GLOBAL FINTECH ENTREPRENEURSHIP AND ITS INFLUENCING FACTORS: AN EVOLUTIONARY ECONOMIC ANALYSIS

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Abstract

Fintech entrepreneurship has already influenced financial markets and their players worldwide in a disruptive, but also a risky way (Thakor, 2020; Zeranski & Sancak, 2020). In this context, it seems worthwhile to analyze which factors drive the design and development of global fintech entrepreneurship. Thus, the paper takes fintech-related research a step further by exploring the drivers of fintech evolution in different countries and continents that display different levels of fintech activity. For this purpose, first economic, technological, legal, and cultural factors influencing the development of fintech entrepreneurship are examined from an evolutionary point of view, and second, a generalized linear mixed model is used in order to evaluate the statistical relevance of these factors on fintech entrepreneurship more comprehensively. The analyzed data period from 2000 to 2017 also makes it possible to assess the influence of the dot.com bubble and the financial crisis on fintech entrepreneurship. The results of the empirical analysis suggest that the gross domestic product (GDP), regulatory burden, government tech procurement and the degree of individualism are important drivers of fintech startup activity. These findings help gauge the present and future market position of fintechs, leading to implications for entrepreneurs, competitors, and regulators alike.

Keywords: Fintech Entrepreneurship, Startups, Innovation, Financial Institutions, Evolutionary Economics

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1. INTRODUCTION

In line with Schumpeter's principle of creative destruction, new financial institutions[1] called "fintechs" are disrupting the financial sector of the 21st century by innovative services and digitalization. Defined as "technologically enabled financial innovation that could result in new business models, applications, processes, or products with an associated material effect on financial markets and institutions, and the provision of financial services" (Thakor, 2020; on the difficulties of definition, see Schueffel, 2016; Dorfleitner, Hornuf, Schmitt, and Weber, 2017, p. 5-6; Gimpel, Rau, and Röglinger, 2018), we thus consider the latest generation of fintechs only, but not their predecessors (on the development from 1866 to

[1] According to the seminal contributions of Nobel Laureate Douglass C. North, "institutions" are the mere "rules of the game", while he calls the "players" of the very game "organizations" (North, 1990). In financial economics and markets, however, "financial institutions" includes these organizations (e.g., banks, insurers, and, nowadays, fintechs, too), see Merton (1995), Rampini, Viswanathan, and Vuillemey (2020), or the textbook classic of Saunders and Cornett (2019). This paper uses the latter, broader definition of the term.

2008, see Thakor, 2020). Although a global phenomenon, a closer look at the number and types of these startups reveals their heterogeneous evolving in different countries of different continents. Fintech entrepreneurship already has impacted financial markets and their participants significantly (Arwas & Soleil, 2015; Deutsche Bank, 2015; Haddad & Hornuf, 2016; KPMG, 2017a; Cropper & Walshe, 2018); impressing signs in the last years were the U.S. Nasdaq Stock Exchange launching its own FinTech Index with 50 companies in July 2016, which currently includes 49 companies (Wadhwa, 2016; Nasdaq, 2017, 2021) and the German lead index DAX including a fintech company (Wirecard) and at the same time excluding a traditional financial intermediary (Commerzbank) in September 2018 (Deutsche Börse, 2018). Whereas the business model of Wirecard turned out expectedly faulty (according to poorly designed processes in general and neglected governance in particular) just recently (extensively, see Zeranski and Sancak, 2020), it seems worthwhile to research which factors drive – or throttle – the design and development of fintech entrepreneurship, and are responsible for the international diversity of trends. This paper aims to explain the first observable differences of the U.S. American, European, and Asian fintech development from an evolutionary (economics) point of view. The ideas and fundamentals of evolutionary economics can be traced back to early Austrian and institutional economics, as represented by Menger (1871), Veblen (1898), Marshall (1898), Schumpeter (1911), Hayek (1945), and von Mises (1949), who provided seminal contributions (addressed in Section 3). After the groundbreaking work of the aforementioned, mostly "Modern" Austrian Economics (MAE) researchers, especially Nelson and Winter (1982), further elaborated the evolutionary approach. From biology, they adopted the concept of natural selection to construct a precise and detailed evolutionary theory of business behavior and were thus able to develop models of competitive firm and industry dynamics under conditions of growth and technological change (Nelson & Winter, 1982, 2002).

After exploring possible economic, technological, legal, and cultural drivers of fintech evolution, the paper secondly carries out a thorough panel econometric analysis by a generalized linear mixed model in order to reach deeper and solid conclusions. The results of the empirical analysis suggest that especially the gross domestic product (GDP), regulatory burden, government tech procurement and the degree of individualism are important drivers of fintech startup activity. These findings can classify the relevance of these drivers in different countries, helping scientists as well as (prospective) fintech entrepreneurs, fintech competitors, and fintech regulators to understand the backgrounds of the fintech market as a whole (e.g., market structure) in general and the dynamics of startup activity in particular.

In this paper, we, therefore, examine the evolution of global fintech startups in 76 countries in the period from 2000 to 2017 with respect to various economic, technological, legal, and cultural determinants. Thus, our research period includes the dot.com crisis of the turn of the century and also the subprime/financial crisis of 2007-2008, enabling us to analyze their influence in particular. Accordingly, the paper makes a further scientific contribution to the analysis of global fintech entrepreneurship due to the length of the research period, the particular referring to effects of crises, the type of influencing factors, and the application of an evolutionary approach.

After recalling the *raison d'être* of financial intermediaries based on transaction cost and information asymmetry considerations, we present a review of previous research in Section 2. Section 3 contains the research methodology with a descriptive analysis of the global fintech market development, an evolutionary analysis of possible drivers in different countries, a description of data, an introduction of the variables used in the quantitative analysis, and a derivation of the hypotheses. Section 4 presents and discusses the empirical findings, and derives their basic implications. Finally, Section 5 concludes, at the same time suggesting lines of future fintech research that appear promising.

