships among these results, and offer a better understanding of the examined research topic. The fintech is the unit of analysis and each fintech in our study represents an individual case study.

In order to generate a new conceptual framework, the sample is of central importance. Notice that the selected cases are not representative of a larger population (Eisenhardt and

Graebner, 2007). Ridder (2019) states that the goal is not to test a theory but to build a novel one. Statistical representativeness is not relevant. We applied maximum variation sampling, in accordance with Eisenhardt and Graebner (2007) and Yin (2017). This means that our study is designed to maximize variation along different dimensions, to reveal central patterns that hold across these dimensions in the cases (Ridder, 2019). We chose the following dimensions: fintech product segment, fintech clients, and bank type.

We also discussed the topic of this study with different experts in the field of fintech and banking. Based on these early discussions, we selected fourteen fintech-bank collaborations. Table 2.1 presents the main characteristic of each collaboration.

We investigated our research question in the context of a country in which cooperation between fintechs and banks is particularly relevant. As mentioned before, Dorfleitner *et al.* (2017) state that almost 90 percent of their surveyed German banks either already entered into a fintech cooperation or have the intention to cooperate with a fintech in the future. Given our sample number and dimensions, we considered a cross section of the German fintech sector that consists of approximately 24 banks that cooperate with at least one fintech.[13]

2.3.2 Data sources

The primary data sources of our study are semi-structured interviews. This means that our interviews structure based on two aspects, following Ridder (2019): first, we have used the literature on cooperation between incumbents and young companies and the existing fintech literature to predetermine themes and questions for the interviews. Second, we have not only limited on these structured topics. We also went beyond our prepared questions if the interview situation reveals new insights that were not expected. In order words, we combine (loose) structure and flexibility.

Ridder (2019) states that interviews can lack in reliability. Hence, in addition to the interview data, we also collected primary and secondary data by consulting company homepages, industry reports, press release, marketing material, and newspaper articles. This additional data collection increases the reliability and validity of our study through data triangulation (Miles and Huberman, 1994). Data triangulation means that our case study findings are supported by more than a single source of evidence. In contrast, if you use

[13] See: https://paymentandbanking.com/cooperations-between-banks-and-fintechs-in-ger/.

multiple sources but analyze each source separately, then this approach resembles the comparison of conclusions from separate studies. Each based on a different source (Yin, 2017). Moreover, we mitigate the interview bias by following an interview guide that structured our information collection.

Our interview partners are fintech CEOs and bank managers. Interviewees were granted anonymity; thus individual names of respondents are not disclosed. Where quotes from the interviews are used in this study, we refer to the related cooperation with the Greek alphabet (e.g., Theta) and to the interviewee with a letter and number code (e.g., A1). The interviews were conducted by telephone and in-person on site. We also adopted pilot interviews to become familiar with the interview guidelines and to correct any mistakes.

Almost all informants were interviewed two times because our guide evolved systematically (Glaser *et al.*, 1967). Hence, we used a second interview round with the same experts to lessen possible bias. After each interview, we prepared an interview protocol and the audio recordings were transcribed by a professional service provider. Altogether 25 qualitative, depth interviews were carried out. In detail, this study is based on approximately fifteen hours of interviews, resulting in 313 pages of primary source material.

2.3.3 Data analysis

Through analysis we moved from raw data toward identification of central patterns. As common in the related literature, we made a cross-case analyses that was based on five steps (Andriopoulos and Lewis, 2009; Souitaris and Zerbinati, 2014):

Stage 1. Compiling separate case studies. We conducted within-case analyses by preparing a detailed description of each fintech-bank collaboration. The overall idea is to become intimately familiar with each case, which, in turn, accelerated the later cross-case comparison (Eisenhardt, 1989). Table 2.1 provides the results of this first step.

Stage 2. Identifying initial, broad categories for each case. Examining all interview transcripts, we used an inductive coding approach without pre-specified propositions to form provisional categories and first-order concepts, respectively (Ridder, 2019). Inductive coding means that we started to read our data and searched for important pieces without using theoretically guided codes. This approach allows us to be open about what is happening in our data (Ridder, 2019).

The resulting first-order concepts (broad categories) provide general insights in our raw data. Due to high data amount and to enable a systematic analysis, we processed our data with the help of the computer assisted qualitative data analysis software MAXQDA.

We assessed the reliability of the coding in two steps (Andriopoulos and Lewis, 2009). First, both authors coded the collected text separately. Second, we compared our coding. As standard in the related literature (Andriopoulos and Lewis, 2009; Souitaris and Zerbinati, 2014), we checked for Cohen's (1960) coefficient of agreement, where k = 1.00 characterizes a perfect intercoder agreement. For our data, we obtained a high agreement among the codes due to k = 0.83. We resolved any disagreements through discussions between the authors.

Stage 3. Linking related broad categories by cross-case comparison. Next, we searched for links between the first-order concepts across our cases (Gioia and Chittipeddi, 1991). Similar themes were gathered into second-order concepts that served as the basis of our emerging framework. In total, we consolidated our first-order concepts into ten second-order concepts, which are shown in Figure 2.2. We labeled these dimensions by capturing the content at a higher level of abstraction. For instance, statements about 'bank know-how,' 'bank knowledge,' 'knowledge transfer,' and 'bank expertise' were grouped into the second-order concept of 'know-how.' Figure 2.1 provides an example of this analysis step.

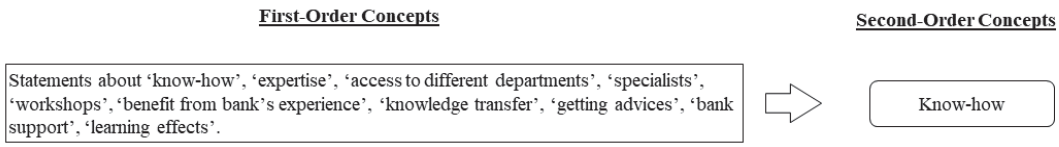


Figure 2.1 Second-order concepts.

Stage 4. Aggregation of the second-order concepts. Next, we identified two aggregated dimensions underlying our second-order themes, namely *bank resources* and *product labels*. Hence, we moved from our first-order concepts to higher-level concepts (Ridder, 2016). An important point of this process was that we allowed concepts and relationships to emerge from the data, rather than being guided by the existing literature. Figure 2.2 depicts our aggregated dimensions.

Table 2.1 Sample.

Collaboration	Fintech Segment	Fintech Clients	Bank type	Fintech description	Principal informants (code)
Alpha	Payments	B2C B2B	Local cooperative bank	The fintech's main product is a mobile application for smartphones, enabling users to send or borrow money to or from other users, collect and split payments among other users for a special occasion, pay invoices in online shops and buy prepaid cards and vouchers.	CEO Fintech (A1) Manager Bank (A2) Manager Bank (A3)
Beta	Payments	B2B	Nationwide cooperative bank	Fintech Beta enables merchants of all sizes to integrate all relevant payment solutions to their own shop platform systems through a single API.	CEO Fintech (B1)
Gamma	Banking	B2B	Central cooperative bank	Fintech Gamma developed a sophisticated online exchange platform for B2B trade receivables, enabling firms to upload their invoices in order to put those up for a Vickrey auction.	CEO Fintech (C1)
Delta	Crowdfunding	B2B	Nationwide cooperative bank	The fintech digitizes emission and investment processes for companies in different industries. One of their main products is a white label crowdfunding platform.	CEO Fintech (D1)
Epsilon	Crowdfunding	B2B	State-owned business development bank	The fintech is an online platform which mainly provides reward-based crowdfunding solutions. In this form of crowdfunding supporters typically get the product as a reward when the project is successful.	Manager Fintech (E1)
Zeta	Banking	B2B	Large private bank	Fintech Zeta is an online financial service marketplace. SMEs can send a request concerning their financing or investing need. Partner banks are free to make offers. The Fintech acts as an advisor to the SME regarding the offers from different banks.	CEO Fintech (F1)
Eta	Payments	B2C B2B	Small private bank	The fintech allows consumers to buy online and make payments at partner shops with cash. The consumer prints out the given receipt in form of a barcode, take it to one of thousand partner shops, scan it and pay it cash.	Managing Director (G1)
Theta	Banking	B2C	Small private bank	Fintech Theta developed a mobile application which analyzes a customer's consuming behavior by an intelligent algorithm and calculates an individual amount of money for savings which can be invested in the next step.	CEO Fintech (H1)
Iota	Banking	B2B	Large private bank	The fintech's main product is a web identification software. The sophisticated software identifies persons by analyzing biometric data during a video call. Furthermore, Fintech Iota developed an online contracting solution which is typically used for online credit contracts.	CEO Fintech (I1)
Kappa	Robo Advice	B2C	Small private bank	Fintech Kappa is a high-tech investment manager for private and institutional investors. By analyzing big data, the algorithm considers multiple key figures and further identifies undervalued companies in order to create a portfolio.	CEO Fintech (J1)
Lambda	Payments	B2B	Nationwide cooperative bank	Fintech Lambda provides payment solutions in the area of donation. Their main product is a donation widget for websites of charitable companies which allows supporters to donate money cashless through different payment solutions.	CEO Fintech (K1)
Mu	Robo Advice	B2B B2B	Large saving bank	The fintech is digital asset management company offering a wide range of services, such as depot opening, customer risk evaluation, depot management or performance reporting.	CEO Fintech (L1)
Nu	Payments	B2C B2B	Large direct bank	Fintech Nu provides an intuitive smartphone app for users who want to send money to friends all over Europe in a matter of seconds. By cooperating with user's principal banks, the app guarantees the bank's normal high security standards.	CEO Fintech (M1)
Xi	Text recognition	B2B	Large private bank	The company provides AI-driven content automation solutions with semantic applications, Natural Language Understanding (NLU), Natural Language Generation (NLG), and chatbots. In this way, the company is not considered as a pure but a partial fintech.	CEO Fintech (N1)

Stage 5. Building a conceptual framework. Lastly, we found that some resources were connected to other resources or to a specific product label. Given this, we developed a conceptual framework to illustrate how the lower concepts and aggregated dimensions relate to each other (Souitaris and Zerbinati, 2014). Additionally, propositions were developed that can be tested in future research. Figure 2.3 provides the results of this final step.

2.3.4 Literature comparison

We compared our results with the existing literature in the fields of fintech and cooperation between young and incumbent companies to enhance the internal validity, generalizability, and theoretical level of our study (Eisenhardt, 1989).

2.4 Analysis

The purpose of this study is to investigate the reasons why fintechs cooperate with incumbents. In this section, we present the overall findings related to the research question from the introduction and our developed propositions.

2.4.1 Conceptual framework

In order to obtain a better understanding of the reasons that determine cooperation between fintechs and incumbents, we derived the conceptual framework illustrated in Figure 2.3. In line with the cooperation literature (Child, 1974; Pfeffer and Salancik, 1978), we argue that access to resources is an important reason for fintechs to cooperate with an incumbent bank. Hence, we selected resources as the viewpoint of our study to provide new insights in the field of fintech-bank cooperation.

The conceptual framework emerged as a result of our data analysis (Teppo and Wüstenhagen, 2009). We found the existence of a recurrent pattern and grouped particular resources (i.e., second-order topics) together (see, for a cross-case comparison of the resources Table 2.2). Each resource group is related to a specific reason (explanatory variable) why fintechs cooperate with banks.

In detail, our conceptual framework is based on the argument that some fintechs are reliant on banks as they cannot enter the market without the banks' cooperation. Thus, cooperation is a necessary condition for these fintechs. Beside this, we also identified that fintechs cooperate with banks to increase their profits by accelerating growth and to enable new products. Indeed, the last two points are not necessary conditions for

collaborating. Bank cooperation is a possible option for the related fintechs to obtain a particular benefit. As we will show, some fintechs cooperate with a bank due to more than one reason. Clearly, new products and market entry also increase (or enable) profits for the fintechs. Hence, it is possible to connect the first two explanatory variables with the last one. However, we want to maintain clarity of the conceptual framework and to highlight the direct impact of resources availability and the fintechs' different requirements, respectively.

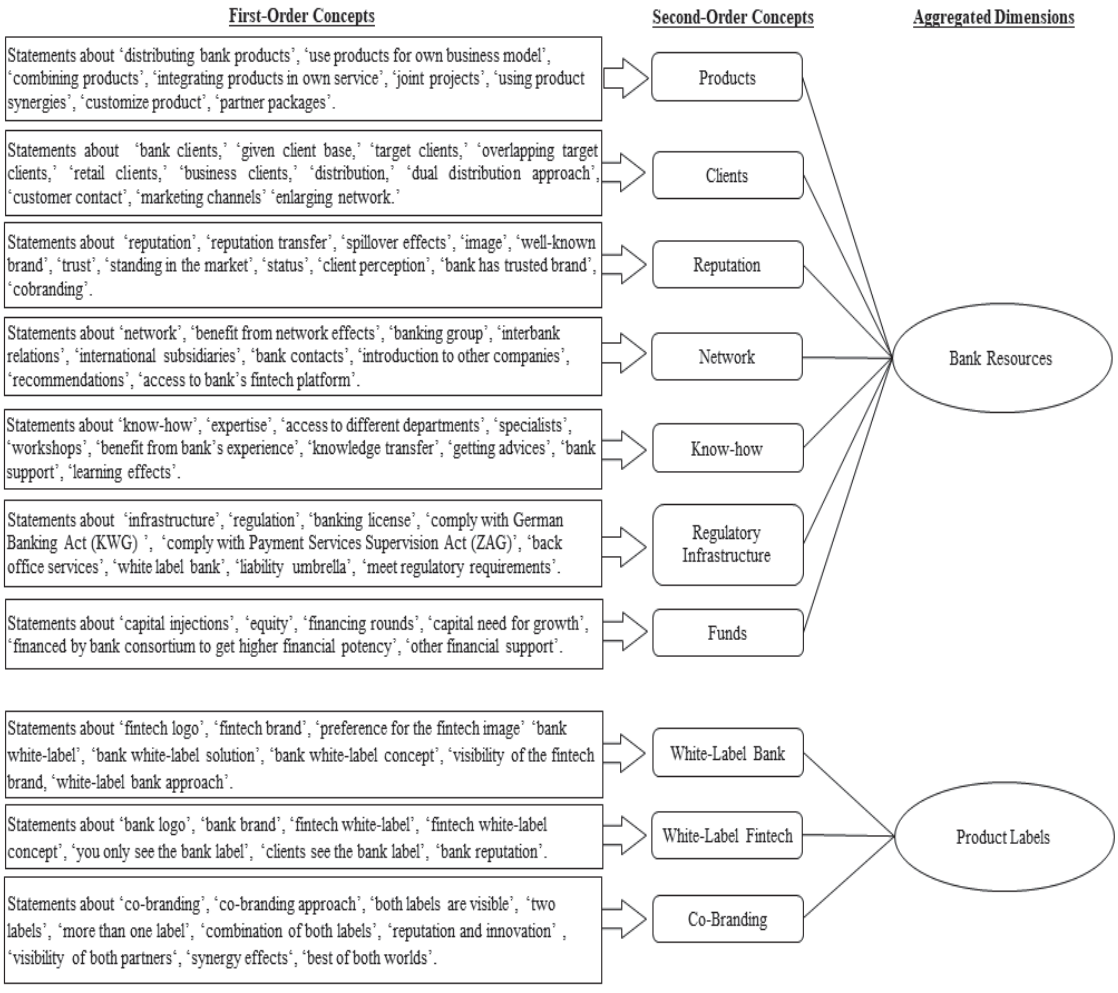


Figure 2.2 Data structure.

In addition, we found that two of our reasons (i.e., banks enable the fintech's market entry and increase fintech's profits) are linked to a specific labeling of the fintechs' products (see Table 2.3 for a cross-case comparison of the labels). The following sections discuss the elements of our conceptual framework in more detail. We also stress the different characteristics of our fintech segments.

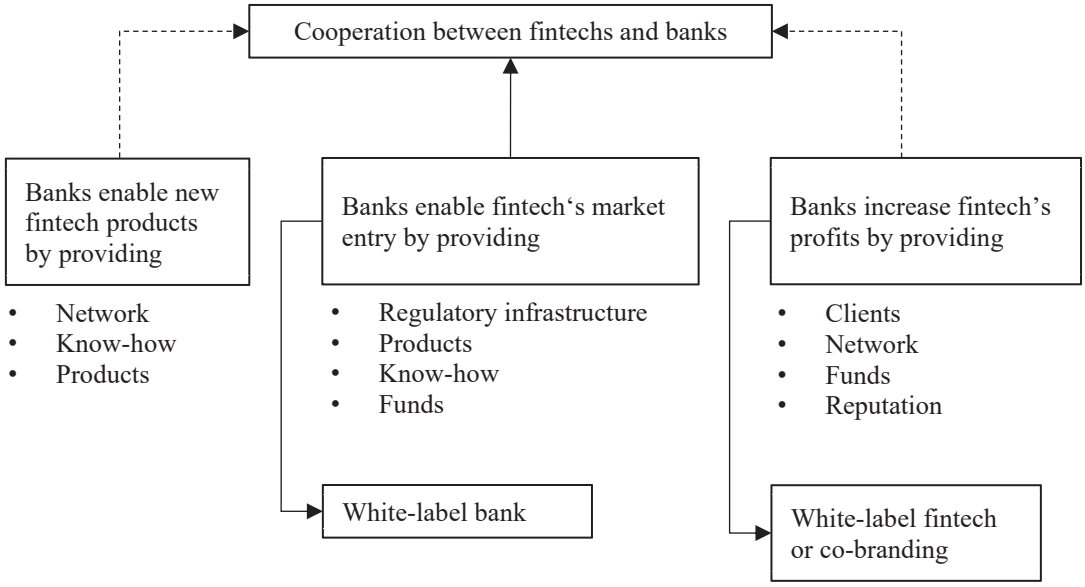


Figure 2.3 Conceptual framework to explain fintech-bank collaboration.

2.4.2 Banks enable fintech’s market entry

When we analyzed the empirical data from our interviews, we found several fintechs that needed specific resources to enter the market, namely Gamma, Zeta, Eta, Theta, Kappa, Mu, and Nu. The fintechs belong to three segments: payments, banking, and robo-advising (see for description of each fintech segment Table 2.1). We identified the main resources that are related to the fintech’s market entry: regulatory infrastructure, products, know-how, and funds.

Regulatory infrastructure: (Wurgler, 2000) emphasizes that financial regulation is important for the efficient functioning of the financial market. For Germany, the Payment Services Supervision Act (ZAG) as well as the German Banking Act (KWG) regulate the financial industry by means of licenses, also called bank licenses. Since it is cost-intensive and time-consuming to obtain a license, (Thwaits, 2016) states that fintechs seek to cooperate with banks. In the words of one interviewed manager:

> *‘An own banking license is too expensive on the one hand. On the other hand, [if we applied for a banking license] we would not have enough time to develop the [core] product, because we would have to develop many functions and many regulatory features from scratch.’* (J1, Kappa)

Another interviewed fintech commented on the regulation requirements as follows:

> *'Like every fintech, we have a partner bank in the background, whose banking license is in principle enabling our business model. In fact, we are only a technical service provider for the product we offer.'* (G1, Eta)

Recall from above that we find three fintech segments where a bank is necessary for market entry due to KWG and ZAG. The other fintech segments of our sample are either able to fulfill the regulation requirements without a partner bank (i.e., crowdfunding) or they are not regulated (i.e., text recognition). Of note, Germany recently passed a specific legislation for crowdfunding, namely the Small Investor Protection Act (Hornuf and Schwienbacher, 2017). An interviewed crowdfunding fintech commented on the possibility of fulfilling the regulation requirements:

> *'…we fulfill the regulation requirements alone…There were some tasks, but we were able to fulfill them. Then, we have started our project and negotiated with the bank.'* (D1, Delta)

Given these results, we state the following proposition:

Proposition 1: Fintechs cooperate with banks when they are regulated in the sense of KWG and ZAG.

We find that all of our fintechs cooperate with a bank when they have to fulfill the KWG or ZAG requirements. Recently, however, there is some evidence that German fintechs can obtain their own licenses to become independent from their partner banks (e.g., the fintechs Bitbond or N26). Hence, we argue that Proposition 1 is an interesting empirical result that can be tested with a larger sample in the future to prove whether fintechs are able to fulfill the regulation requirements without bank cooperation.

For the insurance industry, we expect a similar result in the future. To see this point, consider, for instance, the minimum capital requirement due to Solvency II. To fulfill this requirement, young companies can either seek to obtain funds from venture capital firms (e.g., the insurtech Oscar) or they cooperate with an incumbent insurance company. Nevertheless, we identify that most insurtechs focus on platforms and marketplace solutions nowadays where the regulatory requirements do not apply.

Know-how: A number of studies state that young companies are likely to be the source of highly valuable and innovative ideas (Kortum and Lerner, 2000; Zingales, 2000).

Nevertheless, incumbents usually have expertise for product development and regulatory and patent approvals because they have existed in the market for over a longer period of time (Park and Steensma, 2012). Moreover, from the knowledge-based view of the firm, know-how is the core value in any kind of organization (Weber and Weber, 2011). As a consequence, young companies seek to cooperate with incumbents to obtain access to their considerable know-how (Kogut, 1988).

Our data indicated that all fintechs, which need regulatory infrastructure, rely also on their partner banks' know-how because they have to connect their own technology with the IT system of their cooperation bank. In addition, banks advise fintechs to develop products that are in line with the market requirements and thus enable market entry. As expressed by a manager:

> *'[During the process of product implementation] the bank [sometimes] said, no, we cannot do it like this, because that violates any of our internal rules or those from the supervision…the bank specifies whether it was okay or not.'* (N1, Mu)

Products: Ghazawneh and Henfridsson (2015) found that Internet-based companies, which develop digital marketplaces, cooperate with other companies because they want to distribute their cooperation partners' products. Our data indicated a similar approach for fintechs. They cooperate with banks because bank products are part of their own business models. For instance, fintech Zeta has a platform for financial products, such as credits, leasing instruments, or factoring solutions. A manager explained:

> *'The most important reason why we entered into this collaboration is…that we are driving a marketplace and do not have any own products in the market...'* (F1, Zeta)

Intuitively, partner banks are also better off because fintechs are considered as a supplemental distribution opportunity that increases their sales or reduce cost-intensive processes. The following quote illustrates this:

> *'…asset management solutions are brutally complex in the sense of the technical requirements...Hence, banks are looking for alternative systems, like us [the fintech], that can undertake these tasks…'* (L1, Mu)

Table 2.2 Resource overview.

	Clients	Regulatory Infrastructure	Products	Funds	Network	Know-how	Reputation
Alpha	Yes	No	No	No	Yes	No	Yes
Beta	Yes	No	No	Yes	Yes	Yes	Yes
Gamma	Yes	Yes	No	Yes	Yes	Yes	Yes
Delta	Yes	No	No	Yes	Yes	No	Yes
Epsilon	Yes	No	Yes	Yes	Yes	Yes	Yes
Zeta	No	No	Yes	Yes	No	Yes	No
Eta	Yes	Yes	No	Yes	Yes	Yes	Yes
Theta	No	Yes	Yes	No	Yes	Yes	Yes
Iota	No	No	No	No	Yes	Yes	Yes
Kappa	No	Yes	No	No	No	Yes	Yes
Lambda	Yes	No	No	Yes	Yes	No	Yes
Mu	Yes	No	Yes	Yes	Yes	Yes	Yes
Nu	Yes	Yes	No	No	No	Yes	Yes
Xi	No	No	No	Yes	Yes	Yes	Yes

Funds: Naturally, a young company needs financial resources to realize its innovative product or idea (Stinchcombe, 1965). The problem is that young companies lack of collaterals and track records and thus cannot obtain bank loans. However, there are specialized investors, such as venture capital firms that allocate funds towards young companies with growth potential (Gompers and Lerner, 2001).

In comparison to other countries (e.g., United States, United Kingdom), the German venture capital market is significantly underdeveloped. This is reflected in the small number of German venture capital firms and funds, the relatively small amounts of capital German firms have under management, and the average amount of venture capital funding rounds in Germany (KPMG, 2017). We found in our data that some fintechs abstract from venture capital financing because they require a high funding volume to realize their business ideas. Accordingly, some German fintechs need another type of investors with a higher financial power. For instance, fintech Gamma is financed by a syndicate, consisting of several banks that hold fractions of the fintech's shares and are at the same time part of the fintech's business model. The CEO explained:

'The reasons why we were looking for a partner and contacted banks were that it is quite complicated to realize the fintech with venture capital [firms] only. Being backed by a bank consortium provides you [the fintech] with…a [higher] financial potency; because a bank may contribute higher investments compared to venture capital…This means you have a completely different leverage. Then, you can build entirely different structures and teams…' (C1, Gamma)

Given these results, we state the following proposition:

Proposition 2: A higher funding requirement positively affects the founding of fintech-bank cooperation, instead of venture capital financing.

As mentioned, independent venture capital resources are still limited in Germany (KPMG, 2017). In the same way, there are only a limited number of banks that provide equity investments for young companies (Maxin, 2018). Thus, we argue that Proposition 2 is an interesting empirical statement that can be tested in future research to identify the main financing source, especially when high amounts of funds are required (independent venture capital or equity investments by banks). This proposition is also important for the insurance industry. On the one hand, we identify only a few incumbent insurance companies (Allianz, AXA, HDI, Munich Re and Wüstenrot & Württembergische) that allocate funds towards young companies. On the other hand, the limited venture capital market is also a problem for insurtechs in Germany. Nevertheless, KPMG (2017) states that venture capital investments in this sector are strongly increasing in the last years, i.e. from 2012 to 2017.

White-label bank: A young company can reduce uncertainty about its quality by collaborating with an incumbent simply because it was chosen by an industry incumbent (Stuart *et al.*, 1999). The young company usually demonstrates its affiliation to the incumbent, e.g., by presenting the incumbent's brand on its products (see Section 4.3.). However, we found four fintechs in our sample that sell their product only under their own brand. Hence, they abstract from the endorsement effect of their partner bank in favor of the own brand's name recognition. We refer to this as a white-label bank approach. In the words of a fintech manager:

'They [our partner bank] provide a white-label deposit account. If a client opens an account at our company… it is actually an account of our partner bank.

However, this takes place in the background because it seems as the client opened an account at our company.' (H1, Theta)

It is important to point out that the white-label bank approach only occurs if the fintech requires the bank for market entry. If the cooperation seeks to increase profits, then we have identified other label-approaches. We discuss this in the next section.

2.4.3 Banks increase fintech's profits

From the interviews, a second theme was identified regarding the effect of bank cooperation on the fintech's profits. When we analyzed our data, all fintechs, with the exception of fintech Zeta, cooperated with a bank to increase profits by accelerating growth. We find four main resources related to this theme: clients, networks, funds, and reputation. These factors will be discussed in detail below.

Clients: Young companies have only a few clients at the beginning of their business life because they are unknown and it is cost-intensive (e.g., marketing effort) to acquire customers (Dushnitsky, 2006). In contrast, incumbents usually have a large client base due to their long-term existence in the market.

Many of our interviewed fintechs stated they obtained access to their partner banks' customers. In other words, banks help to sell the fintechs' products. An interviewed fintech manager commented on this bank support:

'...we got access to the banks' customers, which help us to expand our [user] network. We do not have to acquire these users through own marketing [activities] and this is of course an advantage.' (A1, Alpha)

Another interviewed fintech manager described the cooperation bank's client resource as follows:

'The potential of a bank [to sell the product] is, of course, much higher since it conveys and manages higher volumes [compared to other clients] because there is a better access to the [customers] projects…' (D1, Delta)

It is important to notice that most of our fintechs use a dual approach. They acquire customers on their own as well as having access to the banks' customers. For instance, fintech Alpha and fintech Nu provide mobile peer-to-peer payment applications for retail clients.

Bank clients increase the number of application users; thus, the payment network becomes more attractive. The following quote illustrates this:

> *'In any case, the expansion of the user group is important as this makes the app more interesting. It is like WhatsApp. You cannot imagine today that there were people who did not use it.'* (A2, Alpha)

However, some fintechs abstract from acquiring their own customers. The manager of fintech Beta, a payment service provider, chose this approach to save on costs and to focus on the development of the fintech's technology. The interviewed fintech manager described this approach as follows:

> *There are already examples [other fintechs] which have to leave the market due to high marketing and sales activities…we are completely focused on technology and customer support. In our opinion, this is the right path for the future.'* (B1, Beta)

Network: Baum *et al.* (2000) provided evidence that access to an established network is another reason why young companies benefit from collaborating with incumbents. Moreover, Milanov and Shepherd (2013) emphasize the importance of the first cooperation partner's network to a young company's success. Indeed, we find that the overwhelming number of our fintechs obtained their first business contacts (e.g., other banks, auditing and consulting firms) through their cooperation bank's network. The following quote illustrates this:

> *'The bank is very open to making contacts, recommending us to other banks, other players, whenever it seems to fit…We were introduced in many circles, we had very often the opportunity to present ourselves and were then recommended once again.'* (N1, Xi)

In particular, fintechs increase their profits by using banks' subsidiaries. An interviewed manager from fintech Iota described this approach as follows:

> *'[…] In other words, having a well-functioning cooperation with [this] German bank helps us, of course, to work with the bank's subsidiaries in all other countries of the world [where the bank is active].'* (I1, Iota)

Table 2.3 Label overview.