2. THEORETICAL BACKGROUND AND LITERATURE REVIEW

Financial markets are characterized according to the theory of new institutional economics by informational asymmetries between borrowers and lenders (seminal, see Brealey, Leland, and Pyle, 1977; Campbell and Kracaw, 1980; Diamond, 1984). Considering these information asymmetries between market participants, which can significantly throttle or even prevent financial contracts, financial intermediaries, e.g., banks, insurance companies, mutual funds, or even (financial) information intermediaries like credit rating companies, can offer an institutional design to effectively and efficiently solve the information problem. The function of these intermediaries is to support the transfer of funds from investing to financing parties at low transaction cost (on transaction cost, see the seminal contributions of Coase, 1937; Williamson, 1975; on their role for financial intermediation, Scholes, Benston, and Smith, 1976). In general, fintechs are financial intermediaries and thus can exist because they help mitigate asymmetric information and transaction cost (He et al., 2017). Compared to traditional intermediaries like banks, they do so in innovative ways, as they operate online/internet-based and by the use of special technology to improve financial activities (Schueffel, 2016). The ability to automate processes (and to raise efficiency) based on technological advantages could allow fintechs to offer customers products less expensive while gaining more valuable data about customers, at the expense of traditional banks (Deutsche Bank, 2015; Olanrewaju, 2014; McKinsey & Co., 2015; Paul, 2016; Stulz, 2019; Thakor, 2020; Torrens, 2016).

Previous research on fintech entrepreneurship topics predominantly focused on specific fintech types, distinguishing them against the backdrop of the typical value chain of a traditional bank. Table 1 displays the fintech prototypes identified, their frequent subtypes, and also important research contributions related to them. According to the contributions included, the synopsis is structured into four various types of fintech startups (Stulz, 2019; Thakor, 2020):

- financing (e.g., crowdfunding, crowdlending, or factoring solutions),
- asset management (e.g., robo-advice, social trading, or personal financial management software),
- payment services (e.g., mobile payment solutions, e-wallets, or cryptocurrencies), and
- other business activities by fintech startups (e.g., insurance, regtech, or other technical advancements).

Table 1. Systematization of previous fintech research (regarding categorization) by the year of publication

Fintech category			
Financing	***Asset management***	***Payment services***	***Other business activity***
Important subtypes			
Crowdfunding, crowdlending, factoring solutions	***Robo-advisory, social trading, financial software***	***Mobile payment, e-wallets, cryptocurrencies***	***Insurtech, regtech, technical advancements***
In the area of equity crowdfunding and reward-based crowdfunding, Mollick (2014) examined the dyna-mics of success and failure among crowdfunded ventures.	Tai and Ku (2013) investigated the determinants of stock investors' intention towards using mobile stock trading.	Mjølsnes and Rong (2003) investigated mobile payment and e-wallet services.	Gabor amd Brooks (2016) explored the growing importance of digital-based financial inclusion as a form of organizing development interventions through networks of state institutions, international development organizations and fintech companies.
Ahlers, Cumming, Guenther, and Schweizer (2015) analyzed the determinants of funding success of equity crowdfunding.	Arwas and Soleil (2015) argued that successful robo-advice 2.0 services will focus not on the technology, but on the underlying investor and their very human needs.	Mallat (2007) investigated in mobile payment and e-wallet services.	Nicoletti (2016) examined in how far digital insurance is an important trend in private and corporate insurance.
Burtuch, Ghose, and Wattal (2015) researched crowdlending investors' privacy preferences when making an investment decision.	Doering et al. (2015) analyzed social trading platforms.	Contini, Crowe, Merritt, Mott, and Oliver (2011) depicted the current mobile payments eco-system in the U.S and analyzed barriers, gaps and opportunities.	Arner, Barberis, and Buckley (2017) analyzed why regtech developments are leading toward a paradigm shift of financial regulation.
Serrano-Cinca, Gutiérrez-Nieto, and López-Palacios (2015) evaluated the likelihood of loan defaults of crowdlending.	Fein (2015) explored whether robo-advisors are fiduciaries and provide personal investment advice, minimize costs, and are free from conflicts of interest.	Kazan and Damsgaard (2014) evaluated four types of market actors which are incumbents and disrupters in the payment industry.	Braun and Schreiber (2017) took a look at the current insurtech landscape including business models and the disruptive potential.
Bernstein, Korteweg, and Laws (2016) investigated more generally the determinants of early-stage investments on AngelList and find that the standard investor reacts to information about the founding team, but not to existing lead investors.	Altenhain and Heinemann (2017) showed that the segment of wealthy internet savvy investment customers in Germany can be regarded as hybrid in respect of their demand for digital as well as personal asset management services and products.	Böhme, Christin, Edelman, and Moore (2015) analyzed platform design principles and risk or regulatory issues according to virtual currencies such as Bitcoin or Ethereum.	Cropper and Walshe (2018) showed that technology has the potential to lessen the burden of regulation by increasing efficiency, transparency and reducing friction.
Hornuf and Schwienbacher (2016) studied the regulation of equity crowdfunding.	Berger, Wenzel, and Wohlgemuth (2017) examined 16,964 investment observations at eToro, the world's largest social trading platform.	Dahlberg et al. (2015) discussed how the ecosystem of m-payment is expected to change due to technology changes.	In the area of insurance technology, Yan et al. (2018) evaluated the potenial from the perspective of enablement for financial and insurance services.
Iyer, Khwaja, Luttmer, and Shue (2016) evaluated the likelihood of loan defaults of crowdlending.	Kaya and Schildbach (2017) shed light on robo-advisory business models, investment strategies and clients, as well as the performance and super-vision of robo-advisory services.	Gao and Waechter (2015) examined the role of initial trust in user adoption of mobile payments.	
Lin and Viswanathan (2016) analyzed the geography of investment behavior in the area of crowdlending.	Jung et al. (2018) took the perspective of information system researchers and discuss the current state-of-the-art of robo-advisory.	Gandal and Halaburda (2016) analyzed platform design principles and risk or regulatory issues according to virtual currencies such as Bitcoin or Ethereum.	
Vulkan et al. (2016) analyzed the determinants of funding success.		Gozman et al. (2018) examined fintech startups who participated in SWIFT competition over a three-year period.	
Fenwick et al. (2017) examined the crowdfunding market for small and medium-sized enterprises.			