	White-Label Bank	White-Label Fintech	Co-Branding
Alpha	No	Yes	No
Beta	No	Yes	No
Gamma	Yes	No	No
Delta	No	Yes	No
Epsilon	No	No	Yes
Zeta	No	No	Yes
Eta	Yes	No	No
Theta	Yes	No	No
Iota	No	No	Yes
Kappa	Yes	No	No
Lambda	No	No	Yes
Mu	No	No	Yes
Nu	No	Yes	No
Xi	No	Yes	No

Funds: Dushnitsky (2006) emphasizes that young companies obtain funds to finance product development but also for other activities, such as market research or reducing production costs. Analogously, we found evidence that funds are used to increase fintechs' profits. For instance, fintech Xi finances its marketing activities and new employees with the monetary support. Funds are also required when fintechs decide to expand their business and enter new markets. As a fintech CEO explained:

> *'…the banks distribute our joint product. Distribution is quite expensive…this will be financed by the banks on their own. Hence, we have a financial support for our fintech.'* (L1, Mu)

Reputation: Young companies often lack stable relationships with customers and suppliers (Stinchcombe, 1965). In line with this, Stuart *et al.* (1999) state that outsiders will generally be uncertain about the young companies' quality because they have less production experience and thus they operate with unestablished processes. An interviewed fintech manager commented on the importance of quality and reputation in the financial industry:

'*At the end of the day we talk about payment traffic and cash flows and not somehow about the 25th social network…In this way, people consider this business as very serious…It is about finance and it is about the success of a company…' (B1, Beta)*

Reuber and Fischer (2005) and Maxin (2018) state that affiliations with prominent incumbent companies are valuable for young companies because they signal the endorsement of a reputable organization. Hence, young companies seek to cooperate with incumbents to reduce uncertainty about their quality due to a reputation spillover effect (Stuart *et al.*, 1999; Ginsberg *et al.*, 2011). Our data indicated that nearly all of our fintechs have confirmed the existence of such reputation effects. A manager of fintech Delta explained this effect:

'We were in contact with a company, even before we have started the cooperation with the bank. [Unfortunately,] the company rejected [collaborating with us] ... [However] the company is also a client of our partner bank and they work together very closely. When the company heard about our cooperation with the bank, they also decided to start collaborating with us anyway. The other company has specifically referred to it [the bank cooperation].' (D1, Delta)

White-label fintech and co-branding: Most of the fintechs interviewed that sought to increase profits by collaborating with a bank apply two specific product labels. First, we identify a group of three fintechs that sell the product only under the partner bank's brand. We refer to this as a white-label fintech approach. The following quote from fintech Nu illustrates this:

'The user perceives the service as a service of the bank. He primarily sees the bank logo ...They [the banks] have built trust with the customer over the years and of course we can use this trust for our innovative payment solution.' (N1, Nu)

Our findings indicate that all fintechs that apply a white-label fintech approach cooperate with more than one bank. Then, fintechs are only technology service providers and they distribute their technology to many banks to increase profits as well as the number of users. In return, banks receive the opportunity to offer innovative products to their customers. As a bank manager explained:

> *'... but to the customers and users of this app, it [the white-label fintech app] appears as a strong technical innovation…and users who connect their account to the app have fewer incentives to change [the bank].'* (N1, Nu)

Additionally, we found evidence that some collaborations use a combination of both labels, such that the clients notice the fintechs' and the partner banks' brands together; we refer to this as a co-branding approach. A manager at Mu indicated:

> *'This is not a white-label-case but rather a co-branding case. The fintech's brand is still visible.'* (L1, Mu)

In this case, we have a combination of two effects. First, we have a reputation effect due to the bank's brand. The clients recognize that they are using a product that is distributed by an established bank. Second, we have an innovation effect because the fintech's brand is also visible. The clients also notice that they are using a new technology. The following quote from fintech Mu illustrates this:

> *'We [the bank] ensure that everything works safely, such that the clients can trust the [fintech] product. On the other hand, the fintech is responsible for the new and cool features… Hence, we have the best of both worlds.'* (L1, Mu)

The same manager concluded:

> '*... I would almost speak of Yin and Yang [with respect to reputation and innovation]…And in this way, we have a great synergy chain, because, what is missing, the bank has and vice versa.'* (L1, Mu)

Given these results, we state the following proposition:

Proposition 3: The visibility of the cooperation bank's label positively affects the fintech's profits.

We argue that there is a high likelihood that Proposition 3 can be validated in future research as, in particular, the financial industry is characterized by long-term relationships between customers and banks. The success of banks depends to a high degree on the customers' belief in their quality and the banks' reputation, respectively (Castelfranchi and Falcone, 2010; Sapienza and Zingales, 2012). Hence, we expect a positive effect on the fintechs' profits due to the visibility of the cooperation bank's label. Clearly, we

expect a similar result for the insurance industry. Csiszar and Heidrich (2006) emphasize that insurance companies have also long-term relationships with their customers that are based on trust and loyalty. Therefore, the visibility of an incumbent‘s label can have a positive effect on the insurtechs’ profits.

2.4.4 Banks enable new fintech products

From the interviews, a last theme was identified regarding the effect of cooperation on a fintech’s product line. We identify different fintechs that cooperate with a bank to develop new products, namely Epsilon, Eta, Theta, Iota, Nu, and Xi. These fintechs belong to the following segments: payments, banking crowdfunding, and text recognition. Overall, we found three main resources related to this theme: network, know-how, and products. These factors will be discussed in detail below.

Network: Fintech Theta’s product calculates a monthly saving amount for the customers by using an algorithm that analyzes income and consumption behavior. Its partner bank also cooperates with several other fintechs. Most of these young companies provide investment products, such as fixed income assets, exchange traded funds, and security products. Fintech Theta integrates all of these services into its own product. Hence, the customers have a wider range of investment opportunities for their saving amount. As expressed by the CEO:

> *‘We are building with our fintech a layer over these fintechs and above the bank, if you now think of a bit bigger, more visionary, you can say we are the Google of the financial sector and we are looking for the right partners for our users.’* (H1, Theta)

Know-how: Fintechs also use the cooperation banks’ know-how to expand and improve their products. An interviewed fintech manager commented on the possibility of generating new products:

> *‘…there are frequent workshops for the exchange of knowledge where we talk about common products…The basic product… remains untouched. It's more about finding new business opportunities for using the product [technology], for instance, municipal payments, or other banking products, such as loan payments or something else.’* (G1, Eta)

Another interviewed manager whose fintech is involved in a bank's digital factory described it as follows:

> '*The idea of this digital factory is to re-think things…there are people who think differently to those in the regular departments...we have access to specialists who do not work for us [exclusively] but we can exploit their know-how for product development'* (I1, Iota)

Interestingly, fintech Xi started in the field of text recognition and is originally not a pure fintech. However, its technology is also relevant for banks and insurance companies. The fintech requires a bank's know-how to evaluate key performance indicators due to the founders' limited expertise in this field. Hence, the young company started cooperating with a bank to develop different products for the financial industry, combining its technology and the bank's know-how. The following quote is illustrative of this:

> *'…we have a basic technology ... And the [idea of this] cooperation is that we work together with different units of the bank, such as marketing, human resources, financial analysts… and think of how to make our technology usable for a bank.'* (N1, Xi)

Products: Moreover, we found evidence that fintechs in the segments of banking and crowdfunding integrate bank products in their own products to become more attractive for customers. An interviewed fintech manager commented on the product integration:

> *'We discovered a huge product flexibility at the bank…we had not seen from other bank partners. We had previously scanned the market very closely and just realized that they could offer us the opportunity to build a truly innovative product.'* (H1, Theta)

We also observed joint projects of fintechs and banks that extend the fintechs' product lines. Fintech Epsilon usually provides a reward-based crowdfunding system. Aside from this, the fintech started a co-funding project with a development bank. A manager at Epsilon indicated:

> *'...so, I [a young company] apply to the bank for funds and say:" I have a financing volume of 30,000 euros. I'll raise 20,000 euros through crowdfunding but would like to have a follow-up financing." Then, the bank checks the document*

> *and [may] say: "Okay, that works for us. If you collect 10,000 euros minimum, you will get the follow-up financing from us." And this gives them a real market test where I can see if… anyone buys it [the young company's product]?'* (E1, Epsilon)

Hence, fintech Epsilon's crowdfunding approach has the function of a pre-market product evaluation for the bank, reducing uncertainty about the demand for new products. In this way, the joint project enhances the financing opportunities for young companies by loans and reward-based crowdfunding.

Given these results, we state the following proposition:

Proposition 4: A fintech-bank cooperation positively affects the number of products a fintech develops.

Fintechs are often described as disruptive forces in the financial industry (Tiberius and Rasche, 2017). However, we found in our study that several fintechs and banks cooperate to develop together new products. In other words, the young companies do not seek to replace the incumbents. Thus, we argue that Proposition 4 can be tested in future research to highlight the synergistic effects of a fintech-bank cooperation. Furthermore, proposition 4 is also relevant for the insurance industry. We find that most insurtechs focus on platforms and marketplace solutions nowadays due to the regulatory requirements. This shows that insurtech products can apparently be combined with products of incumbent insurance companies. Given our identified resources that increase the fintechs' number of products, we believe that incumbent insurance companies can provide the same resources for insurtechs. Thus, we expect that cooperation can also positively affect the insurtechs' number of products.

2.5 Conclusion

We have proposed a conceptual framework that helps to explain why fintechs cooperate with banks. It is based on the argument that some fintechs are reliant on banks, in the sense that they cannot enter the markets without collaborating. Thus, collaboration is a necessary condition for these fintechs. Beside this, our framework shows that fintechs cooperate with banks to increase their profits and to enable new products.

Our article contributes to two strands of literature. Initially, we contribute to the fintech literature in general by documenting and explaining resources that are usually an element

of fintech-bank cooperation. In contrast to recent studies that focus on different segments (e.g., payment, crowdfunding, Blockchain), we analyzed fintechs in general. Moreover, we provide a deeper understanding of the fintech perspective in collaborations as (to our knowledge) no other paper considers the fintechs' point of view. The development of our conceptual framework creates new opportunities for future research on this topic. In this way, we developed propositions that can be tested in future research.

We also extend a stream of work that looked at cooperation between young and incumbent companies. We argue that fintech-bank collaborations differ from other collaborations between young companies and incumbents in several ways. First, since the financial industry is strongly regulated and many services require costly licenses, fintechs are forced to cooperate with banks to obtain regulatory infrastructure. Therefore, in many of our cases, banks operate in the background by providing white-label solutions for fintechs and enable their market entry. Second, the financial industry is characterized by highly sensitive business-to-consumer relationships. In particular, Germany is the classic example of a bank-based system that is well known for long-term relationships between banks and their clients. Banks are usually considered as trustworthy companies with great reputations. In line with this, we showed that fintechs are unknown companies and thus cooperate with banks to benefit from reputation spillover effects (company endorsement). This is underlined by the fact that fintechs and banks agree on a co-branding or white-label approach to generate a higher market acceptance for the fintech's products and hence increase profits. Lastly, several technical innovations that arose during the mid-2000s (e.g., smartphones, broadband Internet) led to the existence of fintechs and their new products. The financial industry was historically not faced with radical innovations. However, we showed that banks can cooperate with fintechs to generate synergistic effects and develop new products. Hence, fintechs do not inevitably lead to a disruption in the financial industry.

This generates a number of implications for practice. For entrepreneurs venturing into fintech, our findings indicate that bank cooperation can be an option to push business activities at different stages (e.g., before market entry, product/market expansion etc.). In this way, banks can be seen as enablers, accelerators and innovators for fintechs. For policy makers interested in facilitating strong fintech start-ups, this study can provide an impetus to bring banks and fintechs together, e.g. by hosting and supporting special events where these actors enter into dialogue. Furthermore, policy makers may encourage

fintech bank collaborations by passing certain laws. A good example in this context is the Payment Service Directive II, which encourages banks to provide application programming interfaces for fintechs that get access to client information. This may be a first step to build digital ecosystems with multiple banks and fintechs.

As this paper was concerned with proposition building rather than theory testing, a number of limitations to the results exist. First, we had a limited number of cases; hence, there will be a danger that the results are sensitive to specific case selection. However, our sample had a large number of variations (e.g., fintech product segment, fintech clients, and bank type), thus we argue that the findings of our study could be transferable. Second, we focused only on a single country (i.e., Germany). Thus, there is the danger of a country bias. Indeed, this focus allowed us to gain an in-depth understanding of fintechs in a country where the majority of banks seek to cooperate with fintechs (Dorfleitner *et al.*, 2017). Third, we mainly conducted interviews with fintech managers to receive in-depth insights from this perspective and abstract from the banks' perspective. Hence, there is a danger of overemphasizing positive effects and neglecting potential negative effects.

The findings and limitations suggest several possibilities for future research. First of all, the conceptual framework and propositions should be quantitatively tested and further refined. Second, it would also be interesting to use empirical data from other countries to test whether our results differ. For instance, fintechs may have other collaboration motives in countries with lax regulation (e.g., no regulatory infrastructure required) or higher competition (e.g., strong need for fast growth through access to clients). Next, as we mainly concentrate on positive cooperation aspects, future research may shed light on possible negative aspects (e.g., imbalance of power, corporate versus startup culture etc.). Last, studies enlarging the young field of fintech research would be welcomed, especially in the rising field of insurtechs.

3. Resource-based perspective of VC investments in fintech

3.1 Introduction

Fintech startups have attracted significant interest by VC funds in recent years, given their potential to reap large shares of financial activities in the future (Claessens *et al.*, 2018). As documented by Philippon (2016), they offer opportunities to reduce transaction costs in the financial industry, given that these costs have been rather constant over a long period. While some of these fintech startups may become significant players in the future, others will be sold to incumbent banks at high prices, making VC investments in fintech startups attractive today. In 2017, the total amount of VC funds invested in fintech startups has increased to $12.85 billion worldwide (KPMG, 2018). At the same time, VC firms have traditionally concentrated their activities in specific locations, such as Silicon Valley and Route 128 in the US. These geographic clusters have developed and attracted other human and corporate resources that helped attract further innovative startups in different industries over time, establishing vibrant ecosystems for innovative developments (Cumming and Johan, 2010; Collewaert and Manigart, 2016). In this paper, we study what drives VC investments in fintech. In particular, we adopt a research-based view and investigate which local industries and sectors have the function of important resource pools for fintech startups and thereby help regions to establish fintech ecosystems.

Following the resource-based view (Alvarez and Busenitz, 2001; Barney, 1991, 2001; Das and Teng, 2000), the management and entrepreneurship literature argues that opportunity recognition and development are shaped by the availability of resources to the firm. This is particularly important for entrepreneurial firms as these take on opportunities without having the needed resources available at the time when decisions on opportunity developments are made. Resource availability and access to resources are then important dimensions of competitive advantage over firms located in resource-scarce areas (Barney, 1991; West and Noel, 2009; van Auken, 2002). Fintech startups are likely to require a large range of different resources to develop and grow, starting from financing resources to human capital and access to financial and technological networks.

To analyze the success factors of VC fintech investments, we collect a large sample of 7,326 VC-backed fintech transactions in the US from 2003-2015, which we match with county-level information on local industries and sectors that proxy for local resource availability. We believe that the existence and strength of the specific sectors and

industries, represented by the number of establishments, may be important for the success of fintech startups and affect the ability of a county to produce fintech startups. In particular, we consider the following dimensions: VC investor base, business education sector, finance industry, wireless telecommunication industry, and software technology industry. We then construct a panel dataset that includes almost every county-year pair for 2,918 counties in the US from 2003 to 2015. In extended analyses, we also consider cross-sectional analyses of our VC transaction data to study the funding impact on individual VC-backed startups.

We find that the bulk of the VC-backed fintech investments is concentrated in a few counties, with San Francisco and New York as -by a large extent- the top 2 counties in terms of number of investments and overall transaction volume. These results are not surprising, since these counties are leading for VC investments in general. However, there is also a great variation in counties across the US for the rest of the fintech investments made. We exploit this variation to test our hypotheses on resource availability. In particular, our findings indicate that, on the one hand, the number of large financial firms, especially large banks, positively affects the number of VC investments in fintech. On the other hand, we find that the existence of software technology ecosystems has a positive impact on the number of VC investments in fintech. We argue that the financial and software technology industries can be considered as local pools of resources for fintech startups and are critical for their success. For instance, fintech startups may obtain finance knowhow through collaborations with large banks (Bömer and Maxin, 2018; Klus *et al.*, 2019) or attract skilled employees from local software technology companies (Lee and Shin, 2018) and large financial companies. Thus, fintech startups in these resource-rich counties have a competitive advantage over startups located in counties where large financial firms and software technology companies are missing. Against this background, we argue that the existence of large financial institutions (e.g., banks) and software technology companies is crucial to develop local fintech centers. This finding is consistent with our prediction based on the resource-based perspective. In cross-sectional analyses, we further find that fintech startups located in counties with a strong investor base receive ceteris paribus higher VC investments, indicating that VC firms have a preference for local firms (Coval and Moskowitz, 1999; Cumming and Dai, 2010). As robustness check, we perform similar analyses for other industries than fintech and find that in particular the proximity of financial institutions is specific to fintech. This distinction suggests that

specific resources are needed and that fintech clusters may develop in different areas than traditional VC clusters that require a different set of resources.

We contribute to several strands of literature. First, we contribute to the growing research area of fintech. Taking a global perspective, Haddad and Hornuf (2019) show that country-level factors such as technological development are helpful in generating fintech activities. Cumming and Schwienbacher (2018) find that fintech investments have proportionately moved more towards countries with smaller financial centers and thus weaker financial regulations. We add to this understanding by studying local factors that these studies have not considered. Gazel and Schwienbacher (2019) also study local factors using a sample of French fintechs, but their focus is not on VC investments. Second, we contribute to the understanding on how entrepreneurial clusters may develop, in particular, in the context of digitalization of industries. As argued by Autio (2017) and Autio *et al.* (2018), digitalization is likely to affect the way entrepreneurial opportunities emerge and are undertaken, both of which may potentially affect location and comparative benefits of local resources as a mean to recognize these opportunities. Gazel and Schwienbacher (2019) study cluster formation and find that incubators and accelerator programs are facilitating factors. To the best of our knowledge, there is no study so far on the impact of local resources on the development of VC fintech investments in the US. We construct detailed county-level measures for different sectors and industries to investigate their impact. And third, we contribute to the VC and entrepreneurial finance literature. This literature is very broad and has studied VC funds' investment behavior and VC-backed startups in other industries, with the exception of Cumming and Schwienbacher (2018) that analyze individual investments in fintech startups.

The remainder of the paper is structured as follows: after discussing the related literature and theory in Section 3.2, we present in Section 3.3 the data and method of the panel study. Next, we provide the regression results of our panel study in Section 3.4. In Section 3.5, we provide the results of additional analyses and robustness checks. The last section concludes the paper.

3.2 Literature and theory

3.2.1 Regional perspective on resources

At the core of strategic management is a firm's attempt to achieve a competitive advantage over other firms by using superior strategic resources. Following Barney's (1991)

resource-based view (RBV), resources include all assets, capabilities, organizational processes, firm attributes, information, and knowledge controlled by a firm. To generate a sustained competitive advantage, a firm's resources need to be valuable, rare, imperfectly imitable and non-substitutable. In addition, the classical formulation of the RBV is based on the assumption of imperfect resource mobility (Barney, 1991). This means that resources are non-tradable or at least less valuable to external firms that do not control the resources, and thus only the holder of a set of resources can generate a competitive advantage (Peteraf, 1993).

However, more recent research departs from the strict assumption of imperfect resource mobility. Several authors found evidence that resources of alliance partners transmitted via direct interactions have a positive impact on a firm's success (Lavie, 2007; Lin *et al.*, 2009). These resources can be conceptualized as "network resources" that are embedded in a firm's alliance network and influence its strategic behavior and performance by enabling new opportunities to the firm (Gulati, 1999; Gulati *et al.*, 2011; Huggins and Johnston, 2010). Furthermore, there is another strand of literature that deals with "regional resources" (Asheim and Coenen, 2005; John St and Pouder, 2006). This concept is closely linked to Porter's (1990) approach of business clusters as geographic concentrations of interconnected companies and focusses on the resource profiles given in certain regions, provided by different local firms and institutions. Similar to firms in the classic RBV, regions may have a competitive advantage over other regions when the combination of firms and institutions supplies a preferential and superior set of technological, physical, intangible, financial, organizational, and human resources (Steinle and Schiele, 2008; Collewaert and Manigart, 2016). For instance, if a region's unique experience and technological know-how in a certain industry passes through a vibrant local ecosystem from one firm to another, such that firms located there can generate outstanding performances, the region has a competitive advantage (John St and Pouder, 2006; Hervás-Oliver and Albors-Garrigós, 2007).

A region's ability to assert a competitive advantage over other regions by providing superior resources is particularly important to attract new ventures that foster the innovativeness, create new jobs, and promote regional welfare. The success of many new ventures from the high technology sector in certain US regions during the last decades (e.g. Silicon Valley, Route 128) has stimulated researchers and policy makers to investigate the characteristics and success factors of these startup ecosystems. For instance, Wiewel

and Hunter (1985) find that established local firms are crucial to supply resources for the genesis of new ventures from the same industry, while the absence of preexisting firms from the same industry hinder the emergence of these ventures. Accordingly, Friedman (1995) found that the local mix of firms and institutions able to supply potentially important resources to new ventures, positively affects the emergence of young and fast-growing firms in a region. In particular, US urbanized areas with a high industrial diversity, a major university, and local VC firms produce more successful ventures than other regions.

3.2.2 The role of VC funds in startup ecosystems

In line with Friedman (1995), a number of researchers emphasize the central role of VC firms in startup ecosystems. For instance, Zook (2002) argues that VC investing was extremely important for the expansion and concentration of Internet or dotcom startups in certain regions across the US. Even though VC firms are widely considered as financial intermediaries, they are at the same time vital providers of nonmonetary resources. By supplying support in the fields of operations, strategy, finance, and corporate governance, a VC firm's competencies are essential for a startup's success. In addition, if a VC firm lacks resources, it uses its network of partner VCs, corporates, banks, law firms, research institutes and other affiliations to make resources available (Manigart *et al.*, 2002; Lockett and Wright, 2001; Keil *et al.*, 2010; Verwaal *et al.*, 2010). For instance, some VC firms syndicate with corporate venture capitalists (CVC), which are connected through ownership to large corporates (e.g. Google, Cisco, IBM, Intel), to get access to their rich resource bases (Keil *et al.*, 2010), while other VC firms cooperate with local research institutes to obtain scientific knowledge (Powell *et al.*, 2002).

VC firms sit at the center of these networks and can be considered as architects that coordinate and accelerate the business processes of new ventures by bringing different institutions together to allocate the optimal mix of resources. At the same time, this means that VC firms are just one kind of institutions being essential for the development of vibrant startup ecosystems. For this reason, Florida and Smith Jr (1990) question the efficacy of those VC programs (e.g. governmental programs) that seek to stimulate high technology development by supplying capital to places that lack of pre-existing firms able to supply important resources to technology-orientated startups. They argue that VC is not the starting point of regional entrepreneurship, and thus, if someone simply puts venture capitalists in the middle of nowhere, the capital will either end up in non-competitive

local startups or will engender at Silicon Valley or Route 128. Indeed, Florida and Smith Jr (1993) found that VC predominantly flows toward regions with a high number of preexisting technology firms, industry-funded R&D at universities, and highly networked VC communities. In contrast, VC firms from regions with large financial resources but a lack of high technology companies export their capital to technology centers.

3.2.3 Determinants of fintech VC

Fintech startups have attracted significant interest by VC funds in recent years, given their capacity to reduce transaction costs in the financial industry and to reinvent many of the financial services (Philippon, 2016). However, prior research has not examined the spatial distribution of venture capital investments to fintech companies. An exception is the work by Cumming and Schwienbacher (2018), who find that investments in fintech companies are relatively more common in countries with weaker regulatory enforcement and without major financial centers. We expand this strand of literature by investigating local establishments as holder of resources that are important for the emergence of fintech startups. In this way, we attempt to identify the conditions that are essential to develop a regional fintech ecosystem.

As fintech companies lie at the intersection between software technology and financial services, we assume they need a certain set of resources from both worlds to be successful. First, in line with the argumentation above, a recent report by Ernst & Young (2016) argues that vibrant fintech ecosystems (e.g. London, Singapore, Hong Kong) are driven by well-established VC networks with competencies in the fields of finance and software technology. Teigland *et al.* (2018) argue that fintech is a segment where VC firms require a deep knowledge of a broad spectrum of technologies and services, as well as an advanced understanding of the current regulatory standards. Accordingly, Haddad and Hornuf (2019) found that countries with higher VC activity produce more fintech startups than countries with a low level of VC financing.

Second, just like other startups from emerging industries, fintech startups are in great need of specialized human capital (Teigland *et al.*, 2018), part of which may also be supplied by investors (Collewaert and Manigart, 2016). Apart from established financial and information technology companies, research institutions (e.g. universities) are the starting point for the next generation of fintech founders and employees. Brandl and Hornuf (2017) found that 92% of German fintech founders hold a degree from higher education

institutions. In particular, 55% of the German fintech founders hold a degree in business administration or a related field and 27% of the founders studied engineering or computer science. Recently, many leading research institutions have started offering different fintech classes, lecture series, and full degree programs. While some programs give a broad overview of the entire fintech industry and its segments, other programs concentrate more on technical aspects, such as Bitcoin, Blockchain, cryptocurrencies, and the data analytics behind it (Kursh and Gold, 2016). In addition, some universities even set up boot camps, hackathons, and incubation or accelerator programs. For instance, the Draper University, USA initiated in 2015 a fintech incubator program that exclusively promoted fintech innovations in co-working spaces and provided access to funds (Ernst & Young, 2016).

Third, although established financial institutions (e.g., banks, insurance companies) may be considered as main competitors of fintech startups (Lacasse *et al.*, 2016; Jakšič and Marinč, 2015), several authors emphasize that both would be better off cooperating rather than competing (Bömer and Maxin, 2018; Drasch *et al.*, 2018; Maxin, 2018; Temelkov, 2018). For instance, Maxin (2018) concentrates on Commerzbank's Main Incubator GmbH as the first Corporate Venture Capital unit of a German bank that directly invests in fintech startups and supplies nonmonetary support. Subsequently, Bömer and Maxin (2018) show that banks provide important resources to fintech companies through different forms of collaboration, such that they are able to enter the market, increase their profits, and develop new products. In this context, Hornuf *et al.* (2018) found that especially large and listed banks, digital banks, and banks with a digital strategy seek for fintech cooperation. These kinds of banks are particularly attractive for fintechs, since they provide a larger pool of resources than smaller and locally based financial companies. For instance, people who work for a large financial institution with a digital strategy can be considered as potential fintech employees, because they may have detailed knowledge about customer needs at age of digital banking and dispose over knowledge about the IT infrastructure of financial institutions. Accordingly, Brandl and Hornuf (2017) found that 28% percent of Germen fintech founders have previously worked for banks or insurance companies.

Fourth, the evolution of fintech companies is closely linked to several technological innovations during the last decade (Deutsche Bank Research, 2014). In particular, the emergence of wireless telecommunication in the form of broadband internet (4G, LTE) and

compatible devices, such as smartphones and pads with unlimited data payment plans has enabled the launch of many internet-based financial services, such as mobile banking, P2P payment, social trading, crowdfunding, robo-advising etc. (Seo and Park, 2018). Thus, the availability of the latest wireless telecommunication solutions is essential as it generates the opportunity for entrepreneurial firms to develop fintech solutions. On the other hand, a sound wireless telecommunication infrastructure is important for potential clients to use these applications. Indeed, on the country level, Haddad and Hornuf (2019) confirm that fintech startup formation is positively affected by the number of mobile telephone subscriptions and secured Internet servers.

Last, fintech companies are exploring the latest technology to develop superior products, such as artificial intelligence, big data analytics, and Blockchain. To keep pace with competitors in the process of technology implementation, fintech startups form strategic alliances and business relations with software technology developers to get access to their large pools of talents and know how. In this way, fintechs often source out parts of the software development process to concentrate on strategic tasks (Lee and Shin, 2018). In addition, fintech companies collaborate with leading information technology companies to dispose their products to a high number of clients and to set a standard in the market. A prominent example is Ripple, a Blockchain startup from San Francisco that recently entered into a partnership with the local incumbent Google to implement its payment technology in the Google Pay service. Analogous to financial institutions, people who work for leading software companies are attractive employees for fintech startups, since they have detailed programming expertise (e.g., Java, Python, Ruby, C++).