The main findings of the previous research papers can be summarized as follows:

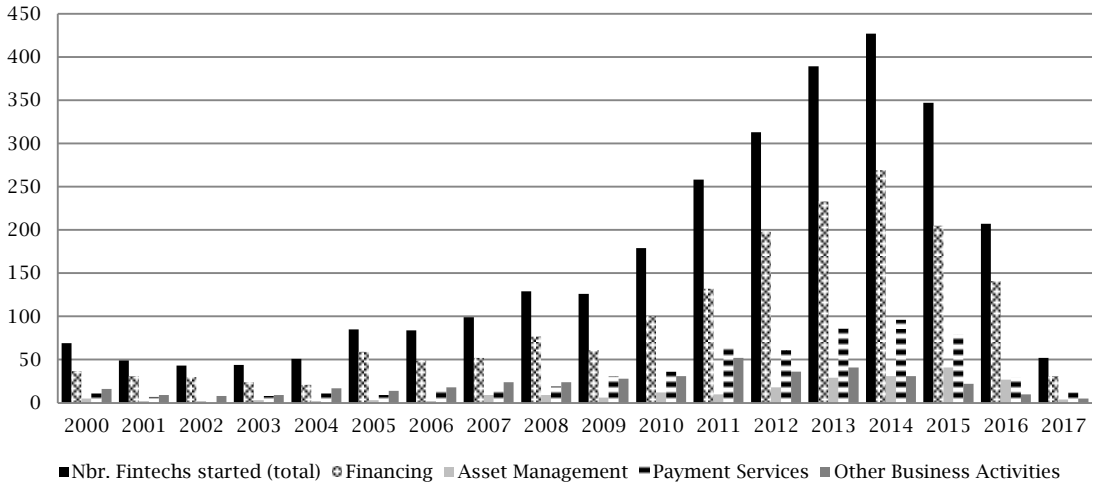
- Fintechs represent new competitors for traditional banks in various areas of banking (Dahlberg, Guo, & Ondrus, 2015; Doering, Neumann, & Paul, 2015; Fenwick, McCahery, & Vermeulen, 2017; Gandal & Halaburda, 2016; Kaya & Schildbach, 2017; Vulkan, Astebro, & Fernandez Sierra, 2016).
- Parallel to competition, also cooperation opportunities for traditional financial intermediaries arise (Gozman, Liebenau, & Mangan, 2018).
- Regulation (and also regtechs) will play an important role for the further development of fintechs (Cropper & Walshe, 2018; Fenwick et al., 2017; Hornuf & Schwienbacher, 2016).
- Fintechs increase complexity at many levels (e.g., markets, innovations, stakeholders, and technologies; see Gozman et al., 2018).
- Currently, financial markets experience the second digitization wave, which focuses on smart services based on algorithms and intelligent software increasing the degree of automation (Jung, Dorner, Glaser, & Morana, 2018).
- Unlike banks, financial intermediaries of the insurer type are increasingly profiting from digitization (Nicoletti, 2016, Yan, Schulte, & Chuen, 2018).

Until now, only a few studies have analyzed the (processes defining *the*) fintech market as a whole, which makes the investigation of the market structure from an evolutionary point of view worthwhile. Dushnitsky, Guerini, Piva, and Rossi-Lamastra (2016) give an extensive overview of the European crowdfunding market and conclude that legal and cultural traits affect the formation of crowdfunding platforms. Furthermore, venture capitalist investment in global fintech startups was examined by Cumming and Schwienbacher (2016). Demertzis, Merler, and Wolff (2018) consider the European fintech market with respect to the increasingly urgent question of justifiable and necessary EU regulation. In particular, the extensive study of Haddad and Hornuf (2016) analyzed the emergence of the global fintech market in 64 countries from 2005 to 2014 and addressed various economic and technological influencing factors, but without considering a period that includes more than the latest financial crisis.

3. RESEARCH METHODOLOGY

The global fintech market has basically grown by investments (venture capital, private equity, or mergers and acquisitions) from $930 million in 2008 to over $27 billion in 2017 (Accenture, 2014, 2016; He et al., 2017; KPMG, 2017a). To illustrate the various patterns of fintech evolution from 2000 to 2017, we decided to focus first on a selection of the largest fintech markets. In this respect, a difference is made (in view of the later evolutionary analysis) between the top 10 European countries, the U.S., and the top 10 Asian countries (both top 10 selections according to the number of fintech startups), referring to the distinction of the four fintech sectors of our second section (companies were classified according to their main business area, so that multiple assignments were avoided, i.e., contrary to the study by Haddad and Hornuf, 2016). Hereafter, we analyze the startup activity in these largest fintech markets in order to provide better knowledge of differences of market structures on the one hand, and the influence of the financial crisis on activity patterns on the other hand. The data used was retrieved from the CrunchBase database, which contains detailed information on worldwide fintech startup formation (the database is compiled of more than 200,000 corporate contributors, over 2,000 venture partners, and millions of web data points It should be noted that companies that were involved in M&As are not permanently available under their former firm name on CrunchBase), their financing, and their main fields of business (CrunchBase, https://www.crunchbase.com/), and has already been used in a number of financial research articles (Bernstein et al., 2016; Cumming et al., 2016; Haddad & Hornuf, 2016).

Figure 1. Summary statistics of fintech startup activity for the full sample by the year 2000-2017

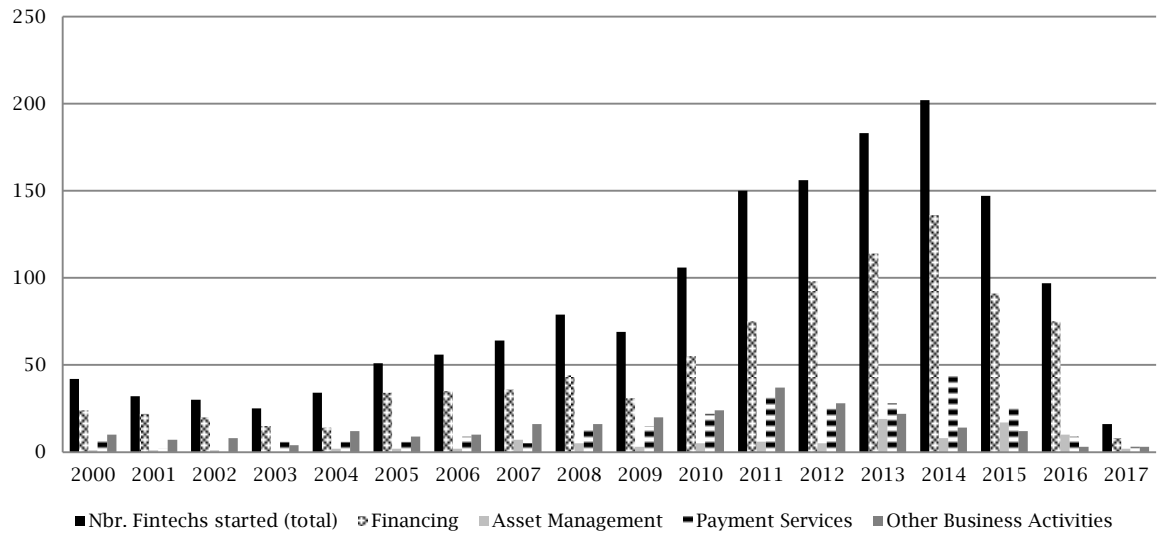


Source: CrunchBase (https://www.crunchbase.com/).

As Figure 1 shows, there was a comparably small and even declining number of fintech startups until 2003, i.e., after the bursting of the dot.com bubble in March 2000, which made the environment more difficult for startups in general (as investors' trust had been severely damaged, see Taylor, 2006). From 2003 to 2008, the number of fintech startups increased modestly and not continuously, being severely interrupted by the year of the Lehman collapse. Against the backdrop of recovering economic conditions, startup numbers returned to a higher level than before the collapse of the dot.com bubble. Then, between 2009 and 2011, there is a steep increase in the fintech startup count following the financial crisis (among other reasons, due to a widespread lack of trust in traditional banks; see Kantox, 2014; Knell and Stix, 2015; analogously on insurers, see Schanz, 2009), with the number of startups founded in 2011 being twice as large as in 2008. Thus, there is a different reaction pattern of fintech startups in the wake of both crises, which could be due to "internet firms" being at the heart of the dot.com bubble, while, in contrast, the subprime and financial crisis seemed more closely related to traditional than tech-based financial intermediaries. On the contrary, the latter crisis incentivized market participants to look for new (banking) options. Finally, it seems that the fintech companies have learned from the dot.com bubble and have matured according to better technology and services (Ruef, 2018).

In 2015, a sharp decline in the number of fintech startup formations could be observed, followed by an even stronger decrease in 2016 and 2017. Fintech startups providing financing services represent nearly 60% of total startups (1750 out of 2951), suggesting that the demand for innovation in financing activities was considered most substantial (probably due to the regulatory innovations of Basel II/III/IV and its effects on bank lending, especially to small and medium-sized companies). Fintech startups providing payment services constitute the second-largest group (20% of 2951), while the other two types of fintechs represent considerably smaller categories. To investigate different dynamics in industrialized countries on the one hand, and developing countries on the other, we present descriptive statistics for the U.S. sample and also for the 10 most relevant European and Asian countries in terms of fintech activities (number of fintech companies started).

Figure 2. Summary statistics for the U.S. sample by year in terms of fintech startup activity 2000-2017