Against this background, we consider the existence of the following regional industries and sectors as potentially important resource providers for fintech startups, which could positively affect the willingness of VC investors to invest in local fintech startups: VC investor base, business education sector, financial industry, wireless telecommunication industry, and software technology industry.

3.3 Data and method

The data source for our dependent variable is the Thomson Reuters Eikon database, which contains detailed information on the financing of fintech startups in the US. For our analysis, we consider VC transactions in fintech companies starting on 1/1/2003. Because other databases we use to construct our county-level explanatory variables publish their

data with significant delay, the observation period in our sample ends on 12/31/2015. To ensure that we only focus on true fintech companies, we identify keywords in the company business description provided in the database. Since fintech is a portmanteau word that is made up of "finance" and "technology", we first search for technology-specific words (e.g., internet, software, digital platform) where the "Company VE Primary Industry Sub-Group 1" is "Financial Services". We include in our database all transactions that meet these criteria. Secondly, we search for finance related words (e.g., crowdfunding, bitcoin, micropayment) where the "Company VE Primary Industry Sub-Group 1" is "Computer Software", "Internet Specific", "Business Serv.", "Computer Hardware", and "Computer Other". We then append these additionally identified transactions to the database. Thirdly, we include all companies from certain sub-groups (e.g., Banks/Financial Institutions Software, Computerized Billing & Accounting Services). A manual check on a selected number of companies confirms our classification. We obtain a final sample of 7,326 transactions and 28.1 billion USD invested in 1,135 fintech startups.

Our dependent variable, the number of *Fintech VC transactions*, is a non-negative count variable that arises from counting the number of transactions made in a given year and county. This yields a panel data structure for which we obtain a value for each US county and year. According to Long and Freese (2001, p. 223), the OLS method for count data often "result[s] in inefficient, inconsistent, and biased estimates". Other regression models are specifically designed for count variables and provide more reliable results (e.g. Poisson regression, negative binominal regression). In our study, the overall variance of VC transactions in fintech startups is many times larger than its mean. This indicates that the unconditional variance of our dependent variable suffers from over-dispersion. In this case, a negative binomial regression model is more appropriate than a Poisson model as it solves the problem of over-dispersion by adding a parameter that reflects the unobserved heterogeneity among observations (Long and Freese, 2001).

In particular, we use a random effects negative binomial (RENB) regression model for our panel analysis. This model has been developed to account for the non-independence of events in longitudinal data (Long and Freese, 2001), which allows us to remove time-invariant heterogeneity from fintech VC financing in startup clusters, such as New York and Silicon Valley (Haddad and Hornuf, 2019). We did not run a fixed effects model due to concerns about its robustness in a negative binomial regression setting (York and Lenox, 2014). Following Allison and Waterman (2002), the fixed effects negative binomial

model is not considered as a true fixed effects model, since it does not control for all stable covariates.

For our independent variables, we use different databases to construct our set of county-year variables to identify the local establishments and industries that provide important resources for fintech startups and encourage fintech VC activities in the US. Our main data source is the County Business Pattern database that provides county-specific economic data by industry. The data series is yearly published by the U.S. Census Bureau and includes, for instance, the number of establishments and employees for a given NAICS code. In particular, we consider five groups of explanatory variables: business education sector, investor base, finance industry, wireless telecommunication industry, and software technology industry.

First, we include the total number of *Funds founded*, *Software funds founded*, and *Bank funds founded* from the Thomson Reuters Eikon database to measure whether a county has a sound investor base with competencies in finance and information technology. To rule out endogeneity problems, we employ a lag of three years for all investor variables. Second, to measure the level of business education, we take the number of *Colleges and universities* (NAICS 611310), the number of establishments in *Computer education* (NAICS 611420), and number of establishments in *Management education* (NAICS 611430). Third, we account for the presence of a well-developed financial industry by including the number of *Large financial companies* (NAICS 52----) with more than 100 employees and the number of *Large banks* (NAICS 522///) with more than 100 employees. Fourth, we use the number of *Wireless telecommunications companies* (NAICS 517210) to capture the access to wireless technology in a county. Last, to test whether the presence of a large software industry positively affects the fintech VC activity, we consider as proxy the number of *Software technology companies*. This includes data processing, hosting, and related services companies (NAICS 518210), internet publishing and broadcasting and web search portals (NAICS 519130), and software publishers (NAICS 511210). As alternative proxy, we also consider below the number of *Data processing companies* (NAICS 518210) only. All the data for the last four groups of explanatory variables are retrieved from County Business Pattern database.

Next, we include several control variables. To control for the overall VC activity in a county, we include all *Other VC transactions* from the Thomson Reuters Eikon database

excluding the VC transactions in fintech startups, which we used to construct our dependent variable. We also consider the variable *Population* to measure the size of a county. The variable comes from the U.S. Bureau of Economic Analysis. To control for the welfare of a county, we include the *Income per capita* as the sum of the personal income (thousands of dollars) in a county over the county population. Both numbers are retrieved from the U.S. Bureau of Economic Analysis. Furthermore, we use the *Unemployment rate* from the U.S. Local Area Unemployment Statistics as another indicator for the county's welfare. To capture the innovation capacity of a county, we include the number of *Patents,* which comes from the U.S. Patent and Trademark Office. All the variables are defined in Table A.1 (Appendix).

Once all the data is obtained, we collapse all the values into a mostly balanced panel dataset that consists of 37,885 observations, given our 13-year observation period from 2003 to 2015 covering 2,918 US counties.

3.4 Results

3.4.1. Summary statistics

Figures 3.1 and 3.2 present the evolution of VC investments in fintech startups from 2003 to 2015 in number of investments and in dollar volume. It shows an increasing trend over time, especially in the most recent years when many new technologies have emerged (Gazel and Schwienbacher, 2019). Contrasting the two figures, one can however see that the growth is stronger in terms of volume than in the number of investments, which indicates that VC funds have especially increased the amount invested in individual fintech startups. A possible reason is that some of the technologies have matured so that VC funds increasingly invest in expansion and later stages when the funds needed are significantly larger than for early stage.

Table 3.1 shows summary statistics for the full sample (panel data) and the subsamples of counties with and without fintech transactions. Overall, there are 37,885 county-year observations for the considered period. On average for the full sample, there are 0.19 transactions per county per year, suggesting there are only very few taking place. Moreover, the median value is 0, meaning that most of the counties do not observe any fintech transactions.

However, there is significant variation across counties (with a maximum of 285), as suggesting by the level of the standard deviation and the maximum value of our sample.

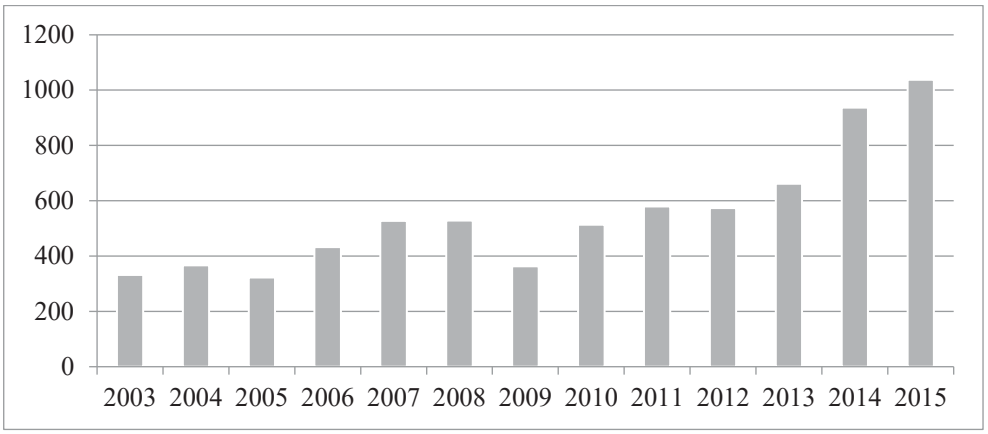


Figure 3.1 Number of fintech VC transactions.

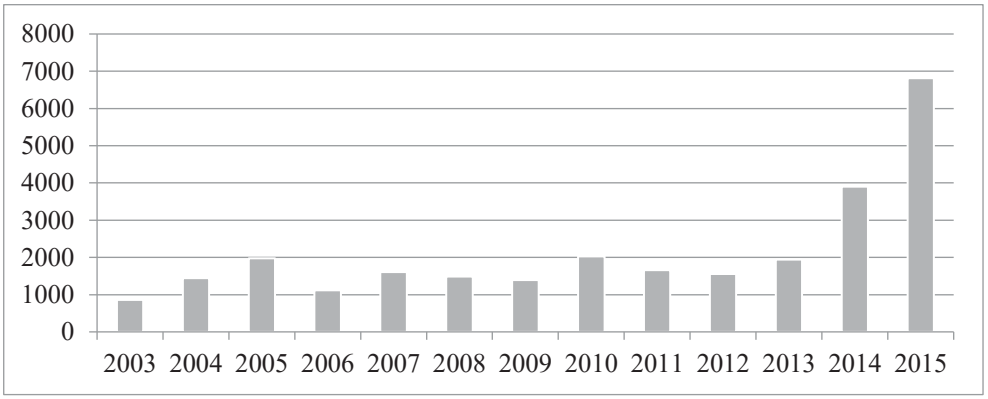


Figure 3.2 Volume of fintech VC transactions [Mil. USD].

Appendix Table A.7 shows that, while the top 5 counties account for the large fraction of transactions, many more counties do also attract some fintech investments during the period considered. Still, large fractions of deals are concentrated in a very few counties, consistent with findings on fintech clusters elsewhere (Gazel and Schwienbacher, 2019).

When considering the subsamples of year-county observations with some fintech activities (i.e., *Fintech VC transactions* > 0), we obtain that in these counties there are on average 3.27 transactions per year, amounting to a volume of 0.14 million USD per capita. In terms of differences for the resources available at the county level, we find significant differences that are in line with our predictions on the relevance of local resources.

We find differences for all types, although this high level of statistical significance may be driven by the size of the sample. Not all of these differences will remain statistically significant at the multivariate level, which we show in the next sub-section. Table A.2 (Appendix) shows summary statistics for the same variables after their natural log transformation.

Table 3.1 Summary statistics for panel regressions.

This table presents summary statistics of variables used in the negative binominal panel regressions on the county level. Statistics are shown for the full sample of 2,918 counties, the subsample of counties that witness at least one VC transaction in a fintech company from 01/01/2003 to 01/31/ 2015, and the subsample of counties that do not witness any VC transaction in a fintech company for the considered period. All the variables are defined in Table A.1. The table also reports p-values of differences in mean tests for the two subsamples.

Variables	Full sample								Fintech	No fintech	Fintech vs. no fintech
	Obs.	Mean	Min (overall)	Max (overall)	75th percentile	Std. Dev. (overall)	Std. Dev. (between)	Std. Dev. (within)	Mean	Mean	p-value
Dependent variable											
Number of fintech VC transactions	37885	0.19	0	285	0	3.33	2.69	1.97	3.27	0	--
Business education sector											
Colleges and universities	37885	1.39	0	195	1	6.21	6.11	1.11	14.61	0.56	0.0000
Computer education	37885	0.68	0	89	0	3.02	2.90	0.83	8.12	0.21	0.0000
Management education	37885	1.85	0	177	1	7.69	7.54	1.53	20.80	0.66	0.0000
Investor base											
L3.Funds founded	37885	0.18	0	179	0	2.42	2.18	1.05	2.85	0.01	0.0000
L3.Software funds founded	37885	0.03	0	37	0	0.44	0.34	0.27	0.45	0.01	0.0000
L3.Bank funds founded	37885	0.01	0	44	0	0.37	0.29	0.23	0.20	0.001	0.0000
Finance industry											
Large financial companies	37885	2.69	0	504	0	15.43	15.35	1.50	35.05	0.67	0.0000
Large banks	37885	1.16	0	150	0	5.97	5.88	0.99	14.33	0.34	0.0000
Wireless telecommunication industry											
Wireless telecommunication companies	37885	4.06	0	380	3	13.53	13.34	2.26	36.99	1.99	0.0000
Software technology industry											
Software technology companies	37885	9.29	0	1357	2	46.44	45.79	7.70	115.31	2.65	0.0000
Data processing companies	37885	4.76	0	535	2	20.86	20.63	3.00	55.75	1.56	0.0000
Control variables											
Other VC transactions	37885	4.16	0	2157	0	51.16	48.59	15.95	66.18	0.27	0.0000
Population	37885	104510.9	610	10112255	73307	323395.3	322968.4	14186.62	820230.40	59640.45	0.0000
Income per capita	37885	33.73	11.75	199.81	37.8	10.12	8.62	5.35	47.12	32.88	0.0000
Unemployment rate	37885	6.73	1.1	28.90	8.3	2.79	2.07	1.88	6.09	6.76	0.0000
Patents	37885	35.16	0	14847	8	247.77	236.54	73.38	410.65	11.63	0.0000

We show these statistics too, since most of our variables are log-transformed in our regression analysis to account for the skewed distribution of these variables that arise from large differences in the county size. As one can see, all resource-based variables for the fintech subsample remain statistically larger than in the no-fintech subsample.

Furthermore, Table A.3 (Appendix) presents correlations between our main variables. Many of them are very high, suggesting multicollinearity concerns. However, below we will report the variance inflation factors (VIF) for all our regressions. These suggest no major multicollinearity problem. Besides this econometric issue, it is not that surprising to see high correlations for county-level data for which there is limited variation over time; our variation stems between county and less within counties. We use panel data regressions to control for the particular structure of our data.

3.4.2. County-level determinants of fintech VC

We now turn to our multivariate analysis, using negative binomial panel regressions with random effects as estimation methodology. As dependent variable, we use the number of *Fintech VC transactions* as proxy for the ability of a county to produce successful fintech startups. We present different specifications that combine our resource-based variables to show robustness of our results.

All the specifications include several control variables. We include certain county-level factors to control for differences across US counties. In this way, we control for the average wealth, the size of the county, the innovation capacity, and the overall supply of VC. Furthermore, we include year dummies to control for any remaining, unobserved time-varying factors affecting all US counties.

Results are provided in Table 3.2 for the five different resource dimensions. Various resources do not seem to matter. These include resource availability in terms of business education (regardless whether computer or management education, or even colleges and universities in general), the size of VC investor base, and the presence of telecommunication companies. On the other hand, we find strong evidence on the importance of a large financial industry and software technology industry presence. In particular, results indicate that *Large banks* and *Data processing companies* are important. The fact that these two resource providers are paramount is consistent with the notion that “fintech” combines “finance” and “technology”.

Table 3.2 Drivers of VC investments in fintech companies.

The table reports the results of negative binominal panel regressions with random effects on the number of VC transactions in fintech companies on county level in the US during the period 2003-2015. All variables are defined in Table A.1. To account for the skewness of the independent variables, we applied ln transformation to normalize the data. ***, **, * denote significance at the 0.1, 1 and 5 percent level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Business education sector:							
Ln(Colleges and universities +1)	-0.187			-0.167	-0.170	-0.150	-0.139
Ln(Computer education+1)		-0.105					
Ln(Management education+1)			-0.0179				
Investor base:							
Ln(L3.Funds founded+1)	0.0596	0.0476	0.0435			0.0608	0.0688
Ln(L3.Software funds founded+1)				-0.0347			
Ln(L3.Bank funds founded+1)					0.0199		
Finance industry:							
Ln(Large financial companies+1)	0.398***	0.373***	0.367***	0.397***	0.400***		0.408***
Ln(Large banks+1)						0.281***	
Telecommunication industry:							
Ln(Wireless telecommunication comp.+1)	-0.168	-0.185	-0.196	-0.173	-0.175	-0.127	-0.0824
Software technology industry:							
Ln(Software technology comp.+1)	1.198***	1.198***	1.163***	1.209***	1.200***	1.238***	
Ln(Data processing companies +1)							0.752***
Control variables:							
Ln(Other VC transactions+1)	0.384***	0.379***	0.377***	0.401***	0.398***	0.394***	0.477***
Ln(Population)	-0.0524	-0.112	-0.118	-0.0678	-0.0564	-0.00206	0.0974
Income per capita	0.00318	0.00304	0.00332	0.00358	0.00341	0.00492	0.00752*
Unemployment rate	0.00869	0.00284	0.00377	0.0112	0.00951	0.0163	-0.00375
Ln(Patents+1)	-0.0163	0.0140	0.0162	-0.0115	-0.0143	-0.0313	0.130*
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-7.539***	-6.863***	-6.790***	-7.373***	-7.491***	-8.055***	-8.673***
Wald χ^2	2516.10	2561.03	2585.20	2533.94	2548.27	2589.54	2576.25
Prob. > χ^2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Observations	37885	37885	37885	37885	37885	37885	37885
Max VIF	7.05	7.21	7.62	7.05	7.05	6.91	6.21
Mean VIF	3.93	3.97	4.09	3.81	3.75	3.79	3.83

The proximity to a large financial industry is helpful in hiring key employee specialized in finance and to facilitate collaboration with large banks (Hornuf *et al.*, 2018). Similarly, given the strong tech component of the products and services developed by fintech startups, the latter gain from the proximity of other, more established software technology companies through access to skilled labor and technological collaborations.

While our results indicate no significant multicollinearity concerns in view of the low VIF values reported at the bottom of Table 3.2 (all means below 4, all maximum values below 8), an open question is whether some of the factors considered are significant when considered in isolation. Indeed, proper analysis requires estimating the different factors jointly, since there might be confounding effects. For instance, counties with a well-developed software technology industry will often have an active VC market, since VC funds contributed in part to the development of the software industry. The approach adopted in Table 3.2 controls for such confounding effects. We nevertheless show in Table A.4 (Appendix) the outcome when estimating each factor in isolation. Then, our two resources identified as critical in Table 3.2 remain highly significant, but others also appear to be important. In particular, the presence of educational institutions and telecommunication industry also turns out to be important drivers. Interestingly, the size of investor base is not. Overall, these differences highlight the importance of testing the different resource factors jointly and the stability of results obtained in Table 3.2.

3.5 Additional analyses

We also conducted cross-sectional analyses to provide further insights into our panel data findings. More specifically, an interesting question is whether the increased volumes observed at the county level can be explained by more VC investments in fintech startups or larger amounts invested in the selected fintech startups. To shed light into this open question, we consider each VC transaction as unit of observation and investigate which resource-based factors affect the amount invested in each fintech startup. As mentioned in Section 3, our sample contains 7,326 VC investments, for which we match our resource-based variables and control variables. We are able to obtain a full information for 6,650 investments where several transaction specific control variables exist. Summary statistics are reported in Table A.5 and a correlation matrix in Table A.6 (Appendix).

The average VC investment involves 4.02 million USD. The median round number is 3 (mean of 3.52), suggesting that our sample is composed to early-stage but also expansion-

and later-stage rounds. This is further consistent with the observed mean age of startups of about 6 years (72.26 months) and deals involving, on average, four VC funds.

Our cross-sectional results are shown in Table 3.3. We find that none of the local resources affect the investment amount, after controlling for other factors that may have an impact on the invested amount (e.g., transaction-specific factors such as stage of development, startup age, financing round, and syndication). The only exception is the size of the investor base. While its significance reduces to the 5% level when again testing several factors jointly (Models (6)) in order to eliminate confounding effects among the different resources, the effect of the size of the investor base is still significant at a commonly accepted level. Also, in Models (6), the maximum VIF values are slightly above 10, however, these high values are not due to our resource factors directly. Overall, we conclude that the presence of a strong investor base significantly affects the amount invested in fintech startups by VC funds. This finding is line with other studies that show that VC investors tend to prefer local investments and invest more in local startups, since these projects can, inter alia, better be monitored (Coval and Moskowitz, 1999).

As final analysis, we explore whether the same resources affect other industries than fintech. Doing so will allow us to determine whether some of the resources identified as being relevant are also specific to fintech. If this is the case, we might expect fintech clusters to emerge in different areas than other clusters funded by VC. To this end, we replicate the analysis done in Table 3.2 for the following alternative industries: manufacturing, agriculture/forestry/fisheries, biotechnology, communication, computer software, and Internet-specific. Results are provided in Table 3.4, including fintech in Model (1) for comparison purposes. While some of the resources are key to other industries studied here (e.g., software technology companies for all other high-tech industries), the presence of large financial institutions is a unique resource to fintech.

Thus, fintech startups may not compete with VC-funded startups of other industries for business ties with financial institutions, but at the same time it may lead fintech startups to locate in different areas (here US counties) than these other VC-funded startups. While the Silicon Valley remains the main area also for fintech (see Appendix Table A.7), larger differences may appear over time in other areas as fintech ecosystems mature.

Table 3.3 Drivers of VC transaction amount in fintech startups.

The table reports the results of the pooled cross sectional OLS regressions on the amount of VC transactions [USD Mil] on the firm level in the US during the period 2003-2015. All variables are defined in Table 1.We include transaction-related control variables. ***, **, * denote significance at the 0.1, 1 and 5 percent level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)
Business education sector:						
Ln(Colleges and universities+1)	0.867					-0.281
Investor base:						
Ln(L3.Funds founded+1)		0.879***				0.697*
Finance industry:						
Ln(Large financial companies+1)			0.935**			0.332
Telecommunication industry:						
Ln(Wireless telecommunication comp.+1)				1.376		0.998
Software technology industry:						
Ln(Software technology comp.+1)					1.526**	0.737
Transaction control variables:						
Age at financing in month	0.00577*	0.00623**	0.00594**	0.00571*	0.00631**	0.00679**
Round number	0.284***	0.282***	0.277***	0.268***	0.282***	0.277***
No. of funds at investment date	-0.288**	-0.247***	-0.217**	-0.213**	-0.251***	-0.248**
County control variables:						
Ln(Population)	0.588	1.231*	0.243	0.170	0.370	-0.422
Income per capita	-0.0111	-0.0286**	-0.0236*	-0.00735	-0.0237*	-0.0445**
Unemployment rate	-0.510**	-0.522**	-0.397*	-0.440*	-0.327	-0.376
Ln(Patents+1)	-0.628**	-1.019***	-0.359	-0.708***	-1.100***	-0.971**
Company investment stage dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-2.215	-7.692	-0.399	0.481	-2.343	7.021
F-Statistic	13.60	13.53	13.60	13.71	13.62	13.86
Prob. > F	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Observations	6690	6690	6690	6690	6690	6690
Max VIF	6.66	2.68	5.29	5.32	6.21	10.88
Mean VIF	2.72	1.65	2.60	2.37	3.07	4.02

Table 3.4 Drivers of VC investments in companies from various industries.

The table reports the results of negative binominal panel regressions with random effects on the number of VC transactions in companies from various industries on county level in the US during the period 2003-2015. All variables are defined in Table A.1. To account for the skewness of the independent variables, we applied ln transformation to normalize the data. ***, **, * denote significance at the 0.1, 1 and 5 percent level, respectively.

	Fintech	Manufacturing	Agriculture, Forestry and Fisheries	Biotechnology	Utilities	Computer Soft-ware	Internet Specific
Business education sector:							
Ln(Colleges and universities +1)	-0.187	0.0769	0.126	-0.124	-0.629	-0.0748	0.0569
Investor base:							
Ln(L3.Funds founded+1)	0.0596	0.145	-0.365	-0.0335	-0.397	0.0238	0.0256
Finance industry:							
Ln(Large financial companies+1)	0.398***	0.367*	-0.0049	-0.0229	1.135**	0.0237	-0.0437
Telecommunication industry:							
Ln(Wireless telecommunication comp.+1)	-0.168	-0.0044	-0.195	-0.0829	0.423	-0.0267	-0.171*
Software technology industry:							
Ln(Software technology comp.+1)	1.198***	-0.214	0.329	0.379***	0102	1.0715***	1.0855***
Control variables:							
Ln(Other VC transactions+1)	0.384***	0.151	0.422*	0.340***	-0.0729	0.391***	0.437***
Ln(Population)	-0.0524	0.679**	0.785	0.264*	-0.0858	-0.0106	0.199*
Income per capita	0.00318	-0.0104	0.0315*	-0.0135**	-0.0254	-0.000824	0.00626*
Unemployment rate	0.00869	-0.107	-0.119	-0.0634**	0.0443	-0.0328*	0.000631
Ln(Patents+1)	-0.0163	0.181	-0.183	0.574***	0.398	0.146**	-0.0106
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-7.539***	-11.72***	-14.41***	-7.78***	-7.74***	-5.56***	-8.764***
Wald χ^2	2516.10	487.80	148.67	1338.81	1836.00	5061.15	4843.25
Prob. > χ^2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Observations	37885	37885	37885	37885	37885	37885	37885
Max VIF	7.05	7.06	7.05	7.05	7.04	7.00	7.02
Mean VIF	3.93	3.94	3.94	3.72	3.71	3.74	3.73

3.6 Conclusion

In this study, we adopt a resource-based view to investigate the local factors that increase the ability of a region to produce successful fintech startups and become a fintech center. We make use of county-level data for 2,918 US counties to obtain variation in resource availability. We then test our hypotheses using a sample of over 7,300 VC investments made in the US from 2003-2015. We find that the existence of large financial firms (e.g., large banks) and software technology firms has a positive impact on the number of successful fintech startups at the county level, while education, telecommunication, and investor base do not. These findings are consistent with the fact that fintech combines, by definition, finance and (software) technology, and thus requires resources from both sides. Our study complements others done at the country-level that focused on macroeconomic and regulatory factors (Haddad and Hornuf, 2019; Cumming and Schwienbacher, 2018). Furthermore, we find in cross-sectional analysis that the presence of a strong investor base in a county positively affects the amount invested in fintech startups by VC funds. This finding is in line with other research that argue that VC investors tend to prefer local investments (Coval and Moskowitz, 1999).

This study generates several implications for practice. For policy makers interested in facilitating the development of a local fintech community, our study highlights the type of local resources that are helpful in achieving this objective. Perhaps most surprisingly, investor base is not one of them, although many authors emphasize the proximity of investors and start-ups (Fritsch and Schilder, 2012; Cumming and Dai, 2010). Rather, resources closest to "fintech" are important, i.e., important financial players and a strong software technology industry. These resources will help VC-backed fintech startups to acquire needed resources and ultimately to develop and grow. Thus, it is important for policy makers to support existing industries as they are relevant for the emergence of (fintech) startups (Wiewel and Hunter, 1985). For entrepreneurs venturing into fintech, our results indicate that the amount they can raise from VC funds is affected by other resources available in the location they have chosen. Although VC firms do not appear to have a direct impact on the development of local fintech ecosystems, the results show that the choice of a location with a strong VC investor base positively affects the investment size.

Naturally, this paper has some limitations and there is room for future research. For instance, this paper is limited to the USA as it is the most active market. However, it would

be interesting to investigate which factors are decisive in other countries for the development of fintech centers (e.g., countries without highly developed finance and software industries). In this context, for example, a qualitative approach could be used to investigate how successful fintech startups are created without links to established industries. Furthermore, our sample consists of fintech startups that are backed by venture capitalists, since this type of investors prefers investments in companies with a high growth potential. Thus, venture capital can be considered as quality signal. However, we do not take other forms of funding (e.g., initial coin offerings) into account, since our database is limited to venture capital investments. Future research may consider more investment instruments to provide a wider picture of the emergence of fintech ecosystems. Another open question is whether resource-rich areas "attract" existing or rather "make emerge" fintech firms. In other words, do entrepreneurs with fintech projects decide to locate in resource-rich areas, or are resource-rich areas promoting the emergence of local fintech initiatives? Future research may develop hypotheses that helps to disentangle these two effects.

4. The impact of national regulation on cryptocurrencies

4.1 Introduction

Cryptocurrencies have gained momentum during the last years, while there is a controversial discussion about this new phenomenon. On the one hand, it is considered as technological opportunity to conduct secure transactions without central party and as an uncomplicated way to raise funds through initial coin offerings (Deng *et al.*, 2018). On the other hand, cryptocurrencies can be used for illegal activities, such as money laundering, drug dealing, or terror financing. In addition, policy makers are concerned about consequences for monetary policy and the lack of investor protection regarding the high number of fraudulent ICOs and pyramid payment schemes (Klöhn *et al.*, 2018). For this reason, many national authorities around the world have taken actions to regulate cryptocurrencies (Kaal, 2018). But as cryptocurrencies are in general considered as borderless and not being backed by registered firms that constitute legal entities, there are concerns whether regulation can be effective (Cumming *et al.*, 2019).