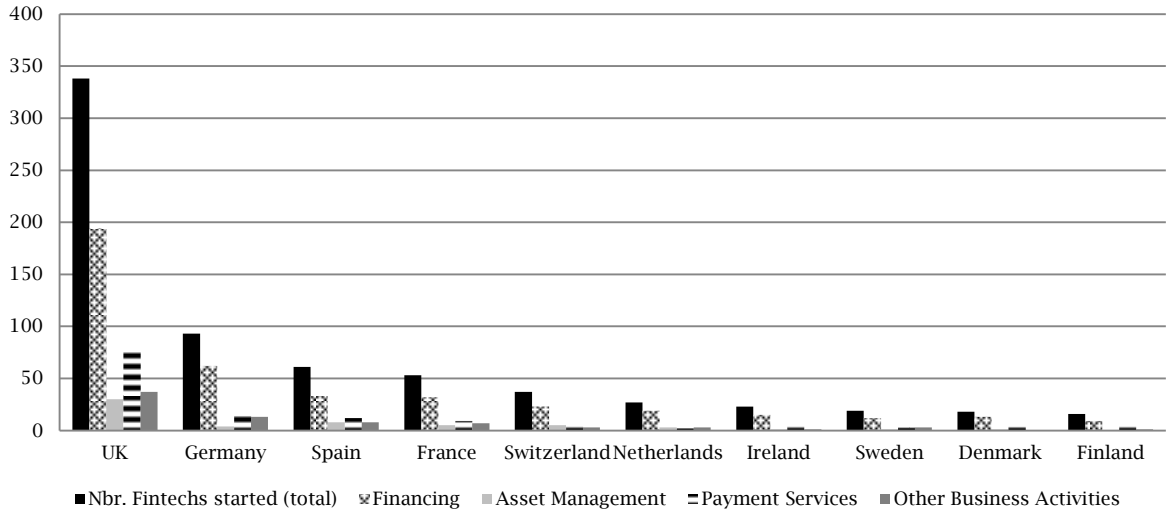


Source: CrunchBase (https://www.crunchbase.com/).

Figure 2 presents statistics for the U.S. fintech market by year during the period 2000-2017 and shows that U.S. fintech startups represent more than 50 percent of the entire sample (1539 of 2951). Thus, the U.S. has the overall strongest fintech activity in the sample, internationally followed by the United Kingdom, India, Canada, and Germany[2]. Likewise, Figure 2 demonstrates that fintech startups reforming financing activities constitute more than 60 % of all U.S. fintech startups (927 of 1539), followed by the other categories similarly in the same order of importance as for the whole sample. Figure 2 displays that since 2015 and above all in 2016 and 2017 there is a sharp decline in U.S. fintech startup activity (KPMG, 2017b; Claessens, Frost, Turner, & Zhu, 2018) leading to a market consolidation at a comparably high level.

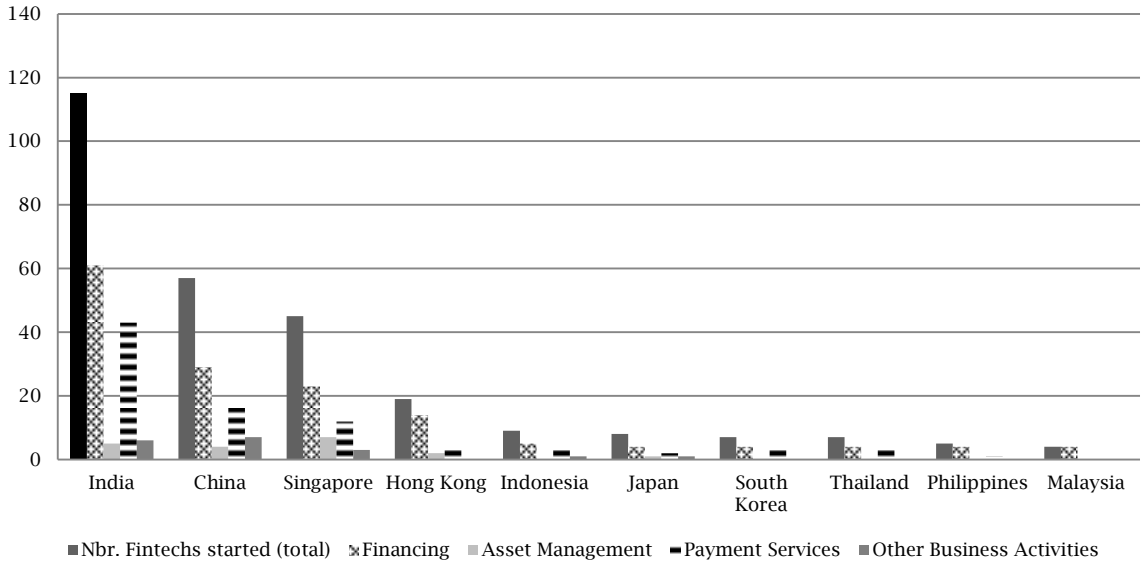
[2] Detailed statistics are available from the corresponding author upon request.

Figure 3. Summary statistics for the 10 most relevant European countries in terms of fintech startup activities 2000-2017



Source: CrunchBase (https://www.crunchbase.com/).

Figure 4. Summary statistics for the 10 most relevant Asian countries in terms of fintech startup activities 2000-2017



Source: CrunchBase (https://www.crunchbase.com/).

Figure 3 presents fintechs startup numbers by the country for the 10 most relevant European countries during the period 2000-2017, as a countrywise presentation helps to underline the differences more clearly. The United Kingdom is at the top of the list (nearly 50% of 685) with regard to new fintech startup formations, followed by Germany and Spain (Ernst & Young, 2016). Up to this point in time, this country had a supportive regulatory regime, effective tax incentives, and – with London – a powerful position as a global financial center (GFC), attracting a high number of entrepreneurs willing to engage in fintech activities (Haddad & Hornuf, 2016).

For the 10 most relevant Asian countries, Figure 4 provides analogous statistics by country (similar to Europe in order to emphasize the differences) during the period 2000-2017. India and China are at the top of the list (more than 60%; 172 out of 276 fintech startups). As well, it shows fintech startup formations for the four subcategories, which differ mainly by a higher share of the payment sector (more than 31%) compared to the European and the U.S. sample. This could be explained by the fact that the Indian and Chinese banking sectors are still considered underdeveloped (Ernst & Young, 2016; Shabaz, Bhattacharya, & Mahalik, 2018).

Altogether, Figures 1-4 illustrate the heterogeneity of global fintech development. Since the year 2000, the U.S. and the UK have been the countries with the most dynamic fintech

development. Nevertheless, it can be stated in recent years that India and China have caught up in terms of fintech activity (Ernst & Young, 2016; PwC, 2016). Eight of the 27 fintech unicorns (privately held startup companies valued at over $1 billion) worldwide meanwhile are Chinese companies (Moysan, 2018). And although not in terms of fintech activity, but in terms of total users and market size, China is now considered the biggest fintech market worldwide. After detecting this heterogeneity, we explore possible explanations, using an evolutionary economic approach.