Despite these arguments put forward against the effectiveness of national regulation, Auer and Claessens (2018) find that some categories of regulatory news events have a significant impact on the valuation of the eight most prominent cryptocurrencies. For instance, their results indicate that regulatory news on general bans of cryptocurrencies and their treatment under security law have a negative effect on the valuation, while publications on specific legal frameworks for cryptocurrencies lead to a positive market response. Furthermore, Shanaev *et al.* (2020) find for a large dataset of cryptocurrencies that tighter regulation and a more active role of authorities decrease cryptocurrency prices, while the relaxation of policy measures and the declaration of self-regulatory and hands-off approaches lead to a positive investor reaction. In this context, Koenraadt and Leung (2019) state that the negative market reaction to regulatory events is less pronounced for cryptocurrencies with higher expert ratings and more social media presence.

One explanation why national regulation is perceived as effective by the markets might be that many cryptocurrency promoters in fact chose specific countries with favorable jurisdictions and disclose the legal home of their firms in whitepapers or on homepages which is recognized by investors (Johnson and Yi, 2019; Adhami *et al.*, 2018). Given the fact that national regulation is intended to serve national interests (e.g., market confidence, financial stability, investor protection) by regulating market participants that

operate under the local jurisdiction, an unanswered question is whether its impact is limited to local cryptocurrencies? Apart from that, national regulation could unintentionally affect cryptocurrencies regulated under foreign jurisdictions due to several mechanisms. Although a few studies find a significant impact for regulatory events in general, it is still unclear whether their results are driven by domestic or spillover effects. I add to this new strand of literature by disentangling these two effects and by investigating the scope of national regulation on the valuation of cryptocurrencies using a unique dataset that takes the jurisdiction of cryptocurrency firms into account.

To provide empirical evidence on this issue, this paper analyzes the market reactions to regulatory news events. I apply an event study approach similar to Auer and Claessens (2018) and Shanaev *et al.* (2020) using a random effects panel model. Regulation news are gathered from coindesk.com and one can differentiate five categories of regulatory news events, namely legal status, interoperability, exchange, violation, and warning. Furthermore, this study uses price data from coinmarketcap.com and I check for each cryptocurrency whether information on the legal affiliation is available. The final dataset consists of 140 regulatory news events and 521 cryptocurrencies for which the company and its jurisdiction are known. The results indicate a strong market reaction to local regulatory news from certain categories (*legal status, interoperability, exchange, violation*). Although the effects are weaker, I also find a significant market response for foreign regulatory news events from the categories *legal status, interoperability, and exchange*. The results are robust when a fixed effects regressions model is applied. Based on these findings, it can be concluded that cryptocurrency markets are interconnected, since cross-border effects take place. It can further be concluded that the market response does not necessarily depend on whether regulation has a legal binding impact, indicating that there must be other explanatory approaches.

This paper contributes to the growing research of cryptocurrencies. In particular, it contributes to the new strand of literature that investigates the effectiveness of national cryptocurrency regulation (Auer and Claessens, 2018; Koenraadt and Leung, 2019; Shanaev *et al.*, 2020). The study confirms that markets perceive national regulation as effective, while there is almost no difference where the news come from. In addition, the paper adds to the literature that deals with diversification strategies of cryptocurrency investments (Antonakakis *et al.*, 2019; Borri and Shakhnov, 2019; da Gama Silva *et al.*, 2019; Fry and Cheah, 2016; Huynh, 2019; Koutmos, 2018). It shows that regulatory news events have

an impact for the entire market that makes it difficult for investors to hedge regulatory risks. Furthermore, the paper contributes to the broad literature examining the investor reactions to new financial regulation. Normally, scholars investigate the market response of new regulation standards for asset classes that are already subject to regulation. In contrast, this paper studies the reaction for a new asset class for which the markets are still immature and lack of consistent regulatory standards (Koenraadt and Leung, 2019).

The remainder of the paper is structured as follows: after developing testable hypothesis in Section 4.2, I present in Section 4.3 the data and method for the event study. Next, regression results of this study panel are provided in Section 4.4. Last, Section 4.5 concludes the paper.

4.2 Hypothesis development

A cryptocurrency is a digital asset created to serve as a medium of exchange that is based on sophisticated cryptography algorithms to secure financial transactions. In contrast to central banking systems, cryptocurrencies are characterized by a decentralized control system enabled through distributed ledger technology, such as Blockchain (Hughes *et al.*, 2019). Cryptocurrencies have gained much attention due to their astronomical price swings, most notably at the end of 2017 when the Bitcoin price hit all time high just below 20,000 USD. Furthermore, cryptocurrencies offer startup companies a new and uncomplicated way to raise funds through ICOs, where investors can buy cryptocurrencies that act as a kind of voucher and may be traded for some resources or special features of the startup company in the future (Howell *et al.*, 2018). ICOs allow companies to reduce disclosure and compliance costs compared to traditional funding through venture capital, debt financing, and initial public offerings (Boreiko and Sahdev, 2018; Pietrewicz, 2018). According to ICObench, the number of listed ICOs increased from 1,349 in 2017 to 3,804 in 2018, replacing traditional Venture Capital as the main source of funding for Blockchain-based startups. However, the fast growing industry has also attracted bad players. This becomes particularly clear with respect to the high number of ICOs that are considered as scams where issuers never had the intention to set up a working business model behind the cryptocurrency. According to a study of the Statis Group, 78 percent of the ICOs conducted in 2017 are considered as deception. Furthermore, bad actors attempt to make a profit by fraudulent price manipulations in the form of cryptocurrency pump-and-dump schemes (Kamps and Kleinberg, 2018; Li *et al.*, 2019).

The growing supply and demand of cryptocurrencies paired with fraudulent actions has raised concerns and led to an increased willingness of financial authorities around the world to take regulatory steps. Basically, the objectives of cryptocurrency regulation are similar to the regulation of other asset classes: ensuring confidence in the financial markets, contributing to the protection and enhancement of stability of the financial system, and securing consumers and investors against fraud and other abuses (Auer and Claessens, 2018). To reach these goals, authorities use different approaches. Predominantly, authorities publish notes on the legal status of cryptocurrencies (Kaal, 2018). Furthermore, national authorities regulate local cryptocurrency exchanges, release trading and listing rules, publish warnings, or take enforcement actions against market participants. See Section 4.2 for a detailed classification of regulatory news.

However, there are concerns whether national regulation of cryptocurrencies can be effective, since cryptocurrencies have some unique features that may hinder regulation. Cryptocurrencies are traded internationally on different exchanges and their protocols often have security solutions that maintain anonymity by blurring the lines between physical, legal, and digital persons and entities (Shanaev *et al.*, 2020). Since many cryptocurrencies operate neither registered with a regulatory authority nor backed by a visible legal entity, they are considered as exterritorial and borderless in nature (McGill *et al.*, 2018; Auer and Claessens, 2018). One prominent example is the Decentralized Autonomous Organization (DAO), a form of an investor-directed venture capital fund that became one of the most successful crowdfunding campaigns as it raised over 150 million USD through a coin offering in June 2016 (Klöhn *et al.*, 2018). The DAO, which was financed by global equity investors via a cryptocurrency called Ether, was not registered as a legal entity in any jurisdiction and had no employees (Cumming *et al.*, 2019). This raises questions of how regulators would deal with this new asset class.

Other arguments indicate that national regulation of cryptocurrencies may be effective, at least for some cryptocurrencies. As mentioned previously, a major argument against national regulation is that cryptocurrencies do not have formal homes, suggesting that they operate out of the reach of national jurisdictions (Cumming *et al.*, 2019; Auer and Claessens, 2018; McGill *et al.*, 2018). In fact, this holds true for many cryptocurrencies, including some of the most prominent digital currencies, such as Bitcoin and Litecoin. In contrast, many issuers of cryptocurrencies chose specific countries with favorable jurisdictions for their offering (see Figure 4). For instance, the promoters of Ethereum network

decided to launch the Ether token in Switzerland due to the principle-based regulatory approach towards Blockchain technology. More recently, Libra association also has chosen Switzerland as headquarter with the ambition to become regulated by the Swiss Financial Market Supervisory Authority (FINMA). Apart from Switzerland, other countries (e.g., Estonia, Gibraltar, Singapore) developed as early adopters of Blockchain technology specific legal frameworks for digital currencies that has been attracting many crypto firms. In this context, Huang *et al.* (2019) find that there is a positive relation between the legal enactment of Blockchain technology and the emergence of ICOs, indicating that countries intending to take regulatory steps, instead of banning Blockchain technology or taking no actions, witness more coin offerings. According to Johnson and Yi (2019), the choice of jurisdiction has also an impact on the governance structure of coin offerings, since ICO promoters from countries with less strict regulation attempt to overcome asymmetric information by implementing more governance mechanisms (voting rights, cash flow rights, lockups, etc.). Furthermore, ICOs that disclose their jurisdiction in the white-paper have a higher probability to run a successful funding campaign compared to ICOs where this information is not available, since it may be perceived as signal of quality. Moreover, it indicates legal protection to potential investors when a cryptocurrency firm registers with a national regulatory authority (Adhami *et al.*, 2018).

The latter finding shows that not only ICO promoters chose a favorable jurisdiction for the offering of a cryptocurrency, but investors take the legal affiliation of a cryptocurrency into account when it comes to an investment decision. Following this logic, it is likely that investors also react on regulatory news events from the responsible authorities as they may have an impact on the further development of the cryptocurrency. Lately, many authorities issued regulations on cryptocurrencies, such as frameworks on the legal status, warnings, trading rules, enforcements etc. that have a direct impact on cryptocurrencies operating within the reach of national regulation. For instance, the launch of higher legal requirements or warnings and interventions against local cryptocurrency firms may constitute a reason for many investors to sell cryptocurrencies regulated under a certain jurisdiction. Such a reaction by investors would suggest that national regulation may be perceived as effective at least for cryptocurrencies that have a legal home.

Another question is whether the impact of national regulation is limited to local token? Intuitively, one would argue that regulatory news events of foreign authorities should not have an impact on the market valuation of domestic cryptocurrencies, since they are not

legally affected. For instance, why would investors of a cryptocurrency that falls under the strict regulation of the Security Exchange Commission (SEC) react (positively) on the publication of a favorable framework for cryptocurrencies issued by the Gibraltar Financial Services Commission (GFSC)? In turn, an announcement of the Canada Securities Administrators (CSA) indicating that many cryptocurrencies are treated as securities should not lead to a (negative) market reaction for cryptocurrencies regulated under friendly regimes, such as Gibraltar or Malta. Furthermore, when the Swiss Financial Market Supervisory Authority (FINMA) releases shut down orders because some local cryptocurrency companies operate without an appropriate authorization, this should be assessed as warning sign for (other) companies regulated by the FINMA, but not for companies regulated elsewhere. Taking the legal affiliation of cryptocurrencies into account, I hypothesize the following:

Hypothesis A: The impact of national cryptocurrency regulation is limited to local cryptocurrencies.

On the other hand, although no direct legal impact exists, there are plausible arguments why changes in domestic regulation may influence the demand and pricing of cryptocurrencies regulated under foreign jurisdictions. First, regulatory actions of authorities can have an indirect effect on foreign cryptocurrency markets. For instance, higher regulation standards and enforcements in one jurisdiction may cause a migration to other jurisdictions with more relaxed standards (Makarov and Schoar, 2020; Li *et al.*, 2019). As an example, Borri and Shakhnov (2019) find a rise in the trading volume and relative cryptocurrency prices for Korean won, Japanese yen, and U.S. dollars as a consequence of China's ban on ICOs and the shutdown of domestic cryptocurrency exchanges in September 2017. Since most of the Chinese investors invested in Chinese ICO projects before, the investments shifted to offshore platforms after the ban and increased the demand for international cryptocurrencies. Furthermore, when the SEC stated in July 2017 that cryptocurrencies are considered and treated as securities, many cryptocurrency firms decided not to offer their token to US citizens to avoid both the efforts of registration and the risks of enforcement actions by the SEC. This regulatory action had an impact on the global demand and supply of cryptocurrencies, since many promoters missed the opportunity to sell their cryptocurrency to one of the largest markets in the world and, in turn, US investors were left with a limited choice of legal investment options in cryptocurrencies.

Second, new regulation in one jurisdiction may be perceived by investors as a role model for other jurisdictions. With respect to cryptocurrency markets, this may especially hold true for the time when the first authorities published regulatory notes while cryptocurrencies were considered as unregulated in the rest of the world. In this context, Auer and Claessens (2018) describe this as mechanism by which one authority could encourage other authorities to adopt an "anti-crypto" mindset. Considering my full sample of regulatory events, I indeed find that regulatory publications in one jurisdiction seem to trigger similar actions in other jurisdictions. For instance, South Korea's financial regulator has prohibited domestic companies and startups from participating in ICOs only a few days after China issued a total ban on ICOs earlier that month. Furthermore, shortly after the SEC released the DAO report, a number of authorities from different countries (e.g., Singapore, Canada, Hong Kong) issued publications on the legal status of cryptocurrencies, indicating that they may be subject to the local security law. On the other hand, several countries that are known as destinations for "offshore financing" have been engaged in a competition to become leading centers for Blockchain technology (Marian, 2019). In this context, it is also notable that many of these so-called "tax haven" countries (e.g., UAE, Malta, Switzerland) published friendly frameworks for cryptocurrencies and ICOs after Gibraltar announced a new regulatory framework in September 2017, which indicates that the most cryptocurrencies remain unregulated.

Last, current literature focused on the diversification benefits of cryptocurrencies find that cryptocurrency markets are in general characterized by a high degree of interdependence. For instance, Yi *et al.* (2018) conclude that cryptocurrency markets are highly interconnected and that cryptocurrencies with a high market capitalization propagate large volatility shocks, while cryptocurrencies with a relatively low market capitalization may be considered as receivers of these shocks. In this context, Ferreira and Pereira (2019) find that an increasing integration between cryptocurrencies has taken place after a crash occurred in December 2017. In this context, scholars state that periods of high (low) market uncertainty correspond to strong (weak) connectedness, indicating that cryptocurrencies follow a joint distribution in extreme value that might be the reason for simultaneous downside trends with negative news (Antonakakis *et al.*, 2019; Huynh, 2019; da Gama Silva *et al.*, 2019). In particular, Koutmos (2018) finds peaks in return spillovers during major news events related to cryptocurrencies. Importantly, some of these events constitute regulatory actions of national authorities, such as the date when China's regulators

send shutdown orders to local Bitcoin exchanges, Japan declares Bitcoin as legal tender, and the US Department of Justice launches criminal probe into cryptocurrency price manipulation.

In addition, Auer and Claessens (2018) find that some categories of regulatory news events have a significant impact on the valuation and transaction volume of the eight most prominent cryptocurrencies (Bitcoin, Ether, Bitcoin Cash, Litecoin, Monero, Zcash, Ripple). Furthermore, Shanaev *et al.* (2020) find for a larger dataset of cryptocurrencies that tighter regulation and a more active role of authorities decrease cryptocurrency prices, while the relaxation of policy measures and the declaration of self-regulatory and hands-off approaches lead to a positive investor reaction. Although these studies did not take the jurisdictions of cryptocurrencies into account, findings may indicate that national regulation does not only affect local cryptocurrencies. Thus, I propose the following alternative hypothesis:

Hypothesis B: The impact of national cryptocurrency regulation is not limited to local cryptocurrencies, since regulation causes cross-border market reactions on foreign cryptocurrencies.

4.3 Data and method

4.3.1 Cryptocurrencies

I gather all market data for cryptocurrencies from coinmarketcap.com (CMC) which is widely used by scholars (Fisch, 2019; Johnson and Yi, 2019; Momtaz, 2018). CMC provides daily data on open, close, high, and low prices, trading volume, circulating supply, and market capitalization for more than 1700 coins and token (April 2019) from 28th April 2013. CMC receives data from different cryptocurrency exchanges. When a cryptocurrency is listed on multiple exchanges, CMC calculates the average price by weighting all cryptocurrency exchange prices by trading volume. The rationale behind this methodology is that exchanges with higher trading volumes are more liquid and have in general less price fluctuation. To calculate the trading volume of a cryptocurrency, CMC sums the total spot trading volumes for all exchanges over the last 24 hours. CMC uses the circulating supply as approximation for the number of assets that are circulating on the market. The concept of circulating supply is closely linked to the concept of public float as assets that are locked via smart contracts or legal contracts have no impact on the pricing and thus are not considered. Last, CMC calculates the market capitalization of a

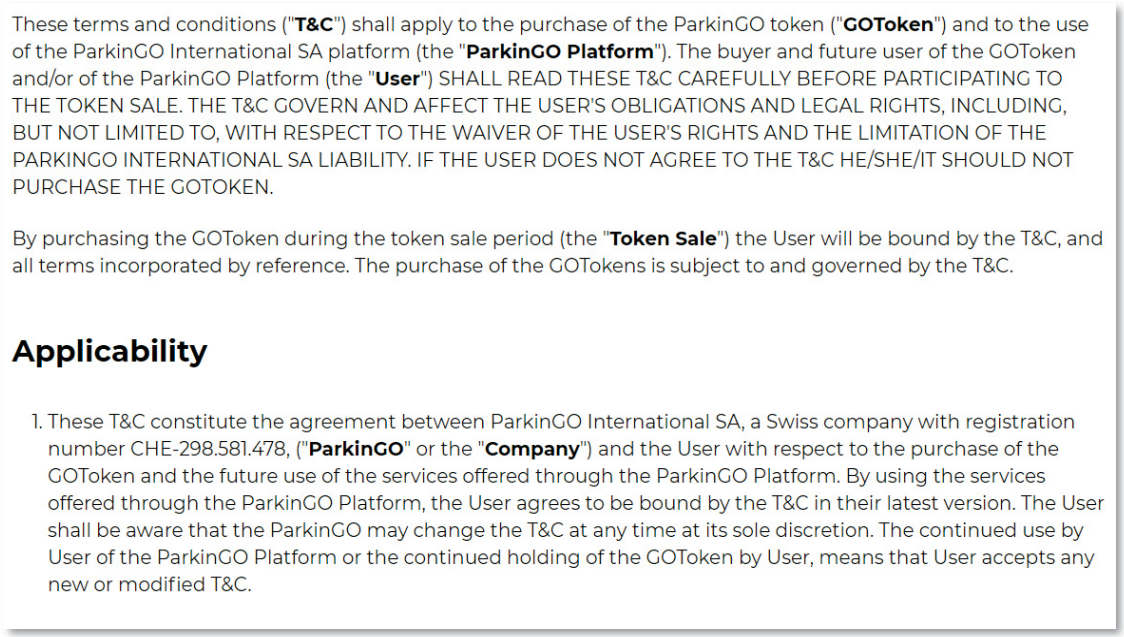
cryptocurrency by multiplying the price of the cryptocurrency by the current circulating supply.

The full CMC sample consists of 1,755 cryptocurrencies with 1,026 token and 729 coins for the period from 28th April 2013 to 15th April 2019. For the regression analysis, cryptocurrencies that have close prices lower than 0.0001 are excluded, since their returns may be affected by rounding errors. In addition, cryptocurrencies with extraordinary price jumps are also excluded if they are a result of miscalculation. To identify wrong price data, I crosscheck extreme values with other platforms (e.g., cryptocompare.com, coingecko.com). Furthermore, all cryptocurrencies with time jumps are dropped to remove any inconsistency from the data. The final sample consists of 1,183 cryptocurrencies with valid price information. Table A.10 (Appendix) displays a breakdown for the cryptocurrency sample.

To investigate the scope of national regulation, information on the firm behind the cryptocurrency is essential. All information on the crypto firm location are gathered from official websites, since many firms publish their address and the corresponding jurisdiction on specific pages, such as terms and conditions, imprint, or legal notes. Figure 4.1 provides an example. In order to gain more confidence in the data, the website location is crosschecked with information from the whitepaper, if available. I find that approximately 40% of the crypto firms from the full sample disclose information about their location or governing law. Compared to Johnson and Yi (2019), this is a relatively small share as 57% of their cryptocurrency firms provide a location in the whitepaper. One explanation is that Johnson and Yi (2019) focus only on cryptocurrencies issued by an ICO process where firms publish detailed information to overcome information asymmetries (Fisch, 2019). I receive a similar share of crypto firms with available country information (56%) when the subsample of coins is ignored (see Appendix Table A.11). To generate the final sample, all cryptocurrencies without country information or with contractionary information about the country are excluded.

The final sample consists of 521 cryptocurrencies from 48 different countries. The sample is dominated by cryptocurrencies from USA (19%), Singapore (16%), United Kingdom (10%), and Switzerland (10%), while the most countries have less than ten crypto firms. I find that many small countries, city states, and island states that belong to the early adopters of Blockchain technology are ranked under the top 25 jurisdictions (e.g., Hong

Kong, Gibraltar, Estonia, Malta). Surprisingly, there are no cryptocurrency firms from China and only one from Russia. This might be the case as firms from these countries may refrain from providing country information to avoid any legal disputes with local regulatory authorities. Table A.12 (Appendix) depicts a list of top cryptocurrencies countries from my sample. Of note, this distribution is not representative for the whole universe of cryptocurrencies as it is driven by the availability of firm information. For instance, it is more likely to find information on the location if the firm is headquartered in Germany, Austria, or Switzerland, since many of these firms are forced to provide an imprint on their homepage, according to local media law. However, I find that other rankings have a similar distribution of cryptocurrencies, especially for the top ten jurisdictions.



These terms and conditions ("**T&C**") shall apply to the purchase of the ParkinGO token ("**GOToken**") and to the use of the ParkinGO International SA platform (the "**ParkinGO Platform**"). The buyer and future user of the GOToken and/or of the ParkinGO Platform (the "**User**") SHALL READ THESE T&C CAREFULLY BEFORE PARTICIPATING TO THE TOKEN SALE. THE T&C GOVERN AND AFFECT THE USER'S OBLIGATIONS AND LEGAL RIGHTS, INCLUDING, BUT NOT LIMITED TO, WITH RESPECT TO THE WAIVER OF THE USER'S RIGHTS AND THE LIMITATION OF THE PARKINGO INTERNATIONAL SA LIABILITY. IF THE USER DOES NOT AGREE TO THE T&C HE/SHE/IT SHOULD NOT PURCHASE THE GOTOKEN.

By purchasing the GOToken during the token sale period (the "**Token Sale**") the User will be bound by the T&C, and all terms incorporated by reference. The purchase of the GOTokens is subject to and governed by the T&C.

Applicability

1. These T&C constitute the agreement between ParkinGO International SA, a Swiss company with registration number CHE-298.581.478, ("**ParkinGO**" or the "**Company**") and the User with respect to the purchase of the GOToken and the future use of the services offered through the ParkinGO Platform. By using the services offered through the ParkinGO Platform, the User agrees to be bound by the T&C in their latest version. The User shall be aware that the ParkinGO may change the T&C at any time at its sole discretion. The continued use by User of the ParkinGO Platform or the continued holding of the GOToken by User, means that User accepts any new or modified T&C.

Figure 4: Extract from the T&C of GOToken.

4.3.2 Events

Regulatory news events are collected for the sample period from 1st January 2017 until 15th April 2019 by applying two steps. First, I review the data archives of regulatory authorities for relevant documents about Blockchain, cryptocurrencies, and ICOs. Second, I verify the relevance of these documents and complete the sample by screening all articles from the category *regulation* from coindesk.com (CDK), one of the leading news portals for cryptocurrencies. I only include regulatory events from CDK to my event sample when the article is linked to an official publication of a regulatory authority. For instance, informal interviews and statements of related authority members are excluded to

ensure that only well-considered regulatory actions rather than misquotation and rumors are considered. Since market participants (e.g., investors) usually receive information on cryptocurrencies from news portals, this paper refers to the date when CDK publishes news.

This study differentiates five major categories of regulatory news. The coding scheme of Auer and Claessens (2018) serves as an orientation. Table A.13 (Appendix) provides examples for each category. First, I collect all regulatory events that deal with the *legal status* of cryptocurrencies. This category is further subdivided into three categories. The first subcategory *security* contains all publications indicating that cryptocurrencies might be classified as securities without providing an alternative and less strict legal treatment. The second subcategory *classification* contains publications that distinguish between different types of cryptocurrencies where at least one type is not subject to local security law (e.g., commodity). The last subcategory of *legal status* deals with news indicating that cryptocurrencies are banned by the national authority (*ban*). Second, I group all publications that deal with the *interoperability* of cryptocurrencies. The first subcategory *institutions* may be considered as reflection on the acceptance of cryptocurrencies by national authorities, since it encompasses publications that regulate under what conditions well-established (financial) institutions, such as commercial banks, clearinghouses, funds, publicly listed companies, and other entities are allowed to integrate cryptocurrencies into their everyday business. For instance, this group contains publications that allow or permit funds to invest in cryptocurrencies, banks to deal with cryptocurrency-related assets, and public companies to perform coin offerings. The second subcategory *listing* is about publications that regulate the listing of cryptocurrency-based products (e.g., futures, exchange-traded funds) on well-established exchanges. One prominent news event from this category is the SEC rejection of the Winklevoss Bitcoin ETF bid. Third, the category *exchange* covers all publications regarding the regulation of cryptocurrency-specific intermediaries (e.g. crypto exchanges, crypto wallets). Since these intermediaries usually provide access to cryptocurrencies for the most investors, their regulation may be considered as an effective tool for national authorities. For instance, authorities may regulate cryptocurrency intermediaries in terms of know-your-costumer (KYC), anti-money laundering (AML), combating the financing of terrorism (CFT), cyber security, or investor protection policies. Furthermore, some national authorities (e.g. Japan, Thailand) issued special licenses companies need to acquire for providing cryptocurrency exchanges or

cryptocurrency trading platforms. Consequently, authorities have also the power to shut down cryptocurrency exchanges if they do not meet or violate the legal requirements. Fourth, I group all publications that constitute general warnings on cryptocurrencies and ICOs (*warning*). News events from this category usually highlight that investments in cryptocurrencies are in general highly speculative due to significant price fluctuations, illiquid secondary markets, incomprehensible or even misleading information of cryptocurrency promoters, a lack of legal requirements and transparency rules etc. Last, the category *violation* encompasses news indicating that authorities take actions against certain market participants due to infringements. For instance, news from this category deal with unregistered ICOs, charges against ICO promoters, falsely claimed authority approvals, cryptocurrency pyramid schemes, and illegal cryptocurrency trades.

The final sample consists of 140 regulatory events from 29 countries, including the European Union. Analogous to the cryptocurrency sample, the news events sample is dominated by the USA (31 events), accounting for more than 20% of all news events. Most of the regulatory events are from the category *legal status* (40 events), followed by *violations* (31 events), *interoperability* (24 events), *warning* (23 events), and *exchange* (22 events). I find more events with a negative sentiment (115 events) than with a positive sentiment (25 events). Tables A.14 (Appendix) provides an overview of the news categories and Table A.15 (Appendix) displays a list of all 140 regulatory events.

4.3.3 Method

Following Auer and Claessens (2018) and Shanaev *et al.* (2020), I apply an event study regression with a binary dummy variable to measure the impact of different categories of regulatory news events on cryptocurrency prices:

$$\log\left(P_{i,t}/P_{i,t-1}\right) = \alpha_i + \beta_i \, R_t^{\text{news indicator}} + \varepsilon_{i,t}$$

where P_i refers to the close price of cryptocurrency i and R_t is a dynamic binary dummy variable that equals +1 for positive regulatory news events and -1 for negative regulatory news events on date t. Following the intuition that investors in general perceive regulation as obstructive, a negative sentiment is associated with news indicating that authorities may take (strict) regulatory actions, while news have a positive sentiment if authorities introduce lax regulation guidelines or signal that no regulatory actions are planned (Koenraadt and Leung, 2019). If no regulatory news are issued on date t, the dummy variable equals 0 to control for "normal" returns. Each major news category has an own

news indicator dummy variable that summarizes the regulatory scores of its subcategories. Referring to the news category *legal status*, all events from the subcategories *security law* and *ban* are coded negatively, while all events from the subcategory *classification* have a positive sentiment.

$$R_t^{legal\ status} = R_t^{security\ law} + R_t^{classification} + R_t^{ban}$$

Furthermore, all news events from the categories *warning* and *violation* have a negative sentiment. For the other news (sub)categories, I consider every event individually to decide whether it leads to a decreased (+1) or increased regulation (-1). For instance, news about exchange regulation are coded as the following:

$$R_t^{exchange\ regulation} = R_t^{increased\ regulation} + R_t^{decreased\ regulation}$$

As reported in section 4.3, this study distinguishes between five categories of regulatory news events. To test the hypotheses formulated in Section 4.2, I further differentiate between local and foreign news events. The study estimates the following model:

$$\begin{aligned}\log\left(P_{i,t}/P_{i,t-1}\right) = {} & \alpha_i + \beta_{i1}\, R_t^{legal\_status\_local} + \beta_{i2}\, R_t^{interoperability\_local} \\ & + \beta_{i3}\, R_t^{exchange\_local} \beta_{i4}\, R_t^{warning\_local} + \beta_{i5}\, R_t^{violation\_local} \\ & + \beta_{i6}\, R_t^{legal\_status\_foreign} + \beta_{i7}\, R_t^{interoperability\_foreign} \\ & + \beta_{i8}\, R_t^{exchange\_foreign} \beta_{i9}\, R_t^{warning\_foreign} + \beta_{i10}\, R_t^{violation\_foreign} \\ & + \varepsilon_{i,t}\end{aligned}$$

Finally, to estimate the regression model, all the values are collapsed into an unbalanced panel dataset that consists of 221,300 observations, given the 6-year observation period covering 521 cryptocurrencies with country information and 140 regulatory news events. Furthermore, a generalized least squares (GLS) regression model with random effects is employed. This is a standard method for estimating the unknown parameters in a linear regression model by using weighted least squares rather than ordinary least squares to overcome problems about a high degree of correlation between the residuals in a regression model (Buse, 1973). As a robustness check, I also apply a fixed-effects (within) regression model.