In the sense of Schumpeter (1911, 1942) fintechs have disruptive power, driving the process of innovation by "creative destruction", invading the domain of traditional banks (Paul, 2016; PwC, 2016). Using new technology (e.g., big data software, or blockchain technology) to create innovative products/services or processes (e.g., robo-advice, see Arwas and Soleil, 2015), fintechs caught traditional financial intermediaries unaware, as particularly banks from 2007 to 2009 struggled with the consequences of the financial crisis. While fintechs succeeded in introducing various types of financial innovation, the demise of the old structure remains limited (World Economic Forum, 2017, p. 13).

According to the views of Hayek (1945, 1994), fintechs could have special technological knowledge (e.g., of mobile functionality or cloud computing, see Brear, 2015), enabling them to penetrate traditional banking markets. Thus, they can create a new form of financial knowledge that traditional banks do not yet possess. However, traditional banks could adopt or acquire this technology (Deutsche Bank, 2015; Anand & Mantrala, 2019) to reduce the newcomers' knowledge advantage. At the same time, savings banks and cooperative banks could be less affected by this fintech knowledge than privately owned commercial banks, because the former work closer to their customers (in the sense of Hayek, 1948, they know better about the special circumstances of their clients) to establish long-lasting relationships, and are less technology-dependent.

Another explanation of different patterns of fintech evolution is offered by North's concept of informal rules (social norms, see North, 1990; for an extensive elaboration, see also Pejovich, 1999). According to this Nobel laureate, informal rules are based on culture or social interactions and thus can provide an explanation of market processes. While the U.S. and China reacted with rapid regulatory countermeasures to the recent crises, Europe's regulatory response appeared rather hesitant. While the U.S. – at least from 2008-2010 – preferred deregulation to financial market stability, China's culture is coined by hierarchy and one-party state command thinking, which also made quick deregulation possible (Dumbaugh & Martin, 2009). Compared to Europe, U.S.-American and Chinese institutional and cultural structures allowed for fast political action and decisions after the financial crisis (Li, Willett, & Zhang, 2012; Reyes, 2013), from which fintechs in these countries profited. As a most prominent example of respective institutional change, the U.S. Dodd-Frank Act was designed to monitor traditional banks more closely, thus adding to the fintechs' regulatory advantage.

From an evolutionary point of view, it can also be questioned to what extent fintechs lead to a kind of "Darwinian" competition of (financial) systems according to the diversification of the landscape and possibilities of financing (see, more general, Johnson, Price, and Van Vugt, 2013). More different types of banks/banking business models could enhance the stability of the financial system due to decentralization and diversification (e.g., in the area of lending) and mitigate the effects of financial shocks (Financial Stability Board, 2017; and, more generally, Weller and Zulfiqar, 2013). Thus, alternative systems, especially capital market financing versus bank financing (Hackethal & Schmidt, 2004), can be examined here in the context of fintech startup formations. The system-related reasoning is that a well-developed capital market could be more conducive for fintech entrepreneurs (e.g., according to faster capital access for funding their business).

Finally, in addition to the economic, technological and cultural factors listed so far, legal influencing factors, e.g., rulemaking by legislators or the enforcement of these rules by actors within regulatory authorities, could also incentivize fintech-related entrepreneurship. Especially for banks, recent crisis-driven (re-)regulation has resulted in increasing regulatory complexity and pressure – i.e., finally, transaction cost – caused by stricter or new capital rules, liquidity regulation, leverage ratio, SIFI norms, stress testing, and more (Treleaven, 2015). While regulation is kind of a double-edged sword for traditional banks (burden and protection at the same time, see Deutsche Bank, 2015; focusing liquidity regulation, also König, 2015), most of it does not apply to fintechs (Yagiz, 2017). With regard to regulatory innovation, regulatory know-how could become more important for fintechs, too, causing the respective cost of information collection and processing (Lautenschläger, 2017), but also allow for another fintech variation, i.e., aforementioned regtechs.

Table 2 summarizes the previous findings and emphasizes further details in order to highlight different environments of U.S., European and Asian fintech entrepreneurship.

Table 2. Possible evolutionary drivers of U.S., European, and Asian fintech market processes