One point worthy of note is that this study departs from the classic event study methodology (MacKinley, 1997), since the high density of news events causes issues in

generating consecutive estimation windows, in particular at the beginning of 2018, the same time when the most ICOs occurred. Furthermore, there is no generally accepted market index for cryptocurrencies. One option is to create an own index that includes all cryptocurrencies available. However, it is again a problem that most cryptocurrencies were issued in early 2018, since rebalancing problems appear due to a strong increase of index constituents at that time. Another option is to apply existing indices, such as CRIX or CCi30. These indices are constructed in the way that market capitalization has a strong impact on the weighting of constituents, meaning they are strongly driven by the major cryptocurrencies (e.g., bitcoin, ether) which raises questions whether they are appropriate for an event study approach.

4.4 Results

Tables 4.1-4.3 display the results for the GLS panel regressions with random effects. Basically, there are three different regression models. In the first regression model, regulatory news are separated regarding their sentiment to investigate whether markets react negatively to more regulation and positively to less regulation (see Table 4.1). For a more intuitive interpretation of the results, all dummy variables of negative news events are multiplied by -1. I find that the coefficients of both regulatory news dummies have the expected sign. Furthermore, the results indicate that both negative and positive regulatory news events have a statistically significant ($p < 0.01$) impact on cryptocurrency prices, whereby the coefficient for positive news has a higher magnitude (0.021) compared to negative news (-0.013).

Table 4.1 Results sentiment.

The table reports the event effect on cryptocurrency returns estimated in a time-series model using a dummy variable approach in a GLS panel regression with random effects. In this regression model, I differentiate between regulatory news events with positive and negative sentiment.

	Coef.	Std. error	z	P>|z|	[95% Conf. interval]	
Positive news	0.0205	0.0016	12.77	0.000	0.0173	0.0236
Negative news	-0.0136	0.0001	-17.57	0.000	-0.0151	-0.0121
Constant	-0.0028	0.0001	-9.39	0.000	-0.0034	-0.0022
Observations	221,300	R-squared	0.0019			

In the second regression model, I take the different categories of regulatory news events into account. The results are displayed in Table 4.2. Considering regulatory news events

from the categories *legal status*, *interoperability*, and *exchanges*, the results confirm a statistically significant ($p < 0.01$) effect. Remarkably, the economic impact is the largest for news about *exchange* regulation (0.047), followed by *interoperability* (0.025) and *legal status* (0.011). In contrast, publications that constitute general *warnings* and *violations* do not lead to a significant market reaction.

Table 4.2 Results categories.

The table reports the event effect on cryptocurrency returns estimated in a time-series model using a dummy variable approach in a GLS panel regression with random effects. In this regression model, I differentiate between regulatory news events from different categories.

	Coef.	Std. error	z	P>|z|	[95% Conf. interval]	
Legal status	0.0107	0.0013	8.29	0.000	0.0082	0.0132
Interoperability	0.0252	0.0017	15.25	0.000	0.0220	0.0285
Exchange	0.0474	0.0019	25.33	0.000	0.0437	0.0510
Warning	0.0010	0.0022	0.44	0.661	-0.0033	0.0052
Violation	0.0010	0.0014	0.67	0.501	-0.0018	0.0036
Constant	-0.0026	0.0003	-9.02	0.000	-0.0032	-0.0021
Observations	221,300	R-squared	0.0041			

So far, results indicate that national regulation may be effective for all cryptocurrencies tested. However, these results may be driven by the impact of national regulation on domestic token. To rule out this possibility, I estimate the third regression model where I split the categories to control for each cryptocurrency whether the regulatory news event is initiated by a local or a foreign authority (Table 4.2). For all regulatory news events initiated by local authorities, events from the categories *legal status*, *interoperability*, and *exchange* are statistically significant ($p < 0.01$), while news about general *warnings* have no measurable impact on cryptocurrency prices. Furthermore, findings confirm a significant ($p < 0.05$) market response for news from the category violation if they are issued by a local regulatory authority.

It is important to highlight that I find similar results for news published by foreign authorities, indicating that cryptocurrency markets are interlinked, since investors seem to react on regulatory news from specific categories no matter where they come from.

Table 4.3 Results jurisdiction.

The table reports the event effect on cryptocurrency returns estimated in a time-series model using a dummy variable approach in a GLS panel regression with random effects. In this regression model, I differentiate between regulatory news events from different categories. I further consider whether regulatory news events are published by domestic or foreign authorities.

	Coef.	Std. error	z	P>|z|	[95% Conf.	interval]
Legal status local	0.0165	0.0056	2.98	0.003	0.0057	0.0274
Interoperability local	0.0358	0.0055	6.49	0.000	0.0249	0.0465
Exchange local	0.0621	0.0102	6.08	0.000	0.0421	0.0821
Warning local	-0.0017	0.0092	-0.19	0.853	-0.0198	0.0163
Violation local	0.0094	0.0039	2.43	0.015	0.0018	0.0170
Legal foreign	0.0103	0.0013	7.72	0.000	0.0076	0.0128
Interoperability foreign	0.0243	0.0017	14.05	0.000	0.0209	0.0277
Exchange foreign	0.0467	0.0019	24.26	0.000	0.0429	0.0504
Warning foreign	0.0011	0.0022	0.51	0.608	-0.0032	0.0055
Violation foreign	-0.0003	0.0015	-0.21	0.837	-0.0031	0.0025
Constant	-0.0026	0.0003	-8.99	0.000	-0.0031	-0.0020
Observations	221,300	R-squared	0.0042			

However, one difference is that news from the category *violation* does not lead to a significant reaction if they are published by a foreign authority. Additionally, the market reaction is stronger for local regulatory news events as coefficients have a larger magnitude for news about the *legal status* (0.017 vs. 0.010), *interoperability* (0.036 vs. 0.024), and *exchange* regulation (0.062 vs. 0.047). As a robustness check, the same models are estimated using a fixed-effects (within) model. Results for the three regression models are displayed in Appendix tables A.16-18. Considering these results, fixed-effects (within) regressions confirm the former findings. For the three regression models, I find neither a difference in significance levels nor large changes in magnitudes of coefficients. Finally, hypothesis A can be rejected in favor of hypothesis B as the impact of regulatory news events is not limited to domestic token. Instead, cryptocurrency markets appear to be interlinked, since investors also react on news events from foreign authorities. One exception are news events from the category *violation*.

4.5 Conclusion

To assess whether cryptocurrency regulation can be effective, this study investigates the market reaction to regulatory news events, using a unique dataset of 140 regulatory news events and price data of 521 cryptocurrencies where the company and its jurisdiction are known. Basically, one can expect a measurable reaction of cryptocurrency prices to regulatory news when they are published by domestic authorities, since cryptocurrency firms operate within the reach of their national regulation. Indeed, results confirm a significant market reaction to certain categories of regulatory news events (*legal status, interoperability, exchange, violation*) of domestic authorities. Of note, results do not differ considerably for regulatory news events published by foreign authorities where I also find significant reactions for news from certain categories (*legal status, interoperability, exchange*). Intuitively, the market reactions are stronger for local publications. It is also notable that foreign cryptocurrency investors do not react when regulatory authorities take enforcement actions against local promoters. At least for this category of regulatory news events the legal binding argument seems to be important.

Based on these findings, this study generates the following implications. Although national regulation of financial authorities from different countries is not binding for the entire cryptocurrency market, results indicate that there is a global response to certain categories of regulatory news events. This may be explained by different reasons. First, regulatory actions of authorities can have an indirect effect on foreign cryptocurrency markets. For instance, stronger regulation in one jurisdiction affects an investment shift to jurisdictions with lower requirements (regulatory arbitrage). Second, new regulation in one jurisdiction may be perceived by investors as a role model for other jurisdictions, especially if these authorities have not published own notes on the legal treatment yet. Third, cryptocurrency markets are in general characterized by a high degree of interdependence. Importantly, periods of high market uncertainty correspond to strong connectedness, indicating that cryptocurrencies follow a joint distribution in extreme value. Since the cryptocurrency market is still immature and investors are insecure about its future, the publication of regulatory news may constitute events that increase the uncertainty and lead to significant price reactions, no matter whether they are published by a local or a foreign authority.

As previously mentioned, results confirm that markets react negatively to events that increase (the likelihood of) regulation, while events that introduce lax regulation guidelines

or even signal that no regulatory actions are planned are associated with market gains. Considering my sample of events, they predominantly have a negative sentiment (115 of 140 events), indicating that (stronger) cryptocurrency regulation is costly rather than beneficial. Given the fact that national regulation is intended to serve national interests (e.g., market confidence, financial stability, investor protection) by regulating cryptocurrency firms and other market participants (e.g., crypto exchanges) that operate under the local jurisdiction, the (mostly negative) spillover effects on foreign cryptocurrency valuation may be considered as negative externalities.

Alternatively, some scholars propose to introduce a coordinated international approach to cryptocurrency regulation (Breu and Seitz, 2018; Edwards *et al.*, 2019; Marian, 2019; Pedrosa-Garcia and Almeida, 2018). In contrast to various national regulation approaches, a coordinated approach would help to overcome the problems of spillover effects and negative externalities by implementing binding global standards for cryptocurrencies and ICOs. In this way, market uncertainty and price swings caused by the ongoing release of new regulations from different national authorities could be eliminated. A transnational regulation may also have other positive aspects. For instance, it could inhibit a regulatory "race to the bottom" where some jurisdictions compete in granting the highest tax reliefs to become a center for cryptocurrency firms (Marian, 2019). According to Edwards *et al.* (2019), transnational regulation would also be more effective to counteract the use of cryptocurrencies for illegal activities (e.g., drug dealing, money laundering, terrorist financing) and to protect investors from fraudulent payment schemes that raises questions about the integrity of the entire cryptocurrency market. Although it constitutes a challenge to design a regulation approach that meets the interests of different countries, there are successful examples of coordinated regulatory actions (e.g., Common Reporting Standards (CRS), International Financial Reporting Standards (IFRS), Financial Action Task Force (FATF)). Against this background, I plead for a coordinated regulation approach to eliminate negative externalities of regulation and strengthen the investor confidence by implementing consistent standards for the cryptocurrency space.

Furthermore, my results also have implications for cryptocurrency investors. I find that regulatory news events have an impact for the entire market that makes it difficult for investors to hedge regulatory risks. The results are in line with findings of other scholars, indicating that cryptocurrency markets follow a joint distribution in extreme value that causes simultaneous downside trends with negative news (Antonakakis *et al.*, 2019; da

Gama Silva *et al.*, 2019; Huynh, 2019). For this reason, investors may be better off when they diversify their portfolio along different asset classes rather than cryptocurrencies.

Naturally, this paper has some limitations. First, this study uses the market reaction to evaluate whether national regulation can be effective. Future research could investigate the direct effects of regulation on affected companies by monitoring whether companies truly comply with new regulations. In other words, regulation is effective if regulatory authorities are able to enforce their regulatory standards. Second, this study uses cryptocurrency price data from CMC that is widely used by scholars. However, there are concerns about the data quality of cryptocurrency price information. For instance, different reports from cryptocurrency companies claim that between 65% and 95% of reported crypto trading volume is fake. Future research may repeat the estimations with other data sources, such as data from the International Token Standardization Association (ITSA). Third, a general problem of events studies are confounding events. To address this problem, I checked different data sources and dropped regulatory events when they fall on the same date as other major events. Fourth, this study uses an alternative event study approach that is not widely used by scholars. However, I think it is the only possibility to deal with the statistical problems described in Section 3 (high density of news events, no established index for the cryptocurrency market). Fifth, another limitation is that this study only differentiates between local and foreign events. Thus, studies that consider whether regulatory news events from certain countries (e.g., USA, China, Russia) have an extraordinary effect on the markets would be welcomed.

5. Final remarks

5.1 Conclusion

Fintech combines elements from finance and technology and this term is widely used to refer to innovations in the world of finance. Fintech has a long history that can be divided into three periods. This dissertation deals with the latest period (fintech 3.0) that is characterized by the loss of confidence in traditional financial institutions as a consequence of the financial crisis, the advent of the digital era with broadband internet and wireless terminal equipment (e.g., smartphones, tablets), and scalable financial solutions that can be used by anybody, even in third world countries. In contrast to the first and second period of fintech where established financial institutions provided innovative financial solutions, the third period is dominated by young companies that make use of new technologies and compete with incumbent financial institutions.

As this dissertation was written in the context of the Manchot Graduate School, which deals with the competitiveness of young companies, different levels of competitiveness are analyzed using the case of fintech. For this dissertation, the following definitions for the different levels are assumed. First, the micro or firm level deals with the ability of a company to reach an advantageous market position by exploiting superior resources that are available within the company and/or are provided by alliance and cooperation partners. Second, the regional level is defined by the ability of a region to attract (young) companies by providing an attractive environment where networks of pre-existing institutions from different industries allocate important resources for newcomers. Third, as a major component of national competitiveness, this dissertation concentrates on the ability of a country to adopt regulatory provisions that promote innovativeness.

Chapter 2 shows, for the micro perspective, that collaborations with incumbent financial institutions (e.g., bank) help fintech startups to increase its competitiveness. In particular, fintechs seek for bank collaboration to gain access to the following bank resources: clients, network, reputation, financial resources, products, know-how, and regulatory infrastructure. With access to resources, banks help fintech startups (a) to enter the market, (b) to grow faster and increase profits, and (c) to develop new products. This study provides evidence that banks are not only competitors, they also have a crucial role in promoting fintech startups and they can be seen as enablers, accelerators, and innovators. Fintech entrepreneurs may consider bank cooperation to push their business at different stages.

Furthermore, political decision makers may promote cooperation between banks and fintechs by hosting networking events and pass directives that foster cooperation.

Next, Chapter 3 deals with the regional perspective of competitiveness. The findings of this study indicate that successful fintech startups, in general, do not emerge in middle of nowhere. In fact, successful fintechs are concentrated in regions with established finance and software technology industries where they get access to resources that are important to develop and grow. In addition, results show that fintechs located in areas with strong investor base receive -ceteris paribus- a higher VC funding amount. These findings generate implications for practice. For policy makers interested in facilitating the development of a local fintech community, the study highlights the type of local resources that are helpful in achieving this objective. Therefore, policy makers should support existing industries, since they are relevant to the emergence of (fintech) startups (Wiewel and Hunter, 1985). Furthermore, entrepreneurs venturing into fintech have a better chance to receive a high funding when they choose a location with a high density of VC investors.

Last, Chapter 4 considers the macro level of competitiveness. In particular, the study analyzes whether national regulation of an innovative technology, namely Blockchain-based cryptocurrencies, can be effective. The findings confirm that at least markets perceive regulation of domestic and foreign authorities as effective. The results further indicate that spillover effects take place on strongly interlinked cryptocurrency markets with high uncertainty and that the market response does not necessarily depend on whether regulation has a directly binding legal impact. Furthermore, findings show that (stronger) regulation in general is perceived as net costly, while news about lax regulation or no regulation lead to a positive market reaction. Based on these findings, implications are formulated. For policy makers interested in effective regulation of cryptocurrencies, the study suggests a coordinated international regulation approach that can mitigate the negative spillover effects of uncoordinated actions of single national authorities. Furthermore, cryptocurrency investors should diversify their portfolio along different asset classes as the results indicate that cryptocurrency markets follow a joint distribution in extreme value that causes simultaneous downside trends with negative news.

5.2 Limitations and future research

Despite the findings of this dissertation, there are several open questions, which offer promising approaches for future research. Chapter 2 focuses on strategic alliances as one possibility to improve micro level competitiveness by receiving external resources. Apart from that, further research may focus on internal resources as reason for competitive advantage (Barney, 1991). Furthermore, as the study in Chapter 2 deals with proposition building rather than theory testing, several limitations exists. First, the study uses a qualitative research concept that is sensitive to specific case selection. However, the sample has a number of variations, thus the findings could be transferable to a certain degree. Second, another limitation is that the study concentrates only on the German market. For this reason, future studies may collect empirical data from other countries to test whether certain cooperation motives differ. Third, the study focuses on in-depth interviews with fintech managers to explain why bank cooperation may be beneficial for fintechs. Hence, there is a danger of overemphasizing positive effects and neglecting possible negative effects. Following up on this, future research may shed light on possible negative aspects of these collaborations, such as differences in company culture or imbalances of power between cooperation partners.

Chapter 3 deals with established industries as essential condition to build fintech ecosystems in the context of regional competitiveness. Moreover, future research may concentrate on dynamics within regional ecosystems of fintech startups and how newcomers may benefit from the existence of an already established fintech community. Next, similar to Chapter 2, the data in Chapter 3 is limited to one country, namely the USA, which is the most active market for venture capital investments in fintech startups (CBInsights, 2019). However, it would be interesting to investigate which factors are decisive in other countries where highly developed finance and software industries are missing. Next, the data is limited to fintech firms that are backed by venture capital investors as it can be considered as quality signal. However, there are other forms of funding (e.g., initial coin offerings) that have become popular, in particular for fintech companies using Blockchain technology. Future research may consider more investment instruments to provide a more precise picture of the emergence of fintech ecosystem. Another open question is whether resource-rich areas “attract” existing or rather “make emerge” fintech firms? In other words, do entrepreneurs decide to locate in resource-rich areas, or are resource-rich areas

promoting the emergence of local fintech initiatives? Future research may develop hypotheses that helps to disentangle these two effects.

Last, Chapter 4 is about the national regulation of innovative technologies with respect to macro level competitiveness. One limitation of this study is that it uses the market reaction to evaluate whether national regulation can be effective. Future research could investigate the direct effects of regulation on affected companies by monitoring whether companies, in fact, comply with new regulations. This makes it possible to assess the real effectiveness of regulation. Moreover, this study uses cryptocurrency price data from CMC, which are widely used by scholars but have also been criticized for data quality. Future research may repeat the estimations with other data sources, such as academic data from the International Token Standardization Association (ITSA). Last, another limitation is that the study only differentiates between local and foreign events. Thus, future studies may consider whether regulatory news events from certain countries (e.g., USA, China, Russia) have an extraordinary effect on the market evaluation.

Table 5.1 Conclusive overview of the dissertation

Study	Level	Research questions	Findings	Implications
Study 1	Micro (firm)	-Which resources are the reason why fintech startups enter into cooperation with incumbent banks? -How does the access to incumbent banks' resources help fintech startups to reach a better market position?	-Fintech startups cooperate with banks in order to gain access to the following resources: clients, network, reputation, financial resources, products, know-how, regulatory infrastructure. -With access to resources, banks help fintech startups (a) to enter the market, (b) to grow faster/ to increase profits, and (c) to develop new products.	-Fintech entrepreneurs may consider bank cooperation to push the business model at different stages as banks are not only competitors, they also have a crucial role in promoting fintech startups. They can be seen as enablers, accelerators and innovators. -Political decision makers should promote cooperation between banks and fintechs by setting up certain programs.
Study 2	Regional	-Which regional industries are needed to build an ecosystem of (successful) fintech startups? -How does the location of fintech startups affect VCs' funding behavior?	-Successful fintech startups are concentrated in regions with established finance and software technology industries. Fintech startups located in regions with strong investor base receive -ceteris paribus- higher funding rounds.	-Policy makers should support existing industries, in particular finance and software as they are relevant to the emergence of (fintech) startups. -The choice of the location has an impact on funding conditions of fintech startups. Entrepreneurs should take that into account when they decide for a location.
Study 3	Macro (nation)	-Can (national) regulation of Blockchain-based cryptocurrencies be effective given their special characteristics (decentralized, international, anonymous issuing procedure)? -What effect does the regulation of cryptocurrencies have on their market valuation?	-Markets perceive regulation of domestic and foreign authorities as effective. Spillover effects take place on strongly interlinked cryptocurrency markets with high uncertainty. -Regulation in general is perceived as net costly, while news about lax regulation or no regulation lead to a positive valuation.	-Policy makers should pass internationally coordinated regulations to mitigate the uncertainty and negative spillover effects. - Investors should diversify their portfolio along different asset classes as the results indicate that cryptocurrency markets follow a joint distribution in extreme value.

References

Adhami, S., Giudici, G. and Martinazzi, S. (2018), "Why do businesses go crypto? An empirical analysis of initial coin offerings", *Journal of Economics and Business*, Vol. 100, pp. 64–75.

Aghion, P., Bloom, N., Blundell, R., Griffith, R. and Howitt, P. (2005), "Competition and innovation: An inverted-U relationship", *The Quarterly Journal of Economics*, Vol. 120 No. 2, pp. 701–728.

Ajitabh, A. and Momaya, K. (2004), "Competitiveness of firms: review of theory, frameworks and models", *Singapore Management Review*, Vol. 26 No. 1, pp. 45–61.

Alavi, M. and Leidner, D.E. (2001), "Knowledge management and knowledge management systems: Conceptual foundations and research issues", *MIS Quarterly*, Vol. 25 No. 1, pp. 107–136.

Allison, P.D. and Waterman, R.P. (2002), "Fixed–effects negative binomial regression models", *Sociological Methodology*, Vol. 32 No. 1, pp. 247–265.

Alt, R., Beck, R. and Smits, M.T. (2018), "FinTech and the transformation of the financial industry", *Electronic Markets*, Vol. 28, pp. 235–243.

Alt, R. and Puschmann, T. (2016), *Digitalisierung der Finanzindustrie*, Springer, Berlin.

Alvarez, S.A. and Busenitz, L.W. (2001), "The entrepreneurship of resource-based theory", *Journal of Management*, Vol. 27 No. 6, pp. 755–775.

Álvarez, I., Marin, R. and Fonfría, A. (2009), "The role of networking in the competitiveness of firms", *Technological Forecasting and Social Change*, Vol. 76 No. 3, pp. 410–421.

Anca, H.D.B. (2012), "Literature review of the evolution of competitiveness concept", *Annals of the University of Oradea, Economic Science Series*, Vol. 21 No. 1, pp. 41–46.

Andriopoulos, C. and Lewis, M.W. (2009), "Exploitation-exploration tensions and organizational ambidexterity: Managing paradoxes of innovation", *Organization Science*, Vol. 20 No. 4, pp. 696–717.

Annoni, P. and Kozovska, K. (2010), "EU regional competitiveness index 2010", available at: https://www.researchgate.net/profile/Kornelia_Kozovska/publication/259357555_EU_Regional_Competitiveness_Index_2010/links/00b7d52b2c7973ccb5000000.pdf (accessed 10 March 2020).

Antonakakis, N., Chatziantoniou, I. and Gabauer, D. (2019), "Cryptocurrency market contagion: Market uncertainty, market complexity, and dynamic portfolios", *Journal of International Financial Markets, Institutions and Money*, Vol. 61, pp. 37–51.

Arner, D.W., Barberis, J. and Buckley, R.P. (2015), "The evolution of Fintech: A new post-crisis paradigm", available at: https://heinonline.org/HOL/LandingPage?handle=hein.journals/geojintl47&div=41&id=&page= (accessed 10 March 2020).

Asheim, B.T. and Coenen, L. (2005), "Knowledge bases and regional innovation systems: Comparing Nordic clusters", *Research Policy*, Vol. 34 No. 8, pp. 1173–1190.

Auer, R. and Claessens, S. (2018), "Regulating cryptocurrencies: assessing market reactions", *BIS Quarterly Report* September 2018, pp. 51–65.

Autio, E. (2017), "Digitalisation, ecosystems, entrepreneurship and policy", *Policy Brief*, Vol. 20.

Autio, E., Nambisan, S., Thomas, L.D.W. and Wright, M. (2018), "Digital affordances, spatial affordances, and the genesis of entrepreneurial ecosystems", *Strategic Entrepreneurship Journal*, Vol. 12 No. 1, pp. 72–95.

Banham, R. (2017), "Investing in the insurtech toolbox", *Risk Management*, Vol. 64 No. 6, 12-21.

Bankenverband (2018), "Online-Banking in Deutschland. Repräsentative Umfrage im Auftrag des Bundesverbands deutscher Banken", available at: https://bankenverband.de/media/files/2018_06_19_Charts_OLB-final.pdf (accessed 10 March 2020).

Bardey, D., Bommier, A. and Jullien, B. (2010), "Retail price regulation and innovation: reference pricing in the pharmaceutical industry", *Journal of Health Economics*, Vol. 29 No. 2, pp. 303–316.

Barney, J. (1991), "Firm resources and sustained competitive advantage", *Journal of Management*, Vol. 17 No. 1, pp. 99–120.

Barney, J. (2001), “Resource-based theories of competitive advantage: A ten-year retrospective on the resource-based view”, *Journal of Management*, Vol. 27 No. 6, pp. 643–650.

Baum, J.A.C., Calabrese, T. and Silverman, B.S. (2000), “Don't go it alone: Alliance network composition and startups' performance in Canadian biotechnology”, *Strategic Management Journal*, Vol. 21 No. 3, pp. 267–294.

Bena, J. and Li, K. (2014), “Corporate innovations and mergers and acquisitions”, *Journal of Finance*, Vol. 69 No. 5, pp. 1923–1960.

Berger, T. (2008), “Concepts of national competitiveness”, *Journal of international Business and Economy*, Vol. 9 No. 1, pp. 3–17.

Blind, K. (2016), “The impact of regulation on innovation”, in Manchester Institute of Innovation Research (Ed.), *Handbook of innovation policy impact*, Edward Elgar Publishing.

BNY Mellon Treasury Services (2015), “Innovation in Payments: The Future is Fintech”, available at: https://www.bnymellon.com/_global-assets/pdf/our-thinking/innovation-in-payments-the-future-is-fintech.pdf (accessed 10 March 2020).

Bodek, M.C. and Matinjan, J. (2017), “Innovation durch corporate incubation”, in *Innovationen und Innovationsmanagement in der Finanzbranche*, Springer, Wiesbaden, pp. 117–144.

Bömer, M. and Maxin, H. (2018), “Why fintechs cooperate with banks—evidence from germany”, *Zeitschrift für die gesamte Versicherungswissenschaft*, Vol. 107 No. 4, pp. 359–386.

Boot, A.W.A. and Thakor, A.V. (2000), “Can relationship banking survive competition?”, *Journal of Finance*, Vol. 55 No. 2, pp. 679–713.

Boreiko, D. and Sahdev, N.K. (2018), “To ICO or not to ICO – Empirical analysis of Initial Coin Offerings and Token Sales”, available at: https://ssrn.com/abstract=3209180 (accessed 10 March 2020).

Borri, N. and Shakhnov, K. (2019), "Regulation Spillovers across Cryptocurrency Markets", available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3343696 (accessed 10 March 2020).

Bourreau, M. and Doğan, P. (2001), "Regulation and innovation in the telecommunications industry", *Telecommunications Policy*, Vol. 25 No. 3, pp. 167–184.

Brandl, B. and Hornuf, L. (2017), "Where did Fintechs come from, and where do they go? The transformation of the financial industry in Germany after digitalization", available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3036555 (accessed 10 March 2020).

Breu, S. and Seitz, T.G. (2018), "Legislative Regulations to Prevent Terrorism and Organized Crime from Using Cryptocurrencies and Its Effect on the Economy and Society", available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3081911 (accessed 10 March 2020).

Bunea, S., Kogan, B. and Stolin, D. (2016), "Banks vs fintech: At last, it's official'", *Journal of Financial Transformation*, Vol. 44, pp. 122–131.

Burgmaier, S. and Hüthig, S. (2015), "Kampf oder Kooperation–Das Verhältnis von jungen Wilden und etablierten Geldinstituten", in *Multi-und Omnichannel-Management in Banken und Sparkassen*, Springer, pp. 101–114.

Buse, A. (1973), "Goodness of Fit in Generalized Least Squares Estimation", *The American Statistician*, Vol. 27 No. 3, pp. 106–108.

Castelfranchi, C. and Falcone, R. (2010), *Trust theory: A socio-cognitive and computational model*, John Wiley & Sons.

CBInsights (2019), "Global Fintech Report Q3 2019", available at: http://ibdi.io/wp-content/uploads/2019/11/CB-Insights_Fintech-Report-Q3-2019.pdf (accessed 10 March 2020).

Cellini, R. and Soci, A. (2002), "Pop competitiveness", *PSL Quarterly Review*, Vol. 55 No. 220, pp. 71–101.