Factors	*US fintech market*	*European fintech market*	*Asian fintech market*
Economic factors	• largest fintech sector worldwide (market share by investments of more than 50%, see Accenture, 2016; International Trade Administration, 2016); • higher profits of financial intermedi-aries due to advanced deregulation (Baily, Klein, & Schardin 2017); • a good position for incubating ermer-ging fintech companies by significant GFC, e.g., in New York and Chicago (demand, infrastructure, capital and talents, see International Trade Administration, 2016).	• UK as the biggest fintech market in Europe (followed by Germany, see Haddad and Hornuf, 2016); • the availability of funds in the UK is good for fintech startups (Henry, 2016); • Brexit could be an obstacle to the UK fintech market but on the other hand a driver for the German or French fintech market due to changing company headquarters (Financial Times, 2016; Business Insider Intelligence, 2017); • profits of European financial inter-mediaries against the U.S. market are still low and as a result competitiveness remains in danger (European Central Bank, 2017); • growing insurtech sector in Europe (Ernst & Young, 2017).	• fast growing fintech markets in China and India (Ernst & Young, 2016; PwC, 2016); • China's banking sector is until now compared to the U.S. and Europe underdeveloped but digital infrastructure is well (Wang & Dollar, 2018); • generation Y and millenials in China account for 45% of consumption (Chinadaily, 2016); • India has by far the largest worldwide unbanked population (measured in people without a bank account) (PwC, 2016); • the payment segment has been the most funded within the Indian fintech landscape (PwC, 2016); • also strong growth in the Indian insur-tech sector (PwC, 2016, Swift, 2017).
Technological factors	• banks and stock exchange operators in the U.S. are increasingly using blockchain technology for financial transactions (Manning, 2017); • the predominant payment method in U.S. in the area of e-commerce is still the credit card (rather than e-wallet, see Worldpay, 2015).	• globally, UK has one of the highest penetration of cellular and web (eMarketer, 2017); • 56% of the Germans use the internet for banking transactions (online banking, see Eurostat, 2018); • payment via e-wallets in Germany more popular than in the U.S. and UK (Worldpay, 2015).	• in China the smart-phone is becoming the universal internet access device (Kontomatik, 2017); • China has 710 million internet user (mid 2016) and thus more than the U.S. and Europe combined (Kontomatik, 2017, Wang & Dollar, 2018).
Legal factors	• advanced deregulation of the general financial sector in the U.S. due to the Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 (Baily et al., 2017); • however, despite their huge investment pool and financial resources, U.S. rule-making especially for fintechs (e.g., in the area of lending) is less liberal than other world regions (Dykema Gossett PLLC, 2017).	• the Financial Conduct Authority (FCA) as UK regulator, has been dynamic in their method by partaking with innovators (Financial Conduct Authority, 2017); • simplified regulatory requirements in UK by the "Regulatory Sandbox" since 2016 (Financial Conduct Authority, 2017; New Posts, 2017); • tax incentives for entrepreneurs above all in the UK (Financial Conduct Authority, 2017; New Posts, 2017); • in Europe, measures are still being taken to stabilize the financial sector (Financial Times, 2016) and standardize prudential activities (but complex political organization with 28 states can lead to unequal regulation); • facilitation of European fintechs through the adopted "Payment Services Directive" by the European Parliament (European Commission, 2015); • European Union wants to support fintechs' crowdfunding solutions (modernization of the "Prospectus Directive", see Dorfleitner et al., 2017).	• strong, proactive policy level support from the Indian government (e.g., startup India programm, see Kontomatik, 2017); • the action plan for Chinese investors and fintech startups is to focus on what the Communist Party seems to adopt and implement for its citizenry (Kontomatik, 2017); • Chinese government focuses on curbing issues in the P2P lending space (Bloomberg, 2016); • Singapore is also considering the introduction of simplified regulatory requirements in form of a "Sandbox" scheme (Monetary Authority of Singapore, 2016).
Cultural factors	• positive post-crisis cultural mindset (due to management of the banking sector and high capacity for innovation, see Reyes, 2013); • slope to quick "clean up" after the financial crisis (monetary and fiscal policy has acted immediately, see Bernanke, 2009; U.S. Congress, 2009); • cultural motto by policy: "fast deregulation" (see Sherman, 2009; Sunstein, 2017).	• no fast-acting mindset (Eurozone reacted more hesitantly to the financial crisis, see Matei and Calapod, 2014); • cultural motto by policy: "financial market stability preferred over deregulation" (see European Commission, 2011; Lambert, 2016).	• Chinese crisis management after the onset of the financial crisis started comparably early (bpb, 2009, Li et al., 2011); • the head of the Chinese Communist Party in China already in mid 2008 used the strict party hierarchy to implement swift monetary and fiscal measures across all state and party bodies, regardless of formal hurdles (bpb, 2009); • culture of hierarchy and one-party state in China based on times of command economy (Dumbaugh & Martin, 2009, Xia, 2011; Jing, Cui, & Li, 2015); • India has a largely bilingual population because of the British colonial legacy, which facilitates the adoption of British patterns of behavior also in the fintech market (Kontomatik, 2017).

Based upon the above-market features, different paths of fintech evolution prevail. Therefore, subsequently, a thorough empirical analysis using a generalized linear mixed model is carried out in order to reach deeper findings.

Besides startup data of the CrunchBase database (as mentioned before) of 76 countries in the period from 2000 to 2017, we retrieved data on economic, technological, legal, and cultural influencing factors from published reports of supranational institutions[3]. Using these factors, we formulate testable hypotheses regarding drivers of fintech startup activity in different regions.

To test whether well-developed capital markets and a more fragile financial sector positively affect the frequency of fintech startups, we include economic factors, like the size of the gross domestic product (measured by GDP per capita), the number of commercial bank branches (measured by commercial bank branches per 100,000 adult population), the banking intermediation rate (measured by the averaged share of stock market and public bond market capitalization to GDP in percent), the soundness of banks (measured by response to the survey[4] question: *"In your country, how do you assess the soundness of banks?"*) and the share of cooperative banks (measured by the averaged share of the domestic market share of deposits and the domestic market share of loans of all cooperative banks in a given country). Yartey (2008) suggests that income level is a good measure of capital market development while Levine (2002), Black and Gilson (1999) state that more commercial bank branches and a lower banking intermediation rate allow (here: fintech) entrepreneurs to better access to the necessary funds. On the other hand, a more fragile financial sector could explain the sudden upsurge of fintech startups in the wake of the financial crisis due to the lack of trust of customers in banks (Guiso, Sapienza, & Zingales, 2013). Schindele and Szczesny (2016) further explain that the financial crisis and subsequent crisis-driven regulation incentivized banks to lend to SMEs more restrictively, thus increasing the cost of debt for the latter. Groeneveld (2011) and Chiaramonte, Poli, and Oriani (2015) analyze that a low rate of cooperative banks in a country can cause a higher fragility of the financial sector. In summary, the subsequent hypotheses can be derived:

H1a: There is a positive correlation between well-developed capital markets (measured by a high GDP, many commercial bank branches, and a low banking intermediation rate) and fintech startup activity (measured by the number of fintech startups).