Child, J. (1974), *Management and organization*, Halstead Press, New York.

Chuen, K., Lee, D. and Teo, E.G.S. (2015), "Emergence of fintech and the LASIC principles", *Journal of Financial Perspectives*, Vol. 3 No. 3.

Claessens, S., Frost, J., Turner, G. and Zhu, F. (2018), "Fintech credit markets around the world: size, drivers and policy issues", available at: https://www.bis.org/publ/qtrpdf/r_qt1809e.htm (accessed 10 March 2020).

CNBC (2019), "M-Pesa has completely changed Kenyans' access to financial services, this is how…", available at: https://www.cnbcafrica.com/east-africa/2019/04/03/m-pesa-has-completely-changed-kenyans-access-to-financial-services-this-is-how/ (accessed 10 March 2020).

Cohen, J. (1960), "A coefficient of agreement for nominal scales", *Educational and Psychological Measurement*, Vol. 20 No. 1, pp. 37–46.

Collewaert, V. and Manigart, S. (2016), "Valuation of Angel-Backed companies: The role of investor human capital", *Journal of Small Business Management*, Vol. 54 No. 1, pp. 356–372.

Corea, F. (2015), "What finance can learn from biopharma industry: A transfer of innovation models", *Expert Journal of Finance*, Vol. 3 No. 1, pp. 45–53.

Coval, J.D. and Moskowitz, T.J. (1999), "Home bias at home: Local equity preference in domestic portfolios", *Journal of Finance*, Vol. 54 No. 6, pp. 2045–2073.

Csiszar, E. and Heidrich, G.W. (2006), "The question of reputational risk: perspectives from an industry", *The Geneva Papers on Risk and Insurance-Issues and Practice*, Vol. 31 No. 3, pp. 382–394.

Cumming, D. and Dai, N. (2010), "Local bias in venture capital investments", *Journal of Empirical Finance*, Vol. 17 No. 3, pp. 362–380.

Cumming, D. and Hornuf, L. (2018), *The Economics of Crowdfunding*, Springer.

Cumming, D. and Johan, S. (2010), "Venture capital investment duration", *Journal of Small Business Management*, Vol. 48 No. 2, pp. 228–257.

Cumming, D., Johan, S. and Pant, A. (2019), "Regulation of the Crypto-Economy: Managing Risks, Challenges, and Regulatory Uncertainty", *Journal of Risk and Financial Management*, Vol. 12 No. 3.

Cumming, D. and Schwienbacher, A. (2018), "Fintech venture capital", *Corporate Governance: An International Review*, Vol. 26 No. 5, pp. 374–389.

D'Acunto, F., Prabhala, N. and Rossi, A.G. (2019), "The promises and pitfalls of robo-advising", *Review of Financial Studies*, Vol. 32 No. 5, pp. 1983–2020.

da Gama Silva, P.V.J., Klotzle, M.C., Pinto, A.C.F. and Gomes, L.L. (2019), "Herding behavior and contagion in the cryptocurrency market", *Journal of Behavioral and Experimental Finance*, Vol. 22, pp. 41–50.

Das, T.K. and Teng, B.-S. (2000), "A resource-based theory of strategic alliances", *Journal of Management*, Vol. 26 No. 1, pp. 31–61.

Delgado, M., Ketels, C., Porter, M.E. and Stern, S. (2012), "The determinants of national competitiveness", available at: https://www.nber.org/papers/w18249 (accessed 10 March 2020).

Delgado, M., Porter, M.E. and Stern, S. (2010), "Clusters and entrepreneurship", *Journal of Economic Geography*, Vol. 10 No. 4, pp. 495–518.

Deng, H., Huang, R.H. and Wu, Q. (2018), "The Regulation of Initial Coin Offerings in China: Problems, Prognoses and Prospects", *European Business Organization Law Review*, Vol. 19 No. 3, pp. 465–502.

Deutsche Bank Research (2014), "FinTech 2.0: Creating new opportunities through strategic alliance", available at: http://cib.db.com/insights-and-initiatives/white-papers/FinTech_2_0_Creating_new_opportunities_through_strategic_alliance.htm (accessed 10 March 2020).

Dierickx, I. and Cool, K. (1989), "Asset stock accumulation and sustainability of competitive advantage", *Management Science*, Vol. 35 No. 12, pp. 1504–1511.

Dorfleitner, G., Hornuf, L., Schmitt, M. and Weber, M. (2017), *The FinTech Market in Germany*, Springer.

Douglas, J.L. (2016), "New wine into old bottles: Fintech meets the bank regulatory world", available at: https://scholarship.law.unc.edu/cgi/viewcontent.cgi?article=1391&context=ncbi (accessed 10 March 2020).

Drasch, B.J., Schweizer, A. and Urbach, N. (2018), "Integrating the 'Troublemakers': A taxonomy for cooperation between banks and fintechs", *Journal of Economics and Business*, Vol. 100, pp. 26–42.

Drees, J.M. and Heugens, P.P. (2013), "Synthesizing and extending resource dependence theory: A meta-analysis", *Journal of Management*, Vol. 39 No. 6, pp. 1666–1698.

Duschek, S. (2004), "Inter-firm resources and sustained competitive advantage", *Management Revue*, Vol. 15 No. 1, pp. 53–73.

Dushnitsky, G. (2006), *Corporate venture capital: Past evidence and future directions*, Oxford University Press, Oxford.

Edwards, F.R., Hanley, K., Litan, R. and Weil, R.L. (2019), "Crypto Assets Require Better Regulation: Statement of the Financial Economists Roundtable on Crypto Assets", *Financial Analysts Journal*, Vol. 75 No. 2, pp. 14–19.

Eisenhardt, K.M. (1989), "Building theories from case study research", *Academy of Management Review*, Vol. 14 No. 4, pp. 532–550.

Eisenhardt, K.M. and Graebner, M.E. (2007), "Theory building from cases: Opportunities and challenges", *Academy of Management Journal*, Vol. 50 No. 1, pp. 25–32.

Elsas, R. and Krahnen, J.P. (1998), "Is relationship lending special? Evidence from credit-file data in Germany", *Journal of Banking & Finance*, Vol. 22 10-11, pp. 1283–1316.

Ernst & Young (2016), "UK FinTech: On the cutting edge: An evaluation of the international FinTech sector", available at: https://fintechauscensus.ey.com/2018/Documents/EY-UK-FinTech-On-the-cutting-edge.pdf (accessed 10 March 2020).

Ernst & Young (2017), "Germany FinTech Landscape", available at: https://www.ey.com/Publication/vwLUAssets/EY-capital-markets-innovation-and-

the-finTech-landscape/$FILE/EY-capital-markets-innovation-and-the-fintech-landscape.pdf (accessed 10 March 2020).

EY (2019), "Global FinTech Adoption Index 2019", available at: https://fintechauscensus.ey.com/2019/Documents/ey-global-fintech-adoption-index-2019.pdf (accessed 10 March 2020).

Ferreira, P. and Pereira, É. (2019), "Contagion Effect in Cryptocurrency Market", *Journal of Risk and Financial Management*, Vol. 12 No. 3, pp. 115–123.

Findexable (2019), "The Global Fintech Index 2020", available at: https://findexable.com/wp-content/uploads/2019/12/Findexable_Global-Fintech-Rankings-2020exSFA.pdf (accessed 10 March 2020).

Firth, L. and Mellor, D. (1999), "The impact of regulation on innovation", *European Journal of Law and Economics*, Vol. 8 No. 3, pp. 199–205.

Fisch, C. (2019), "Initial coin offerings (ICOs) to finance new ventures", *Journal of Business Venturing*, Vol. 34 No. 1, pp. 1–22.

Florida, R. and Smith Jr, D.F. (1990), "Venture capital, innovation, and economic developmemt", *Economic Development Quarterly*, Vol. 4 No. 4, pp. 345–360.

Florida, R. and Smith Jr, D.F. (1993), "Venture capital formation, investment, and regional industrialization", *Annals of the Association of American Geographers*, Vol. 83 No. 3, pp. 434–451.

Fougner, T. (2008), "Neoliberal governance of states: the role of competitiveness indexing and country benchmarking", *Millennium*, Vol. 37 No. 2, pp. 303–326.

Friedman, J.J. (1995), "The effects of industrial structure and resources upon the distribution of fast-growing small firms among US urbanised areas", *Urban Studies*, Vol. 32 No. 6, pp. 863–883.

Fritsch, M. and Schilder, D. (2012), "The regional supply of venture capital: Can syndication overcome bottlenecks?", *Economic Geography*, Vol. 88 No. 1, pp. 59–76.

Fry, J. and Cheah, E.-T. (2016), "Negative bubbles and shocks in cryptocurrency markets", *International Review of Financial Analysis*, Vol. 47, pp. 343–352.

Gans, J.S., Hsu, D.H. and Stern, S. (2002), "When does start-up innovation spur the gale of creative destruction?", *Rand Journal of Economics*, Vol. 33 No. 4, pp. 571–586.

Gazel, M. and Schwienbacher, A. (2019), "Entrepreneurial Fintech Clusters", available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3309067 (accessed 10 March 2020).

Ghazawneh, A. and Henfridsson, O. (2015), "A paradigmatic analysis of digital application marketplaces", *Journal of Information Technology*, Vol. 30 No. 3, pp. 198–208.

Ginsberg, A., Hasan, I. and Tucci, C.L. (2011), "Unpacking the effects of corporate venture capital investor ties on the reduction of price discounting among IPO firms", *Entrepreneurship Research Journal*, Vol. 1 No. 2.

Gioia, D.A. and Chittipeddi, K. (1991), "Sensemaking and sensegiving in strategic change initiation", *Strategic Management Journal*, Vol. 12 No. 6, pp. 433–448.

Glaser, B.G., Strauss, A.L. and Strutzel, E. (1967), *The discovery of grounded theory; strategies for qualitative research*, Routledge.

Gompers, P. and Lerner, J. (2001), "The venture capital revolution", *Journal of Economic Perspectives*, Vol. 15 No. 2, pp. 145–168.

Grant, R.M. (1996), "Toward a knowledge-based theory of the firm", *Strategic Management Journal*, Vol. 17 No. 2, pp. 109–122.

Gulati, R. (1998), "Alliances and networks", *Strategic Management Journal*, Vol. 19 No. 4, pp. 293–317.

Gulati, R. (1999), "Network location and learning: The influence of network resources and firm capabilities on alliance formation", *Strategic Management Journal*, Vol. 20 No. 5, pp. 397–420.

Gulati, R., Lavie, D. and Madhavan, R.R. (2011), "How do networks matter? The performance effects of interorganizational networks", *Research in Organizational Behavior*, Vol. 31, pp. 207–224.

Haddad, C. and Hornuf, L. (2019), "The emergence of the global fintech market: Economic and technological determinants", *Small Business Economics*, Vol. 53 No. 1, pp. 81–105.

Halawi, L.A., Aronson, J.E. and McCarthy, R.V. (2005), "Resource-based view of knowledge management for competitive advantage", *Electronic Journal of Knowledge Management*, Vol. 3 No. 2, pp. 75–86.

Hellmann, T. (2002), "A theory of strategic venture investing", *Journal of Financial Economics*, Vol. 64 No. 2, pp. 285–314.

Hervás-Oliver, J.L. and Albors-Garrigós, J. (2007), "Do clusters capabilities matter? An empirical application of the resource-based view in clusters", *Entrepreneurship & Regional Development*, Vol. 19 No. 2, pp. 113–136.

Hillman, A.J., Withers, M.C. and Collins, B.J. (2009), "Resource dependence theory: A review", *Journal of Management*, Vol. 35 No. 6, pp. 1404–1427.

Hornuf, L., Klus, M., Lohwasser, T. and Schwienbacher, A. (2018), "How do banks interact with fintechs? Forms of alliances and their impact on bank value", available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3252318 (accessed 10 March 2020).

Hornuf, L. and Schwienbacher, A. (2017), "Should securities regulation promote equity crowdfunding?", *Small Business Economics*, Vol. 49 No. 3, pp. 579–593.

Howell, S., Niessner, M. and Yermack, D. (2018), "Initial Coin Offerings: Financing Growth with Cryptocurrency Token Sales", available at: http://www.nber.org/papers/w24774 (accessed 10 March 2020).

Huang, W., Meoli, M. and Vismara, S. (2019), "The geography of initial coin offerings", *Small Business Economics*, Vol. 40 No. 1, pp. 1–26.

Huggins, R. and Johnston, A. (2010), "Knowledge flow and inter-firm networks: The influence of network resources, spatial proximity and firm size", *Entrepreneurship & Regional Development*, Vol. 22 No. 5, pp. 457–484.

Hughes, L., Dwivedi, Y.K., Misra, S.K., Rana, N.P., Raghavan, V. and Akella, V. (2019), "Blockchain research, practice and policy: Applications, benefits,

limitations, emerging research themes and research agenda", *International Journal of Information Management*, Vol. 49, pp. 114–129.

Huynh, T.L.D. (2019), "Spillover Risks on Cryptocurrency Markets: A Look from VAR-SVAR Granger Causality and Student'st Copulas", *Journal of Risk and Financial Management*, Vol. 12 No. 2, pp. 1–19.

Jabareen, Y. (2009), "Building a conceptual framework: philosophy, definitions, and procedure", *International Journal of Qualitative Methods*, Vol. 8 No. 4, pp. 49–62.

Jakšič, M. and Marinč, M. (2015), "The future of banking: The role of information technology", *Bančni Vestnik*, Vol. 64 No. 11, pp. 68–73.

John St, C. and Pouder, R.W. (2006), "Technology clusters versus industry clusters: resources, networks, and regional advantages", *Growth and Change*, Vol. 37 No. 2, pp. 141–171.

Johnson, W.C. and Yi, S. (2019), "Governance in the absence of regulation: a study of Initial Coin Offerings", available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3337096 (accessed 10 March 2020).

Kaal, W.A. (2018), "Initial Coin Offerings: The top 25 jurisdictions and their comparative regulatory responses", available at: http://www.financeestonia.ee/wp-content/uploads/2018/03/ICO-TOP-25-JURISDICTIONS.pdf (accessed 10 March 2020).

Kalmykova, E., Ryabova, A., Ardashkin, I. and Martyushev, N. (2016), "Fintech market development perspectives", available at: https://www.shs-conferences.org/articles/shsconf/pdf/2016/06/shsconf_rptss2016_01051.pdf (accessed 10 March 2020).

Kamps, J. and Kleinberg, B. (2018), "To the moon: defining and detecting cryptocurrency pump-and-dumps", *Crime Science*, Vol. 7, pp. 1–18.

Keil, T. (2000), *External corporate venturing: cognition, speed, and capability development*, Helsinki.

Keil, T., Maula, M.V.J. and Wilson, C. (2010), "Unique resources of corporate venture capitalists as a key to entry into rigid venture capital syndication networks", *Entrepreneurship Theory and Practice*, Vol. 34 No. 1, pp. 83–103.

Kelly, M.J., Schaan, J.-L. and Joncas, H. (2000), "Collaboration between technology entrepreneurs and large corporations: Key design and management issue", *Journal of Small Business Strategy*, Vol. 11 No. 2, pp. 60–76.

Kitson, M., Martin, R. and Tyler, P. (2004), "Regional competitiveness: an elusive yet key concept?", *Regional Studies*, Vol. 38 No. 9, pp. 991–999.

Klöhn, L., Parhofer, N. and Resas, D. (2018), "Initial Coin Offerings (ICOs) - Economics and Regulation", available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3290882 (accessed 10 March 2020).

Klus, M.F., Lohwasser, T.S., Holotiuk, F. and Moormann, J. (2019), "Strategic alliances between banks and fintechs for digital innovation: Motives to collaborate and types of interaction", *The Journal of Entrepreneurial Finance*, Vol. 21 No. 1, pp. 1–16.

Knight, B. (2017), "Federalism and federalization on the Fintech frontier", available at: https://www.mercatus.org/system/files/mercatus-knight-federalism-fintech-v1.pdf (accessed 10 March 2020).

Koenraadt, J. and Leung, E. (2019), "The Impact of Regulation and Transparency in the Cryptocurrency Market", available at: https://ssrn.com/abstract=3339197 (accessed 10 March 2020).

Kogut, B. (1988), "Joint ventures: Theoretical and empirical perspectives", *Strategic Management Journal*, Vol. 9 No. 4, pp. 319–332.

Kortum, S. and Lerner, J. (2000), "Assessing the contribution of venture capital to innovation", *Rand Journal of Economics*, pp. 674–692.

Koutmos, D. (2018), "Return and volatility spillovers among cryptocurrencies", *Economics Letters*, Vol. 173, pp. 122–127.

KPMG (2017), "The Pulse of Fintech Q3 2017", available at: https://assets.kpmg.com/content/dam/kpmg/de/pdf/Themen/2017/pulse-of-fintech-q3-2017.pdf (accessed 10 March 2020).

KPMG (2018), "The Pulse of Fintech 2018", available at: https://assets.kpmg/content/dam/kpmg/xx/pdf/2019/02/the-pulse-of-fintech-2018.pdf (accessed 10 March 2020).

Kraus, S., Richter, C., Brem, A., Cheng, C.-F. and Chang, M.-L. (2016), "Strategies for reward-based crowdfunding campaigns", *Journal of Innovation & Knowledge*, Vol. 1 No. 1, pp. 13–23.

Krugman, P. (1994), "Competitiveness: a dangerous obsession", *Foreign Affairs*, Vol. 73 No. 2, pp. 28–44.

Krugman, P.R. (1991), *Geography and trade*, MIT press.

Kursh, S.R. and Gold, N.A. (2016), "Adding fintech and blockchain to your curriculum", *Business Education Innovation Journal*, Vol. 8 No. 2, pp. 6–12.

Lacasse, R.M., Lambert, B.A., Osmani, E., Couture, C., Roy, N., Sylvain, J. and Nadeau, F. (2016), "A digital tsunami: FinTech and crowdfunding", available at: http://fintechlab.ca/wp-content/uploads/2016/11/Digital-Tsunami-Site-Web.pdf (accessed 10 March 2020).

Lamond, D., Dwyer, R., Herciu, M. and Ogrean, C. (2008), "Interrelations between competitiveness and responsibility at macro and micro level", *Management Decision*, Vol. 46 No. 8, pp. 1230–1246.

Lavie, D. (2006), "The competitive advantage of interconnected firms: An extension of the resource-based view", *Academy of Management Review*, Vol. 31 No. 3, pp. 638–658.

Lavie, D. (2007), "Alliance portfolios and firm performance: A study of value creation and appropriation in the US software industry", *Strategic Management Journal*, Vol. 28 No. 12, pp. 1187–1212.

Lee, H., Kelley, D., Lee, J. and Lee, S. (2012), "SME survival: The impact of internationalization, technology resources, and alliances", *Journal of Small Business Management*, Vol. 50 No. 1, pp. 1–19.

Lee, I. and Shin, Y.J. (2018), "Fintech: Ecosystem, business models, investment decisions, and challenges", *Business Horizons*, Vol. 61 No. 1, pp. 35–46.

Leong, K. and Sung, A. (2018), "FinTech (financial technology): what is it and how to use technologies to create business value in FinTech way?", *International Journal of Innovation, Management and Technology*, Vol. 9 No. 2, pp. 74–78.

Li, T., Shin, D. and Wang, B. (2019), "Cryptocurrency pump-and-dump schemes", available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3267041 (accessed 10 March 2020).

Lin, Z., Yang, H. and Arya, B. (2009), "Alliance partners and firm performance: resource complementarity and status association", *Strategic Management Journal*, Vol. 30 No. 9, pp. 921–940.

Lockett, A. and Wright, M. (2001), "The syndication of venture capital investments", *Omega*, Vol. 29 No. 5, pp. 375–390.

Long, J.S. and Freese, J. (2001), *Regression models for categorical dependent variables using Stata: First Edition*, Stata Press.

MacKinley, A.C. (1997), "Event Studies in Economics and Finance", *Journal of Economic Literature*, Vol. 35, pp. 13–39.

Magnuson, W. (2018), "Financial regulation in the Bitcoin era", *Stanford Journal of Law, Business & Finance*, Vol. 23 No. 2, pp. 159–209.

Maier, E. (2016), "Supply and demand on crowdlending platforms: connecting small and medium-sized enterprise borrowers and consumer investors", *Journal of Retailing and Consumer Services*, Vol. 33, pp. 143–153.

Makarov, I. and Schoar, A. (2020), "Trading and arbitrage in cryptocurrency markets", *Journal of Financial Economics*, Vol. 135 No. 2, pp. 293–319.

Manigart, S., Wright, M., Lockett, A., Meuleman, M., Landström, H., Bruining, H., Desbrieres, P. and Hommel, U. (2002), "Why do European venture capital companies syndicate?", available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=371048 (accessed 10 March 2020).

Marian, O. (2019), "Blockchain Havens and the Need for Their Internationally-Coordinated Regulation", available at: https://ssrn.com/abstract=3357168 (accessed 10 March 2020).

Maskell, P. and Malmberg, A. (1999a), "Localised learning and industrial competitiveness", *Cambridge journal of economics*, Vol. 23 No. 2, pp. 167–185.

Maskell, P. and Malmberg, A. (1999b), "The Competitiveness of Firms and Regions: 'Ubiquitification'and the Importance of Localized Learning", *European Urban and Regional Studies*, Vol. 6 No. 1, pp. 9–25.

Maskell, P. and Malmberg, A. (2002), "The elusive concept of localization economies: towards a knowledge-based theory of spatial clustering", *Environment and Planning A: Economy and Space*, Vol. 34 No. 3, pp. 429–449.

Maula, M.V.J. (2001), *Corporate venture capital and the value-added for technology-based new firms*, Helsinki.

Maxin, H. (2018), "Corporate Venture Capital im Bankensektor: Eine Fallstudie", *Zeitschrift für KMU und Entrepreneurship (ZfKE)*, Vol. 66 No. 2, pp. 71–89.

McGill, D.H., Sauter, B.J.A. and Barnes, B.D. (2018), "Cryptocurrency Is Borderless—but Still Within the Grip of US Regulators", *International Law Practicum*, Vol. 31 No. 1, p. 11.

Meinert, M.C. (2017), "Making Friends with Fintech", *ABA Banking Journal*, Vol. 109 No. 5, pp. 32–33.

Milanov, H. and Shepherd, D.A. (2013), "The importance of the first relationship: The ongoing influence of initial network on future status", *Strategic Management Journal*, Vol. 34 No. 6, pp. 727–750.

Miles, M.B. and Huberman, A.M. (1994), *Qualitative data analysis: An expanded sourcebook*, CA Sage Publications, London & New Delhi.

Momtaz, P.P. (2018), "Initial Coin Offerings", available at: https://ssrn.com/abstract=3166709 (accessed 10 March 2020).

Moritz, A., Block, J. and Lutz, E. (2015), "Investor communication in equity-based crowdfunding: a qualitative-empirical study", *Qualitative Research in Financial Markets*, Vol. 7 No. 3, pp. 309–342.

Nakamoto, S. (2019), "Bitcoin: A peer-to-peer electronic cash system", available at: https://git.dhimmel.com/bitcoin-whitepaper/ (accessed 10 March 2020).

Nicoletti, B. (2017), *Future of FinTech: Integrating Finance and Technology in Financial Services*, Springer.

NZZ (2018), "Weltweit findet heute jede zweite mobile Geldtransaktion in Kenya statt", available at: https://www.nzz.ch/international/der-weltmarktfuehrer-aus-afrika-ld.1338079 (accessed 10 March 2020).

Oehler, A., Horn, M. and Wendt, S. (2016), "Benefits from social trading? Empirical evidence for certificates on wikifolios", *International Review of Financial Analysis*, Vol. 46, pp. 202–210.

Olafsson, A. and Pagel, M. (2018), "The liquid hand-to-mouth: Evidence from personal finance management software", *Review of Financial Studies*, Vol. 31 No. 11, pp. 4398–4446.

Park, H.D. and Steensma, H.K. (2012), "When does corporate venture capital add value for new ventures?", *Strategic Management Journal*, Vol. 33 No. 1, pp. 1–22.

PayPal (2019), "PayPal Reports First Quarter 2019 Results", available at: https://investor.paypal-corp.com/news-releases/news-release-details/paypal-reports-first-quarter-2019-results (accessed 10 March 2020).

Pedrosa-Garcia, J.A. and Almeida, Y.W. (2018), "Regulation of Cryptocurrencies: Evidence from Asia and the Pacific", available at: https://ideas.repec.org/p/unt/wpmpdd/wp-18-03.html (accessed 10 March 2020).

Peteraf, M.A. (1993), "The cornerstones of competitive advantage: a resource-based view", *Strategic Management Journal*, Vol. 14 No. 3, pp. 179–191.

Pfeffer, J. and Salancik, G.R. (1978), *The external control of organizations: A resource dependence perspective*, New York: Harper & Row.

Philippon, T. (2016), "The fintech opportunity", available at: https://www.nber.org/papers/w22476 (accessed 10 March 2020).

Pietrewicz, L. (2018), "Token-based blockchain financing and governance: A transaction cost approach", available at: http://www.sim.wz.uw.edu.pl/sites/default/files/artykuly/leslaw_pietrewicz_0.pdf (accessed 10 March 2020).

Porter, M.E. (1990), “The competitive advantage of nations”, *Harvard Business Review*, Vol. 68 No. 2, pp. 73–93.

Porter, M.E. (1998), *Clusters and the new economics of competition*, Vol. 6, Harvard Business Review Boston.

Porter, M.E. (2000), “Location, competition, and economic development: Local clusters in a global economy”, *Economic Development Quarterly*, Vol. 14 No. 1, pp. 15–34.

Powell, W.W., Koput, K.W., Bowie, J.I. and Smith-Doerr, L. (2002), “The spatial clustering of science and capital: Accounting for biotech firm-venture capital relationships”, *Regional Studies*, Vol. 36 No. 3, pp. 291–305.

Puschmann, T. (2017), “Fintech”, *Business & Information Systems Engineering*, Vol. 59 No. 1, pp. 69–76.

PWC (2017), *FinTech 2017 – Quo Vadis?, Startup Camp Berlin*, Berlin.

Reuber, A.R. and Fischer, E. (2005), “The company you keep: How young firms in different competitive contexts signal reputation through their customers”, *Entrepreneurship Theory and Practice*, Vol. 29 No. 1, pp. 57–78.

Ridder, H.-G. (2019), *Case study research: Approaches, methods, contribution to theory*, Mering, München.

Rotering, J. (1993), *Zwischenbetriebliche Kooperation als alternative Organisationsform: Ein transaktionskostentheoretischer Erklärungsansatz*, Schäffer-Poeschel.

Rothwell, R. (1983), “Innovation and firm size: a case for dynamic complementarity; or, is small really so beautiful?”, *Journal of General Management*, Vol. 8 No. 3, pp. 5–25.

Santander (2016), “The Fintech 2.0 Paper: Rebooting financial services”, available at: https://santanderinnoventures.com/wp-content/uploads/2015/06/The-Fintech-2-0-Paper.pdf (accessed 10 March 2020).

Sapienza, P. and Zingales, L. (2012), “A trust crisis”, *International Review of Finance*, Vol. 12 No. 2, pp. 123–131.

Schleussner, A.R. (2017), "FinTech und Regulierung–Katalysator oder Hemmstoff?", in *Innovationen und Innovationsmanagement in der Finanzbranche*, Springer, Wiesbaden, pp. 357–364.

Schueffel, P. (2016), "Taming the beast: a scientific definition of fintech", *Journal of Innovation Management*, Vol. 4 No. 4, pp. 32–54.

Scott, A.J. (1983), "Industrial organization and the logic of intra-metropolitan location: I. Theoretical considerations", *Economic Geography*, Vol. 59 No. 3, pp. 233–250.

Seo, J.-H. and Park, E.-M. (2018), "A study on financing security for smartphones using text mining", *Wireless Personal Communications*, Vol. 98 No. 4, pp. 3109–3127.

Shanaev, S., Sharma, S., Ghimire, B. and Shuraeva, A. (2020), "Taming the blockchain beast? Regulatory implications for the cryptocurrency Market", *Research in International Business and Finance*, Vol. 51.

Souitaris, V. and Zerbinati, S. (2014), "How do corporate venture capitalists do deals? An exploration of corporate investment practices", *Strategic Entrepreneurship Journal*, Vol. 8 No. 4, pp. 321–348.

Spulber, D.F. (2008), "Unlocking technology: Antitrust and innovation", *Journal of Competition Law and Economics*, Vol. 4 No. 4, pp. 915–966.

Statista (2020), "Number of Fintech startups worldwide from 2018 to 2020, by region", available at: https://www.statista.com/statistics/893954/number-fintech-startups-by-region/ (accessed 20 March 2020).

Steinle, C. and Schiele, H. (2008), "Limits to global sourcing?: Strategic consequences of dependency on international suppliers: Cluster theory, resource-based view and case studies", *Journal of Purchasing and Supply Management*, Vol. 14 No. 1, pp. 3–14.

Stinchcombe, A.L. (1965), "Social structure and organizations", *Handbook of Organizations*, Vol. 7, pp. 142–193.

Storper, M. (1997), *The regional world: territorial development in a global economy*, Guilford press.

Stuart, T.E., Hoang, H. and Hybels, R.C. (1999), "Interorganizational endorsements and the performance of entrepreneurial ventures", *Administrative Science Quarterly*, Vol. 44 No. 2, pp. 315–349.

Teigland, R., Siri, S., Larsson, A., Puertas, A.M. and Bogusz, C.I. (2018), *The Rise and Development of FinTech: Accounts of Disruption from Sweden and Beyond*, Routledge.

Temelkov, Z. (2018), "Fintech firms opportunity or threat for banks?", *International Journal of Information, Business and Management*, Vol. 10 No. 1, pp. 137–143.

Teppo, T. and Wüstenhagen, R. (2009), "Why corporate venture capital funds fail–evidence from the European energy industry", *World Review of Entrepreneurship, Management and Sustainable Development*, Vol. 5 No. 4, pp. 353–375.

Thomas, L.G. (2018), "The Case for a Federal Regulatory Sandbox for Fintech Companies", *North Carolina Banking Institute*, Vol. 22, pp. 257–281.

Thwaits, C.R. (2016), "Unicorns and Fortresses: The barriers and enablers to effective fintech start-up collaboration with South African Banks", Gordon Institute of Business Science, University of Pretoria, 2016.

Tiberius, V. and Rasche, C. (2017), "Disruptive Geschäftsmodelle von FinTechs: Grundlagen, Trends und Strategieüberlegungen", in *FinTechs*, Springer, pp. 1–25.

Tyson, L.D.'A. (1993), *Who's bashing whom?: trade conflict in high-technology industries*, Peterson Institute.

van Auken, H. (2002), "A Model of Community–Based Venture Capital Formation To Fund Early–Stage Technology–Based Firms", *Journal of Small Business Management*, Vol. 40 No. 4, pp. 287–301.

Verwaal, E., Bruining, H., Wright, M., Manigart, S. and Lockett, A. (2010), "Resources access needs and capabilities as mediators of the relationship between VC firm size and syndication", *Small Business Economics*, Vol. 34 No. 3, pp. 277–291.

Weber, C. and Weber, B. (2011), "Exploring the antecedents of social liabilities in CVC triads—A dynamic social network perspective", *Journal of Business Venturing*, Vol. 26 No. 2, pp. 255–272.

Wernerfelt, B. (1984), "A resource-based view of the firm", *Strategic Management Journal*, Vol. 5 No. 2, pp. 171–180.

West, G.P. and Noel, T.W. (2009), "The impact of knowledge resources on new venture performance", *Journal of Small Business Management*, Vol. 47 No. 1, pp. 1–22.

Wiewel, W. and Hunter, A. (1985), "The interorganizational network as a resource: A comparative case study on organizational genesis", *Administrative Science Quarterly*, pp. 482–496.

World Bank (2018), *The Global Findex database 2017: Measuring financial inclusion and the fintech revolution*, World Bank, Washington D.C.

World Economic Forum (2019), "The Global Competitiveness Report 2019", available at: http://www3.weforum.org/docs/WEF_TheGlobalCompetitivenessReport2019.pdf (accessed 10 March 2020).

Wurgler, J. (2000), "Financial markets and the allocation of capital", *Journal of Financial Economics*, Vol. 58 No. 1, pp. 187–214.

Yi, S., Xu, Z. and Wang, G.-J. (2018), "Volatility connectedness in the cryptocurrency market: Is Bitcoin a dominant cryptocurrency?", *International Review of Financial Analysis*, Vol. 60, pp. 98–114.

Yin, R.K. (2017), *Case study research and applications: Design and methods*, Sage publications.

York, J.G. and Lenox, M.J. (2014), "Exploring the sociocultural determinants of de novo versus de alio entry in emerging industries", *Strategic Management Journal*, Vol. 35 No. 13, pp. 1930–1951.

Zavolokina, L., Dolata, M. and Schwabe, G. (2016), "The FinTech phenomenon: antecedents of financial innovation perceived by the popular press", *Financial Innovation*, Vol. 2 No. 1.

Zingales, L. (2000), "In search of new foundations", *Journal of Finance*, Vol. 55 No. 4, pp. 1623–1653.

Zook, M.A. (2002), “Grounded capital: venture financing and the geography of the Internet industry, 1994–2000”, *Journal of Economic Geography*, Vol. 2 No. 2, pp. 151–177.

Appendix

Table A.1 Variable definitions and data sources.

Dependent variables	
Number of Fintech VC transactions	The annual number of VC transactions in fintech companies at the county level for the period 2003-2015 Source: Thomson Reuters Eikon
Amount of VC transactions *(only used in cross sectional model)*	The amount of VC transactions [USD Mil] in fintech companies at the firm level for the period 2003-2015 Source: Thomson Reuters Eikon
Business education sector	
Colleges and universities	The annual number of establishments in "Colleges, Universities, and Professional Schools" (NAICS 611310) at the county level for the period 2003-2015 Source: County Business Patterns
Computer education	The annual number of establishments in "Computer Training" (NAICS 611420) at the county level for the period 2003-2015 Source: County Business Patterns
Management education	The annual number of establishments in "Professional and Management Development Training" (NAICS 611430) at the county level for the period 2003-2015 Source: County Business Patterns
Investors base	
L3.Funds founded	The annual number of founded funds at the county level lagged by three years Source: Thomson Reuters Eikon
L3.Software funds founded	The annual number of founded funds with the industry focus "Internet Specific" or "Computer Software and Services" at the county level lagged by three years Source: Thomson Reuters Eikon
L3.Bank funds founded	The annual number of founded funds with the investor type "Investment Bank" at the county level lagged by three years Source: Thomson Reuters Eikon
Wireless telecom. industry	
Wireless telecommunication companies	The annual number of establishments in "Wireless Telecommunications Carriers" (NAICS 517210) at the county level for the period 2003-2015 Source: County Business Patterns
Finance industry	
Large financial companies	The annual number of establishments in "Finance and Insurance" (NAICS 52----) with more than 100 employees at the county level for the period 2003-2015 Source: County Business Patterns
Large banks	The annual number of establishments in "Credit Intermediation and Related Activities" (NAICS 522///) with more than 100 employees at the county level for the period 2003-2015 Source: County Business Patterns
Software technology industry	
Software technology companies	The annual number of establishments in "Software Publishers" (NAICS 511210), "Internet Publishing and Broadcasting and Web Search Portals" (NAICS 519130), and "Data Processing, Hosting, and Related Services" (NAICS 518210) at the county level for the period 2003-2015 Source: County Business Patterns
Data processing companies	The annual number of establishments in "Data Processing, Hosting, and Related Services" (NAICS 518210) at the county level for the period 2003-2015 Source: County Business Patterns
County control variables	
Other VC transactions	The annual number of VC transactions for all companies (excluding the fintech companies used in our analysis) at the county level for the period 2003-2015

	Source: Thomson Reuters Eikon
Population	The annual county population for the period 2003-2015 Source: U.S. Bureau of Economic Analysis
Income per capita	The annual sum of personal income (thousands of dollars) at the county level divided by the county population for the period 2003-2015 Source: U.S. Bureau of Economic Analysis
Unemployment rate	The annual unemployment rate at the county level for the period 2003-2015 Source: U.S. Local Area Unemployment Statistics
Patents	The annual number of patents at the county level for the period 2003-2015 Source: U.S. Patent And Trademark Office
Transaction control variables ***(only used in cross sectional model)***	
Company investment stage	The high level company stage at the round date that is also known as company investment stage 1 Source: Thomson Reuters Eikon
Age at financing in month	The age of the fintech company (in months) at the time of its VC financing in relation to its founded date Source: Thomson Reuters Eikon
Round number	The numerical order of the investment (round) made into the fintech company Source: Thomson Reuters Eikon
No. of funds at investment date	The number of VC firms that invest in the fintech company at the investment date Source: Thomson Reuters Eikon

Table A.2 Summary statistics for panel regressions.

This table presents summary statistics of variables used in the negative binominal panel regressions on the county level. Statistics are shown for the full sample of 2,918 counties, the subsample of counties that witness at least one VC transaction in a fintech company from 01/01/2003 to 12/31/ 2015, and the subsample of counties that do not witness any VC transaction in a fintech company for the considered period. All the variables are defined in Table A.1. The table also reports p-values of differences in mean tests for the two subsamples.

Variables	Full sample								Fintech	No fintech	Fintech vs. no fintech
	Obs.	Mean	Min (overall)	Max (overall)	75th percentile	Std. Dev. (overall)	Std. Dev. (between)	Std. Dev. (within)	Mean	Mean	p-value
Dependent variable											
Number of fintech VC transactions	37885	0.19	0	285	0	3.33	2.69	1.97	3.28	0	--
Business education sector											
Ln(Colleges and universities +1)	37885	0.37	0	5.28	0.70	0.72	0.71	0.14	2.23	0.26	0.0000
Ln(Computer education+1)	37885	0.21	0	4.50	0	0.56	0.53	0.17	1.79	0.11	0.0000
Ln(Management education+1)	37885	0.41	0	5.18	0.70	0.80	0.78	0.21	2.59	0.27	0.0000
Investor base											
Ln(L3.Funds founded+1)	37885	0.04	0	5.19	0	0.28	0.25	0.11	0.65	0.01	0.0000
Ln(L3.Software funds founded+1)	37885	0.01	0	3.64	0	0.13	0.10	0.07	0.19	0.00	0.0000
Ln(L3.Bank funds founded+1)	37885	0.01	0	3.80	0	0.08	0.06	0.05	0.08	0.00	0.0000
Finance industry											
Ln(Large financial companies+1)	37885	0.39	0	6.22	0	0.88	0.87	0.15	2.86	0.24	0.0000
Ln(Large banks+1)	37885	0.27	0	5.02	0	0.67	0.65	0.15	2.12	0.15	0.0000
Wireless telecommunication industry											
Ln(Wireless telecommunication comp.+1)	37885	0.77	0	5.94	1.39	1.04	1.01	0.24	3.19	0.61	0.0000
Software technology industry											
Ln(Software technology comp.+1)	37885	0.85	0	7.21	1.10	1.24	1.21	0.27	4.12	0.64	0.0000
Ln(Data processing companies +1)	37885	0.66	0	6.28	1.10	1.06	1.03	0.27	3.47	0.48	0.0000
Control variables											
Ln(Other VC transactions+1)	37885	0.23	0	7.68	0	0.81	0.77	0.26	2.57	0.08	0.0000
Ln(Population)	37885	10.41	6.41	16.13	11.20	1.38	1.38	0.04	13.17	10.23	0.0000
Income per capita	37885	33.73	11.75	199.81	37.83	10.12	8.62	5.34	47.11	32.88	0.0000
Unemployment rate	37885	6.72	1.1	28.90	8.30	2.79	2.07	1.88	6.09	6.76	0.0000
Ln(Patents+1)	37885	1.41	0	9.61	2.20	1.61	1.56	0.41	5.10	1.18	0.0000

Table A.3 Correlation matrix for panel regressions.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1) Number of fintech VC transactions	1.0000																
(2) Ln(Other VC transactions+1)	0.3777	1.0000															
(3) Ln(Population)	0.1485	0.5533	1.0000														
(4) Income per capita	0.2237	0.3729	0.2157	1.0000													
(5) Unemployment rate	-0.0149	-0.0722	0.0660	-0.2396	1.0000												
(6) Ln(Patents+1)	0.1891	0.6476	0.8196	0.4209	-0.0802	1.0000											
(7) Ln(Colleges and universities +1)	0.2364	0.6945	0.7221	0.3225	-0.0410	0.7119	1.0000										
(8) Ln(Computer education+1)	0.2609	0.7694	0.6575	0.3390	-0.0696	0.7110	0.7612	1.0000									
(9) Ln(Management education+1)	0.2405	0.7465	0.7318	0.4200	-0.0631	0.7818	0.7888	0.8095	1.0000								
(10) Ln(L3.Funds founded+1)	0.5051	0.7111	0.3717	0.3083	-0.0359	0.4326	0.5357	0.5971	0.5514	1.0000							
(11) Ln(L3.Software funds founded+1)	0.5816	0.5204	0.2394	0.2423	-0.0224	0.2875	0.3588	0.4058	0.3712	0.7760	1.0000						
(12) Ln(L3.Bank funds founded+1)	0.4294	0.3395	0.1664	0.1868	-0.0124	0.1871	0.2629	0.3011	0.2631	0.5864	0.5771	1.0000					
(13) Ln(Large financial companies+1)	0.2498	0.7523	0.7144	0.3700	-0.0764	0.7401	0.8141	0.8117	0.8224	0.5783	0.3821	0.2936	1.0000				
(14) Ln(Large banks+1)	0.2574	0.7359	0.6748	0.3382	-0.0709	0.6920	0.7850	0.7930	0.7880	0.5847	0.3900	0.3015	0.9580	1.0000			
(15) Ln(Wireless telecomm. comp.+1)	0.1818	0.6363	0.8354	0.2974	-0.0484	0.7775	0.7789	0.7396	0.7871	0.4454	0.2900	0.2059	0.8077	0.7734	1.0000		
(16) Ln(Software technology comp. +1)	0.2310	0.7297	0.8135	0.4040	-0.0968	0.8465	0.7982	0.8029	0.8631	0.5172	0.3476	0.2388	0.8406	0.7999	0.8457	1.0000	
(17) Ln(Data processing companies + 1)	0.2303	0.7311	0.7921	0.3757	-0.1036	0.8155	0.7991	0.8090	0.8508	0.5247	0.3512	0.2442	0.8492	0.8133	0.8406	0.9733	1.0000

Table A.4 Drivers of VC investments in fintech companies.

The table reports the results of negative binominal panel regressions with random effects on the number of VC transactions in fintech companies on county level in the US during the period 2003-2015. All variables are defined in Table A.1. To account for the skewness of the independent variables, we applied ln transformation to normalize the data. ***, **, * denote significance at the 0.1, 1 and 5 percent level, respectively.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Business education sector:											
Ln(Colleges and universities +1)	0.199*										
Ln(Computer education+1)		0.290***									
Ln(Management education+1)			0.530***								
Investor base:											
Ln(L3.Funds founded+1)				0.0756							
Ln(L3.Software funds founded+1)					-0.0204						
Ln(L3.Bank funds founded+1)						0.0226					
Finance industry:											
Ln(Large financial companies+1)							0.560***				
Ln(Large banks+1)								0.449***			
Telecommunication industry:											
Ln(Wireless telecommunication comp.+1)									0.344**		
Software technology industry:											
Ln(Software technology comp.+1)										1.279***	
Ln(Data processing companies +1)											0.911***
Control variables:											
Ln(Other VC transactions+1)	0.606***	0.601***	0.550***	0.610***	0.634***	0.631***	0.552***	0.585***	0.607***	0.405***	0.510***
Ln(Population)	0.732***	0.734***	0.566***	0.895***	0.904***	0.906***	0.338**	0.496***	0.602***	-0.000561	0.206
Income per capita	0.0157***	0.0158***	0.0153***	0.0161***	0.0169***	0.0166***	0.0113***	0.0141***	0.0161***	0.00549	0.00997***
Unemployment rate	-0.0558*	-0.0432	-0.0428	-0.0562*	-0.0552*	-0.0560*	-0.0362	-0.0255	-0.0474	0.00363	-0.00419
Ln(Patents+1)	0.184**	0.143*	0.120*	0.153*	0.152*	0.150*	0.239***	0.230***	0.155**	-0.0673	0.0678
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	-14.57***	-14.67***	-12.90***	-16.29***	-16.36***	-16.39***	-10.76***	-12.34***	-13.51***	-8.056***	-9.752***
Wald χ^2	2380.86	2421.70	2427.72	2387.53	2364.90	2362.53	2520.18	2510.55	2383.67	2515.66	2527.41
Prob. > χ^2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
Observations	37885	37885	37885	37885	37885	37885	37885	37885	37885	37885	37885
Max VIF	4.28	4.37	4.48	4.27	4.26	4.27	4.33	4.28	4.96	5.58	4.65
Mean VIF	2.62	2.69	2.82	2.51	2.29	2.20	2.75	2.63	2.96	3.23	3.02

Table A.5 Summary statistics for cross sectional regressions.

This table presents summary statistics of variables used in the pooled cross sectional regressions. Statistics are shown for all transactions in fintech companies from 01/01/2003 to 01/31/ 2015. All the variables are defined in Table A.1.

	Obs.	Mean	Min	Max	Median	Std. Dev.
Dependent variable						
Transaction amount	6650	4.02	0.001	700.00	1.57	14.84
Business education sector						
Ln(Colleges and universities+1)	6650	3.30	0.00	5.28	3.40	0.97
Investor base						
Ln(L3.Funds founded+1)	6650	2.47	0.00	5.19	2.89	1.40
Finance industry						
Ln(Large financial companies+1)	6650	4.18	0.00	6.22	4.18	1.20
Wireless telecommunication industry						
Ln(Wireless telecom. comp.+1)	6650	4.03	0.00	5.94	4.01	0.78
Software technology industry						
Ln(Software technology comp.+1)	6650	5.79	0.00	7.21	5.96	1.02
Transaction control variables:						
Age at financing in month	6650	72.26	0	1131	52.00	72.26
Round number	6650	3.52	1	20	3.00	2.60
No. of funds at investment date	6650	4.05	1	15	4.00	2.50
County control variables						
Ln(Population)	6650	13.93	9.44	16.13	13.80	0.76
Income per capita	6650	72.58	20.82	153.50	62.65	31.11
Unemployment rate	6650	6.02	2.50	13.80	5.50	2.03
Ln(Patents+1)	6650	6.67	0.00	9.61	6.68	1.32

Table A.6 Correlation matrix for pooled cross-sectional regressions.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1) Amount of VC transaction in fintech	1.0000														
(2) Ln(Population)	0.0228	1.0000													
(3) Income per capita	0.0153	0.0536	1.0000												
(4) Unemployment rate	-0.0330	0.3396	-0.0920	1.0000											
(5) Ln(Patents+1)	-0.0165	0.5643	0.2329	0.0892	1.0000										
(6) Age at financing in month	0.0541	0.0493	-0.1234	-0.0220	-0.0539	1.0000									
(7) Round number	0.0440	-0.0095	-0.0382	0.0297	0.0927	0.2774	1.0000								
(8) No. of funds at investment date	-0.0298	0.0261	0.1620	-0.0554	0.1998	-0.0295	0.1513	1.0000							
(9) Ln(Colleges and universities+1)	0.0341	0.7995	0.4200	0.3135	0.3739	-0.0449	-0.0839	0.0637	1.0000						
(10) Ln(L3.Funds founded+1)	0.0134	0.3963	0.6830	0.1388	0.4843	-0.1302	-0.0249	0.1793	0.6193	1.0000					
(11) Ln(Large financial companies+1)	0.0444	0.6012	0.5592	0.1682	0.1291	-0.0426	-0.0966	0.0074	0.8420	0.6327	1.0000				
(13) Ln(Wireless telecom. comp.+1)	0.0329	0.9140	0.1938	0.2277	0.4746	0.0222	-0.0188	0.0135	0.8330	0.4673	0.7231	1.0000			
(14) Ln(Software technology comp.+1)	0.0240	0.6994	0.5834	0.1184	0.7038	-0.0984	-0.0183	0.1922	0.7938	0.7723	0.6869	0.7385	1.0000		

Table A.7 Top 100 US counties by the number of VC transactions in fintech companies.

Rank	County	Transactions		Rank	County	Transac-tions
1	San Francisco, CA	1162		51	Hartford, CT	22
2	New York, NY	1092		52	Hennepin, MN	21
3	Santa Clara, CA	630		53	Miami-Dade, FL	21
4	San Mateo, CA	480		54	Hudson, NJ	19
5	Los Angeles, CA	295		55	Anoka, MN	19
6	Travis, TX	248		56	Allegheny, PA	19
7	King, WA	200		57	Tompkins, NY	19
8	Cook, IL	178		58	Delaware, PA	18
9	Middlesex, MA	163		59	Essex, NJ	18
10	Suffolk, MA	159		60	Essex, MA	18
11	Fulton, GA	156		61	Suffolk, NY	18
12	Alameda, CA	98		62	Baltimore (Independent City), MD	18
13	Orange, CA	84		63	Douglas, NE	17
14	Denver, CO	83		64	Norfolk, MA	15
15	Marin, CA	81		65	Sonoma, CA	14
16	Montgomery, MD	68		66	Denton, TX	14
17	Multnomah, OR	57		67	Broward, FL	14
18	Fairfax, Fairfax City + Falls Church, VA*	56		68	Polk, IA	13
19	Cobb, GA	55		69	Somerset, NJ	12
20	New Castle, DE	53		70	Chester, PA	12
21	Philadelphia, PA	52		71	Santa Barbara, CA	12
22	Mecklenburg, NC	47		72	Troup, GA	12
23	Contra Costa, CA	46		73	San Bernardino, CA	11
24	San Diego, CA	45		74	Pinellas, FL	10
25	District of Columbia, DC	45		75	Wake, NC	10
26	Morris, NJ	41		76	Hamilton, OH	10
27	Durham, NC	39		77	Jefferson, AL	10
28	Baltimore, MD	38		78	Bucks, PA	10
29	Johnson, KS	38		79	Kings, NY	10
30	Mercer, NJ	38		80	Providence, RI	10
31	Cuyahoga, OH	38		81	Jefferson, KY	10
32	New Haven, CT	38		82	Monongalia, WV	10
33	Dallas, TX	36		83	Clark, NV	9
34	Williamson, TN	34		84	Brevard, FL	9
35	Orange, FL	32		85	St. Johns, FL	9
36	Harris, TX	32		86	Nassau, NY	9
37	Salt Lake, UT	30		87	Henrico, VA	9
38	Sacramento, CA	28		88	Wayne, MI	9
39	Palm Beach, FL	28		89	Erie, NY	9
40	Cumberland, ME	28		90	Fayette, KY	9
41	Arapahoe, CO	27		91	Westchester, NY	8
42	Fairfield, CT	26		92	Howard, MD	8
43	Hillsborough, FL	26		93	Rockingham, NH	8
44	Montgomery, PA	26		94	Virginia Beach (Independent City), VA	8
45	DeKalb, GA	25		95	Anne Arundel, MD	8
46	Davidson, TN	25		96	Washoe, NV	8
47	Collin, TX	24		97	Worcester, MA	7
48	Utah, UT	24		98	Muscogee, GA	7
49	Bergen, NJ	23		99	Ingham, MI	7
50	Maricopa, AZ	22		100	Franklin, OH	7

Table A.8 Top 100 US counties by VC volume [USD Mil] invested in fintech companies.

Rank	County	VC volume		Rank	County	VC volume
1	San Francisco, CA	6280.30		51	Cumberland, ME	72.26
2	New York, NY	5680.12		52	Hennepin, MN	71.89
3	Santa Clara, CA	1520.99		53	Duval, FL	69.89
4	San Mateo, CA	1487.40		54	Wake, NC	65.06
5	Cook, IL	1353.92		55	Miami-Dade, FL	62.57
6	King, WA	1290.99		56	Multnomah, OR	62.00
7	Los Angeles, CA	1263.38		57	Brevard, FL	56.95
8	Travis, TX	840.93		58	San Luis Obispo, CA	56.67
9	Fulton, GA	600.85		59	Linn, IA	55.00
10	Suffolk, MA	417.61		60	Santa Barbara, CA	54.17
11	Mecklenburg, NC	397.78		61	Salt Lake, UT	53.03
12	Middlesex, MA	376.93		62	Delaware, PA	51.62
13	Alameda, CA	366.02		63	Hillsborough, FL	49.80
14	Orange, CA	339.07		64	Maricopa, AZ	49.39
15	Clark, NV	291.73		65	Ozaukee, WI	49.00
16	Dallas, TX	211.76		66	Denton, TX	47.92
17	San Diego, CA	211.10		67	Troup, GA	46.50
18	Orange, FL	201.04		68	Broward, FL	45.65
19	Tarrant, TX	198.31		69	Hamilton, OH	45.55
20	Somerset, NJ	189.87		70	Utah, UT	44.73
21	Hudson, NJ	189.48		71	Davidson, TN	44.54
22	Baltimore, MD	182.51		72	Essex, NJ	43.57
23	Denver, CO	174.19		73	Hartford, CT	43.45
24	Marin, CA	173.67		74	Norfolk, MA	42.76
25	Johnson, KS	170.05		75	New Haven, CT	41.04
26	Fairfax, Fairfax City + Falls Church, VA*	160.72		76	St. Johns, FL	39.25
27	Sacramento, CA	160.50		77	Essex, MA	38.38
28	Westchester, NY	157.60		78	Durham, NC	38.06
29	Harris, TX	146.59		79	Washington, OR	35.78
30	Williamson, TN	135.32		80	Plymouth, MA	34.00
31	Contra Costa, CA	128.57		81	Jefferson, AL	32.70
32	Bergen, NJ	123.22		82	Polk, IA	31.20
33	Chester, PA	120.81		83	Montgomery, PA	30.82
34	District of Columbia, DC	119.43		84	Muscogee, GA	30.10
35	New Castle, DE	118.13		85	Ingham, MI	28.00
36	Morris, NJ	116.56		86	Franklin, OH	27.36
37	Mercer, NJ	108.64		87	St. Louis, MO	27.26
38	Howard, MD	107.79		88	Alexandria (Independent City), VA	25.00
39	Pinellas, FL	107.23		89	Rockingham, NH	24.39
40	Fairfield, CT	99.12		90	Anoka, MN	24.09
41	Cobb, GA	98.07		91	Bucks, PA	23.75
42	Montgomery, MD	93.96		92	Douglas, NE	22.48
43	DeKalb, GA	90.96		93	Snohomish, WA	21.52
44	Palm Beach, FL	88.72		94	Nassau, NY	21.37
45	Worcester, MA	84.90		95	Richland, SC	20.70
46	Arapahoe, CO	82.10		96	New Hanover, NC	20.02
47	Philadelphia, PA	77.94		97	Oklahoma, OK	18.30
48	Collin, TX	76.68		98	Strafford, NH	17.51
49	Cuyahoga, OH	73.97		99	Lake, IL	17.17
50	Sonoma, CA	73.50		100	Polk, MO	15.20

Table A.9 Top 100 US fintech companies by VC volume [USD Mil].

Rank	FinTech name	VC volume	FIPS		Rank	FinTech name	VC volume	FIPS
1	Social Finance Inc	1370.22	6075		51	ShopKeep.com Inc	105.45	36061
2	E*TRADE Financial Corp	814.53	36061		52	Betterment LLC	105.00	36061
3	Vertafore Inc	680.61	53033		53	Coinbase Inc	104.28	6075
4	Avant Inc	653.23	17031		54	Vivotech Inc	104.19	6085
5	Square Inc	493.75	6075		55	Pollen Inc	103.05	20091
6	Prosper Marketplace, Inc.	376.97	6075		56	Aria Systems, Inc.	99.85	6075
7	Credit Karma Inc	342.10	6075		57	Yodlee Inc	98.69	6081
8	Oscar Health Insurance Co	327.50	36061		58	LendingHome Corp	98.00	6075
9	Global Cash Access Holdings, Inc.	276.50	32003		59	Climate Corp	95.81	6075
10	LendingClub Corp	270.00	6075		60	Sage Intacct, Inc.	94.72	6085
11	Zuora Inc	242.53	6081		61	Plansource Holdings Inc	94.00	12095
12	Kabbage Inc	237.82	13121		62	Boku Inc	88.83	6075
13	Avidxchange Inc	237.27	37119		63	Canopy Financial, Inc.	88.50	6075
14	Zestcash Inc	209.05	6037		64	Payoneer Inc	87.00	36061
15	Eventbrite, Inc.	197.46	6075		65	Zillow Inc	86.98	53033
16	Mozido LLC	195.97	48453		66	Kyriba Corp	86.39	36061
17	Stripe Inc	190.00	6075		67	Addepar Inc	84.36	6085
18	Workday, Inc.	180.25	6001		68	Beecher Carlson Holdings, Inc.	83.95	13089
19	Adaptive Insights Inc	174.09	6085		69	TradingScreen Inc	81.82	36061
20	On Deck Capital Inc	171.15	36061		70	Credorax	80.00	25027
21	Coupa Software Inc	168.63	6081		71	Booker Software Inc	78.86	36061
22	Redfin Corp	168.51	53033		72	Xambala Inc	78.34	6085
23	GAIN Capital Holdings Inc	167.47	34035		73	Green Dot Corporation	78.02	6037
24	Liquidnet Holdings Inc	166.67	36061		74	FX Alliance, Inc.	77.50	36061
25	Bill Me Later, Inc.	159.90	24005		75	Noesis Energy Inc	76.10	48453
26	Santander Consumer Usa Inc	150.00	48439		76	Circle Internet Financial Inc	76.00	25025
27	Bill.Com Inc	141.60	6085		77	Affirm Inc	75.00	6075
28	CommonBond Inc	140.99	36061		78	IEX Group Inc	75.00	36061
29	Clover Health LLC	135.00	34017		79	Reval Holdings Inc	73.54	36061
30	Taulia Inc	131.67	6075		80	Vivareal Inc	73.50	6097
31	Integro Ltd	131.64	36061		81	Kensho Technologies Inc	72.83	25017
32	RiskMetrics Group, Inc.	129.62	36061		82	Steelbrick LLC	72.50	6081
33	Wealthfront Inc	126.67	6081		83	Indiegogo Inc	71.58	6075
34	Archipelago Holdings, Inc.	125.00	17031		84	Learnvest Inc	70.76	36061
35	Chrome River Technologies, Inc.	120.00	6037		85	BlueTarp Financial Inc	70.26	23005
36	Nexxar Group Inc	118.97	34003		86	Focus Financial Partners LLC	70.09	36061
37	Primerevenue Inc	112.64	13121		87	Sierra Auto Finance LLC	70.00	48113
38	Motif Investing Inc	111.60	6067		88	Braintree Payment Solutions LLC	70.00	17031
39	FinancialForce.com Inc	110.00	6075		89	OptionsXpress Holdings, Inc.	69.69	17031
40	Bond Street Marketplace Inc	109.25	36061		90	Nerdwallet Inc	69.00	6075
41	ZenPayroll Inc	108.35	6075		91	New Orleans Exchange Inc	67.01	36061
42	Internet Pipeline Inc	108.30	42029		92	PayNearMe MT Inc	66.10	6085
43	Obopay Inc	108.01	6081		93	Robinhood Markets, Inc.	66.00	6085
44	Merkle Inc	107.79	24027		94	Swift Financial Corp	65.42	10003
45	Fundbox Ltd	107.50	6075		95	ClairMail, Inc.	65.09	6041
46	Revolution Money, Inc.	107.23	12103		96	JAGGAER	65.06	37183
47	Personal Capital Corp	107.10	6081		97	CAN Capital Inc	63.00	36119
48	Earnest Operations LLC	107.00	6075		98	Tilt.com Inc	62.10	6075
49	Passport Health Communications Inc	106.16	47187		99	Pentaho Corp	62.04	12095
50	Xoom Corporation	105.64	6075		100	TradeCard, Inc.	62.00	36061

Table A.10 Cryptocurrency breakdown.

	Token	Coins	Cryptocurrencies
Full sample	1,026	729	1,755
- Invalid prices	107 (=919)	188 (=541)	295 (=1,460)
- Time jumps	134 (=785)	143 (=398)	277 (=1,183)
- No country information	350 (=435)	312 (=86)	362 (=521)
= Final sample	435	86	521

Table A.11 Cryptocurrency country information.

	Token	Coins	Cryptocurrencies
Full sample	1,026	729	1,755
Country information	572	141	713
No country information	454	588	1,042
% country information	55.75%	19.34%	40.63%

Table A.12 Cryptocurrency country breakdown.

	Cryptocurrencies	%	Rank
Final sample	521	100.00%	-
USA	98	18.81%	1
Singapore	85	16.31%	2
United Kingdom	54	10.36%	3
Switzerland	50	9.60%	4
Cayman Islands	25	4.80%	5
Hong Kong	23	4.41%	6
Gibraltar	21	4.03%	7
Estonia	17	3.26%	8
British Virgin Islands	12	2.50%	9
Germany	11	2.11%	10
Netherlands	10	1.92%	11
Malta	10	1.92%	12
Australia	9	1.73%	13
Canada	9	1.73%	14
Seychelles	8	1.54%	15
Liechtenstein	7	1.34%	16
France	7	1.34%	17
South Korea	6	1.15%	18
Slovenia	5	0.96%	19
Belize	5	0.96%	20
Ireland	4	0.77%	21
Cayman Islands	4	0.77%	22
Japan	3	0.58%	23
Austria	3	0.58%	24
United Emirates	3	0.58%	25
Rest of the world (27 countries)	36	6.91%	-

Table A.13 Regulatory event examples.

TABLE 4: Regulatory event examples				
News category	**Sentiment**	**Event date**	**Country**	**Description**
Legal status - Security	negative	25.07.2017	USA	*"The US Securities and Exchange Commission said today that the offering and sale of digital tokens are subject to the requirements of the federal securities law."*
Legal status - Classification	positive	16.02.2018	Switzerland	*"The agency [FINMA] outlined three categories of tokens (...). These include "payment tokens," "utility tokens" and "asset tokens," the latter of which would land in the securities category."*
Legal status - Ban	negative	29.09.2017	South Korea	*"South Korea's financial regulator has prohibited domestic companies and startups from participating in initial coin offerings (ICOs)."*
Interoperability - Institutions	negative	05.04.2018	India	*"India's central bank said Thursday that the banks and financial institutions it oversees will no longer be allowed to work with cryptocurrency exchanges and other related services."*
Interoperability - Listing	negative	10.03.2017	USA	*"The US Securities and Exchange Commission has denied a bid to list a bitcoin-tied exchange-traded fund (ETF), citing the risk of fraud and a lack of regulation among the world's bitcoin markets."*
Warning	negative	01.09.2017	China	*"In a statement yesterday, the National Internet Finance Association of China warned that ICOs may be using misleading information as part of fundraising campaigns, urging investors to proceed with extreme caution."*
Violation	negative	26.01.2018	Philippines	*"The Philippines Securities and Exchange Commission filed a cease-and-desist order against four companies and an operator running an initial coin offering (ICO), citing securities registration regulations, a newly released document reveals."*

Table A.14 Regulatory events country breakdown.

Country	Legal	Interoperability	Exchange	Warning	Violation	Total	%
USA	5	8	2	3	13	31	22.14%
China	1	0	5	2	1	9	6.43%
South Korea	1	2	4	1	1	9	6.43%
United Kingdom	4	1	0	2	0	7	5.00%
Philippines	1	0	1	1	4	7	5.00%
Singapore	2	1	1	1	1	6	4.29%
Japan	1	1	4	0	0	6	4.29%
Switzerland	2	0	0	0	3	5	3.57%
Malta	2	2	0	0	0	4	2.86%
European Union	2	0	0	2	0	4	2.86%
Australia	1	0	1	0	2	4	2.86%
France	1	1	0	1	1	4	2.86%
Lithuania	3	0	0	1	0	4	2.86%
Hong Kong	1	1	0	1	1	4	2.86%
Germany	1	0	1	1	1	4	2.86%
Canada	1	1	1	0	1	4	2.86%
Estonia	2	0	0	0	2	4	2.86%
UAE	2	0	0	1	0	3	2.14%
Russia	0	1	0	2	0	3	2.14%
India	1	1	0	1	0	3	2.14%
Nigeria	0	2	0	1	0	3	2.14%
Israel	1	1	0	0	0	2	1.43%
Thailand	1	0	1	0	0	2	1.43%
Gibraltar	2	0	0	0	0	2	1.43%
Indonesia	0	1	0	1	0	2	1.43%
Liechtenstein	1	0	0	0	0	1	0.71%
South Africa	0	0	1	0	0	1	0.71%
Mauritius	1	0	0	0	0	1	0.71%
Netherlands	0	0	0	1	0	1	0.71%
Total	40	24	22	23	31	140	
%	29.29%	17.14%	15.71%	16.43%	22.14%		

Table A.15 Full sample of regulatory events.

Date	Country	News headline	Category	Sentiment
06.01.2017	China	China's Central Bank Issues Warnings to Major Bitcoin Exchanges	exchange	-1
13.01.2017	Nigeria	Nigeria Warned its Citizens About Onecoin and Bitcoin This Week	warning	-1
18.01.2017	Nigeria	Nigeria: Banks That Handle Bitcoin Do So 'At Their Own Risk'	institutions	-1
25.01.2017	China	China's Central Bank to Continue Bitcoin Exchange Inspections	exchange	-1
07.02.2017	Philippines	The Philippines Just Released New Rules for Bitcoin Exchanges	exchange	-1
09.02.2017	China	China's Central Bank Issues New Warning to Bitcoin Exchanges	exchange	-1
10.03.2017	USA	SEC Rejects Winklevoss Bitcoin ETF Bid	listing	-1
10.04.2017	United Kingdom	DP17/3: Distributed ledger technology	security	-1
25.04.2017	USA	SEC Orders Review of Winklevoss Bitcoin ETF Rejection	listing	1
28.04.2017	Germany	German Regulators Order OneCoin to 'Dismantle Trading System'	violation	-1
06.06.2017	Estonia	Teade Polybius Foundation OÜ tegevuse kohta [Notice regarding the activities of Polybius Foundation]	violation	-1

25.07.2017	USA	SEC: US Securities Laws 'May Apply' to Token Sales	security	-1
01.08.2017	Singapore	Singapore Central Bank: Token Sales May Be Subject to Securities Laws	security	-1
18.08.2017	Australia	Australia Weighs Jail Time for Cryptocurrency Exchange Offenders	exchange	-1
24.08.2017	Canada	Canadian Regulators: 'Many' ICO Tokens Meet Securities Definition	security	-1
28.08.2017	USA	SEC Warns Public Companies Are Using ICOs to Pump Stocks	warning	-1
01.09.2017	China	China's Internet Finance Association Issues ICO Warning	warning	-1
04.09.2017	China	China Outlaws ICOs: Financial Regulators Order Halt on Token Trading	ban	-1
05.09.2017	Hong Kong	Hong Kong Regulator Warns ICO Tokens May Be Securities	security	-1
05.09.2017	Russia	Russia's Central Bank Issues Warning on Cryptocurrencies and ICOs	warning	-1
10.09.2017	Liechtenstein	Fact Sheet on Initial Coin Offerings	security	-1
12.09.2017	Estonia	The legal framework of initial coin offering in Estonia	security	-1
12.09.2017	United Kingdom	FCA: Cryptocurrencies may be subject to security law	security	-1
13.09.2017	United Emirates	Dubai Financial Regulator Issues Warning on ICOs	warning	-1
13.09.2017	China	Bitcoin Exchanges Lack Legal Foundation, China Internet Finance Association Says	exchange	-1
15.09.2017	China	China's Bitcoin Exchanges Receive Shutdown Orders and Closure Timeline	exchange	-1
20.09.2017	Switzerland	Swiss Finance Regulator Cracks Down on 'E-Coin' Cryptocurrency Scheme	violation	-1
25.09.2017	Gibraltar	Gibraltar Issues ICO Advisory Amid Drive Toward Blockchain Regulation	commodity	1
28.09.2017	Australia	Australia's Securities Regulator Issues Formal Guidance For ICOs	security	-1
29.09.2017	Japan	Japan Issues Licenses for 11 Bitcoin Exchanges	exchange	-1
29.09.2017	South Korea	South Korea followed China in banning ICOs	ban	-1
29.09.2017	Switzerland	Swiss Finance Regulator Is 'Investigating ICO Procedures'	security	-1
10.10.2017	United Emirates	Abu Dhabi Markets Regulator Publishes ICO Guidance	commodity	1
11.10.2017	Lithuania	Lithuania's Central Bank Publishes New ICO Guidance	commodity	1
17.10.2017	USA	CFTC Aligns With SEC: ICO Tokens Can Be Commodities	commodity	1
23.10.2017	Canada	Canada Court Holds ICO Organizer in Contempt	violation	-1
24.10.2017	Malta	Malta Proposes Rules for Cryptocurrency Investment Funds	listing	1
26.10.2017	France	The AMF publishes a discussion paper on Initial Coin Offerings and initiates its UNICORN programme	warning	-1
09.11.2017	Germany	Germany's Securities Regulator Warns ICOs Pose 'Numerous Risks'	warning	-1
12.11.2017	Netherlands	AFM warns of serious risks associated with Initial Coin Offerings	warning	-1
13.11.2017	European Union	European Financial Regulator Warns Investors On ICO Risks	warning	-1
14.11.2017	Singapore	MAS issues guide to digital token offerings	commodity	1
14.11.2017	United Kingdom	Consumer warning about the risks of investing in cryptocurrency CFDs	warning	-1
29.11.2017	Russia	Russian Central Bank Issues New Warning Against Cryptocurrencies	warning	-1
30.11.2017	Malta	Discussion Paper on Initial Coin Offerings, Virtual Currencies and related Service Providers	commodity	1

05.12.2017	India	Reserve Bank cautions regarding risk of virtual currencies including Bitcoins	warning	-1
11.12.2017	USA	SEC Halts Multimillion-Dollar 'Munchee' ICO for Securities Violations	violation	-1
12.12.2017	Hong Kong	Hong Kong Regulator Issues Warning on Bitcoin Futures	warning	-1
13.12.2017	South Korea	South Korean Officials Weigh New Curbs on Bitcoin Trading	exchange	-1
19.12.2017	USA	SEC Suspends Crypto Firm's Stock After Big Price Boost	violation	-1
20.12.2017	Singapore	MAS cautions against investments in cryptocurrencies	warning	-1
28.12.2017	South Korea	South Korea to Tighten Bitcoin Exchange Rules Amid 'Speculative' Boom	exchange	-1
08.01.2018	South Korea	South Korean Banks Face Scrutiny Over Crypto Exchange Ties	institutions	-1
10.01.2018	Philippines	SEC warns public on ICOs	warning	-1
13.01.2018	Indonesia	Bank Indonesia Warns All Parties Not to Sell, Buy, or Trade Virtual Currency	warning	-1
22.01.2018	China	China Moves to Crack Down on Digital Currency Pyramid Schemes	violation	-1
22.01.2018	USA	SEC 'Looking Closely' at Public Company Blockchain Pivots, Says Chairman	institutions	-1
23.01.2018	Malta	Malta Finance Watchdog Pushes Ahead With Crypto Fund Rules	listing	1
24.01.2018	South Korea	South Korea Fines Crypto Exchanges for Privacy Failures	exchange	-1
26.01.2018	China	Chinese Finance Association Cautions on Overseas ICOs	warning	-1
26.01.2018	Philippines	Philippines Securities Regulator Orders Halt to ICO	violation	-1
30.01.2018	Germany	German Regulator Orders Crypto Exchange to Halt Brokerage Business	exchange	-1
30.01.2018	USA	Report: CFTC Sends Subpoenas to Bitfinex, Tether	exchange	-1
31.01.2018	South Korea	South Korea: Cryptos Mixed up in $600 Million Illegal Forex Trade	violation	-1
02.02.2018	USA	Customer Advisory: Beware "IRS Approved" Virtual Currency IRAs	warning	-1
12.02.2018	European Union	3 EU Watchdogs Warn Over 'High Risks' of Crypto Investment	warning	-1
14.02.2018	Canada	Canadian Securities Exchange Taps Blockchain for New Clearinghouse	institutions	1
15.02.2018	USA	CFTC Joins SEC In Warning Against Crypto Pump-and-Dumps	warning	-1
16.02.2018	Switzerland	Swiss Finance Regulator to Treat Some ICO Tokens As Securities	commodity	1
16.02.2018	USA	SEC Suspends 3 Companies Claiming Crypto Connection	violation	-1
22.02.2018	Germany	German Regulator Pledges 'Precise' Oversight of ICOs	security	-1
22.02.2018	France	French Regulator Says No to Online Crypto Derivatives Ads	listing	-1
28.02.2018	Lithuania	Lithuanian Banking Group Warns Over Crypto Investments	warning	-1
01.03.2018	Nigeria	Nigeria's Central Bank Again Warns on Crypto Investments	institutions	-1
06.03.2018	USA	FinCEN Deals Major Regulatory Blow to ICOs and Exchanges	exchange	-1
08.03.2018	Japan	Japan's Finance Watchdog Suspends Two Crypto Exchanges	exchange	-1
14.03.2018	Estonia	Information for entities engaging with virtual currencies and ICOs	security	-1
15.03.2018	France	French Regulator Blacklists 15 Crypto Investment Websites	violation	-1
15.03.2018	Gibraltar	Gibraltar Plans to Regulate ICO Tokens as Commercial Products	commodity	1

15.03.2018	Philippines	Crypto Investment Firm Violates Securities Laws, Warns Philippines	violation	-1
16.03.2018	Israel	Israel Bars Crypto Firms from Tel Aviv Stock Exchange Indices	listing	-1
19.03.2018	Hong Kong	SFC's regulatory action halts ICO to Hong Kong public	violation	-1
19.03.2018	Israel	Israeli Regulator Outlines What Makes A Token a Security (Or Not)	commodity	1
23.03.2018	France	Analysis of the legal qualification of cryptocurrency derivatives	security	-1
02.04.2018	USA	SEC Halts Mayweather-Endorsed ICO, Charges Founders With Fraud	violation	-1
04.04.2018	South Korea	Korean Regulator Tells Crypto Exchanges to Revise User Agreements	exchange	-1
05.04.2018	India	RBI Bars Banks From Doing Business With Crypto Firms	institutions	-1
06.04.2018	USA	SEC Sues Public Company That Saw Crypto Stock Price Boost	violation	-1
06.04.2018	United Kingdom	UK Finance Watchdog Issues Warning on Crypto Derivatives	listing	-1
16.04.2018	Malta	Malta Proposes Test to Define When ICOs Are Securities	security	-1
17.04.2018	Philippines	Philippines Lawmaker Urges Senate to Expedite Crypto Crime Bills	violation	-1
18.04.2018	Philippines	Crypto Fraudsters Face Jail Time, Warns Philippines Securities Regulator	violation	-1
01.05.2018	Australia	Australia's Securities Watchdog Moves to Halt 'Deceptive' ICOs	violation	-1
22.05.2018	USA	CFTC Issues Guidance for Firms Offering Cryptocurrency Derivatives	listing	-1
24.05.2018	Russia	Russian Institutions to Trial Central Bank ICO Platform	institutions	1
24.05.2018	Singapore	Singapore Warns 8 Exchanges Over Unregistered Securities Trading	exchange	-1
29.05.2018	USA	No Disney, No PayPal? SEC Charges ICO Founder Over False Statements	violation	-1
08.06.2018	Lithuania	ICO Guidelines – Good News for Startups	commodity	1
11.06.2018	United Kingdom	UK's Financial Watchdog Issues Letter to Banks on Crypto Risks	warning	-1
14.06.2018	USA	SEC Official Pushes Back on Claims Ether Is a Security	commodity	1
22.06.2018	Japan	Japan Hits 6 More Crypto Exchanges With 'Business Improvement Orders'	exchange	-1
25.06.2018	United Emirates	Guidance – Regulation of Crypto Asset Activities in ADGM	commodity	1
27.06.2018	South Korea	Korean Watchdog Tightens Rules on Crypto Exchange Bank Accounts	institutions	-1
26.07.2018	Switzerland	Swiss Markets Authority Investigates Troubled $100 Million ICO	violation	-1
26.07.2018	USA	Winklevoss Brothers Bitcoin ETF Rejected By SEC for Second Time	listing	-1
01.08.2018	Estonia	Finantsinspektsioon - 26.01.2018 - CryptoFinance OÜ	violation	-1
02.08.2018	Philippines	Philippines' Proposed ICO Rules Presume All Tokens Are Securities	security	-1
07.08.2018	USA	SEC Delays VanEck-SolidX Bitcoin ETF Decision to September	listing	-1
14.08.2018	USA	SEC Slaps 'Fraudulent' ICO Founder With $30K Fine, Lifetime Ban	violation	-1
22.08.2018	USA	SEC Rejects 9 Bitcoin ETF Proposals	listing	-1
09.09.2018	USA	SEC Suspends Exchange-Traded Bitcoin and Ether Investment Vehicles	listing	-1
14.09.2018	Thailand	Thai Securities Regulators Seek 'Appropriate' Rules for ICOs	security	-1

20.09.2018	Australia	18-274MR ASIC acts against misleading Initial Coin Offerings and crypto-asset funds targeted at retail investors	violation	-1
27.09.2018	USA	SEC, CFTC Charge Bitcoin Futures Firm 1Broker With Securities Law Violations	violation	-1
27.09.2018	USA	US Judge Sides With CFTC in Fraud Case, Ruling Cryptos Are Commodities	commodity	1
11.10.2018	USA	Regulators Sue ICO Company That Falsely Claimed SEC Approval	violation	-1
19.10.2018	European Union	Own Initiative Report on Initial Coin Offerings and Crypto-Assets	commodity	1
24.10.2018	Japan	Japanese Crypto Exchange Group Gets Legal Status to Self-Regulate	exchange	1
24.10.2018	South Korea	South Korea's Financial Watchdog Warns Investors Over Crypto Funds	warning	-1
29.10.2018	United Kingdom	UK Government Says It Will Update Crypto Tax Guidance By Early Next Year	security	-1
31.10.2018	India	Indian Officials Met to Discuss Possible Ban on 'Private Cryptocurrencies'	ban	-1
01.11.2018	Hong Kong	Hong Kong's Securities Watchdog to Regulate Crypto Funds	listing	-1
15.11.2018	Singapore	Regulator's Column: What SGX expects of listed companies conducting an Initial Coin Offering (ICO)	listing	-1
16.11.2018	USA	SEC Settles Securities Registration Charges Against 2 ICO Startups	violation	-1
07.12.2018	USA	SEC Fines Crypto Fund $50K and Issues Cease-and-Desist	violation	-1
21.12.2018	Japan	Report from Study Group on Virtual Currency Exchange Services	commodity	1
09.01.2019	European Union	European Finance Regulators Call for Bloc-Wide Crypto Rules	security	-1
10.01.2019	Thailand	Thai Finance Ministry Awards Licenses to 4 Crypto Firms, Rejects 2	exchange	-1
17.01.2019	South Africa	South Africa's Central Bank Proposes Rules for Crypto Companies	exchange	-1
23.01.2019	United Kingdom	UK Financial Watchdog Plans Oversight of Security Tokens, Some Stablecoins	commodity	1
24.01.2019	Singapore	MAS halts Securities Token Offering for regulatory breach	violation	-1
14.02.2019	Lithuania	Bank of Lithuania position on virtual assets and initial coin offering reflects changing market realities	security	-1
14.02.2019	USA	Judge Hits Crypto Startup With Injunction In Reversal of Past Court Order	violation	-1
18.02.2019	Indonesia	Indonesia Passes Rules for Trading of Cryptocurrency Futures	listing	1
20.02.2019	USA	SEC Settles Unregistered Securities Charges Against ICO Issuer Gladius	violation	-1
15.03.2019	Canada	Canada Proposes Regulatory Framework for Cryptocurrency Exchanges	exchange	-1
26.03.2019	Japan	E-Commerce Giant Rakuten Wins License for New Crypto Exchange	institutions	1
28.03.2019	Switzerland	Swiss Watchdog Rules Crypto Miner's ICO 'Seriously Violated' Laws	violation	-1
03.04.2019	USA	The SEC Just Released Its Long-Awaited Crypto Token Guidance	commodity	1
10.04.2019	Mauritius	Mauritius Issues Regulatory Guidance on Security Token Offerings	security	-1

Table A.16 Results sentiment (fixed effects).

The table reports the event effect on cryptocurrency returns estimated in a time-series model using a dummy variable approach in a panel regression with fixed effects. In this regression model, I differentiate between regulatory news events with positive and negative sentiment.

	Coef.	Std. error	t	P>|t|	[95% Conf. interval]	
Positive news	0.0207	0.0016	12.92	0.000	0.0175	0.0238
Negative news	-0.0136	0.0008	-17.52	0.000	-0.0151	-0.0121
Constant	-0.0028	0.0003	-9.4	0.000	-0.0033	-0.0022
Observations	221,300	R-squared	0.0019			

Table A.17 Results categories (fixed effects).

The table reports the event effect on cryptocurrency returns estimated in a time-series model using a dummy variable approach in a panel regression with fixed effects. In this regression model, I differentiate between regulatory news events from different categories.

	Coef.	Std. error	t	P>|t|	[95% Conf. interval]	
Legal status	0.0107	0.0013	8.32	0.000	0.0082	0.0133
Interoperability	0.0251	0.0017	15.14	0.000	0.0218	0.0283
Exchange	0.0477	0.0019	25.49	0.000	0.0441	0.0514
Warning	0.0021	0.0022	0.98	0.327	-0.0021	0.0064
Violation	0.0006	0.0014	0.46	0.645	-0.0021	0.0033
Constant	-0.0026	0.0003	-8.97	0.000	-0.0032	-0.0020
Observations	221,300	R-squared	0.0041			

Table A.18 Results jurisdiction (fixed effects).

The table reports the event effect on cryptocurrency returns estimated in a time-series model using a dummy variable approach in a panel regression with fixed effects. In this regression model, we differentiate between regulatory news events from different categories. We further consider whether regulatory news events are published by domestic or foreign authorities.

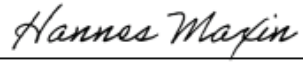
	Coef.	Std. error	t	P>|t|	[95% Conf. interval]	
Legal status local	0.0169	0.0056	3.03	0.002	0.0059	0.0278
Interoperability local	0.0353	0.0055	6.38	0.000	0.0244	0.0462
Exchange local	0.0622	0.0102	6.08	0.000	0.0421	0.0822
Warning local	-0.0010	0.0093	-0.11	0.912	-0.0191	0.0171
Violation local	0.0092	0.0039	2.37	0.018	0.0016	0.0169
Legal foreign	0.0103	0.0013	7.74	0.000	0.0077	0.0129
Interoperability foreign	0.0242	0.0017	13.96	0.000	0.0208	0.0276
Exchange foreign	0.0471	0.0019	24.43	0.000	0.0433	0.0508
Warning foreign	0.0024	0.0022	1.05	0.293	-0.0020	0.0067
Violation foreign	-0.0006	0.0015	-0.41	0.679	-0.0035	0.0022
Constant	-0.0026	0.0003	-8.94	0.000	-0.0032	-0.0020
Observations	221,300	R-squared	0.0042			

Declarationss of Co-authors and record of accomplishments

Title	Why fintechs cooperate with banks – Evidence from Germany
Authors	(1) Max Bömer (Heinrich-Heine-University Duesseldorf) (2) Dr. Hannes Maxin (Leibniz University Hannover)
Conferences	• HVB doctoral seminar, Oldenburg, Germany, 03.11.2017 • EURAM conference, Reykjavik, Iceland, 21.06.2018 • G-Forum, Stuttgart, Germany, 12.10.2018
Publications	German Journal of Risk and Insurance, 2018, Vol. 107 No. 4, pp. 359–386

Contributions	**Author 1**	**Author 2**
Conceptualization Development of research question Methods specification	60%	40%
Execution Literature review and development of theoretical framework Data collection and preparation Data analysis Analysis and discussion of results Derivation of implications and conclusions	60%	40%
Manuscript preparation Initial draft Finalization	60%	40%
Overall contribution	**60%**	**40%**

07.04.2020, Author 1

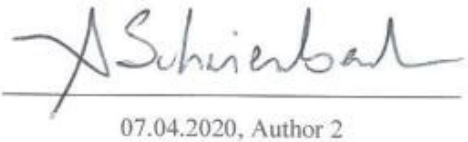


07.04.2020, Author 2

Title	Resource-based perspective of VC investments in fintech
Authors	(1) Max Bömer (Heinrich-Heine-University Duesseldorf) (2) Prof. Armin Schwienbacher (Skema Business School, Lille)
Conferences	• Crowdinvesting Symposium, München, Germany, 20.07.2018 • G-Forum, Stuttgart, Germany, 11.10.2018
Publications	-

Contributions	**Author 1**	**Author 2**
Conceptualization Development of research question Methods specification	70%	30%
Execution Literature review and development of theoretical framework Data collection and preparation Data analysis Analysis and discussion of results Derivation of implications and conclusions	70%	30%
Manuscript preparation Initial draft Finalization	70%	30%
Overall contribution	**70%**	**30%**

07.04.2020, Author 1



07.04.2020, Author 2

Title	The impact of national regulation on cryptocurrencies
Authors	(1) Max Bömer (Heinrich-Heine-University Duesseldorf)
Conferences	-
Publications	-

Contributions	**Author 1**	**Author 2**
Conceptualization Development of research question Methods specification	100%	0%
Execution Literature review and development of theoretical framework Data collection and preparation Data analysis Analysis and discussion of results Derivation of implications and conclusions	100%	0%
Manuscript preparation Initial draft Finalization	100%	0%
Overall contribution	**100%**	**0%**

07.04.2020, Author 1

07.04.2020, Author 2

Eidesstattliche Versicherung

Ich, Max Bömer, versichere an Eides statt, dass die vorliegende Dissertation von mir selbstständig und ohne unzulässige fremde Hilfe und unter Beachtung der „Grundsätze zur Sicherung guter wissenschaftlicher Praxis an der Heinrich-Heine-Universität Düsseldorf“ erstellt worden ist.

Düsseldorf, 25.05.2020