H1b: There is a positive correlation between a more fragile financial sector (measured by low soundness of banks and a low share of cooperative banks) and fintech startup activity (measured by the number of fintech startups).

In order to analyze whether the availability of the latest technology positively influences fintech startup activity, we include technological factors, like the latest technology (measured by response to the survey question: *"In your country, to what extent are the latest technologies available?"*), mobile phone subscriptions (measured by the number of mobile telephone subscriptions per 100 adult population), internet penetration (measured by the number of internet subscriptions), and government tech procurement (measured by response to the survey question: *"In your country, to what extent do government purchasing decisions foster innovation?"*). Ernst & Young (2014) declare that the latest technology is strongly determined by a high mobile phone subscription. Dosi (1982), Arend (1999), Stam and Gurnsey (2007) argue that high internet penetration and government tech procurement are necessary to support startups generally in building their business models on these technologies. This leads to:

H2: There is a positive correlation between the availability of the latest technology (measured by a high mobile phone subscription, high internet penetration, and a high level of government tech procurement in technology) and fintech startup activity (measured by the number of fintech startups).

To test whether an advantageous legal/ regulatory environment positively affects fintech startup activity, we include legal (including regulation) factors, like the efficiency of the legal system (measured by response to the survey question: *"In your country, how efficient are the legal and judicial systems for companies in setting disputes?"*), government regulation (measured by response to the survey question: *"In your country, how burdensome is it for companies to comply with public administration's requirements?"*) and the strength of law (measured by the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending in a country). According to previous research, the influence of law and regulation on entrepreneurship is ambiguous. On the one hand, a high level of efficiency of the legal system can strengthen institutional reliability and lower regulatory risk, thus incentivizing entrepreneurs to pursue (fintech) innovations (Treleaven, 2015). On the other hand, a lower level of regulation means more (entrepreneurial) freedom, and more (room for) innovative behavior, respectively (Levie & Autio, 2011). Thus, our third hypothesis is:

H3: There is a positive correlation between an advantageous legal/regulatory environment (measured by a high level of efficiency of the legal system, a lighter burden of regulation, and a lower strength of law) and fintech startup activity (measured by the number of fintech startups).

Finally, in order to evaluate whether cultural conditions influence fintech startup activity, we include cultural factors, like the public trust in policy (measured by response to the survey question: *"In your country, how do you rate the ethical standards of politicians?"*) and Hofstede's (1980) cultural dimensions of power distance and individualism (measured by a) the degree to which the less powerful members of a society accept and expect that power is distributed unequally, and b) the degree to which individualism is more preferred to collectivism in a society). The reasoning is that in countries with a high degree of public trust

[3] In particular the World Economic Forum Global Competitiveness Report or the IMF's Financial Access Survey (hereafter: "survey"). A table of the factors retrieved is obtainable from the corresponding author upons request.

[4] The survey questions are taken from the World Economic Forum Global Competitiveness Report.

in government due to reliability, transparency, and efficient services (OECD, 2017) entrepreneurship can develop more easily (Johnson, 2013). As well, appreciating power distance and individualism can support stringent and fast (political) decision-making processes (Hofstede, 1980; Hofstede, Neuijen, Ohayv, & Sanders, 1990), especially in times of crisis, and also inner driving forces to becoming an entrepreneur, so that companies can prosper. Thus, the subsequent hypothesis can be derived:

H4: There is a positive correlation between a high level of selected quantifiable cultural factors (measured by a high degree of public trust and a great appreciation for power distance/ individualism) and fintech startup activity (measured by the number of fintech startups).

In order to control for the entrepreneurial environment in a particular country, the state of business cluster development (geographic concentrations of firms, suppliers, or producers of related products or services) and the size of the labor market (for the relevance of the labor market as a source of entrepreneurial supply, see Choi and Phan, 2006), in the respective country were included in the analysis.

The empirical model comprises five dependent variables: the number of fintech startups in a given year and country and the number of fintech startups in a given year and country for each of the four categories – financing, asset management, payment, and other business activities. In order to analyze the economic, technological, legal, and cultural determinants that influence fintech entrepreneurship resulting in startups, the paper uses a panel dataset that consists of 1,368 observations given an 18-year observation period from 2000 to 2017, covering 76 countries. According to our interest in the effects of institutional changes on entry and potential reverse causality, we lagged independent variables in our models by 2 years (York & Lenox, 2014). To take the fast changing environment of fintech startups into account and to test for the sensibility of the results, we also lagged the dependent variable for the first model by one year. The results were almost identical. Therefore the final sample consists of 1,216 observations.

Due to our measuring the dependent as a count variable, classical OLS regression models are not applicable here. The Poisson distribution is often used to model count data but requires that the mean and variance of the dependent variable are equal (Dobson, 2002; Wooldridge, 2002). A simple diagnostic is therefore a plot of the group variances against the group means with the country serving as grouping variable for the counts. Due to the high number of fintechs in these countries, we had to omit the U.S. and the United Kingdom for these plots, because their means and variances were outliers. The Poisson distribution will then result in a slope equal to one, whereas overdispersed distributions, such as the negative binomial, will have slopes greater than one. The resulting plots (obtainable from the corresponding author upon request) display that for three of the dependent variables, most of the points lie above the line with a slope of one indicating that overdispersion is present. Therefore, we took a negative binomial error distribution for model building. Finally, it can be stated that non-normal distributed response variables can be analyzed with the so-called generalized linear models (Dobson, 2002) and according to time-dependent observations, we use a generalized linear mixed model, which is specified as follows (to account for differences between the different years and countries, both effects were also included in the model although not mentioned in the formula. Furthermore, the standard errors were clustered by the countries):

$$\begin{aligned} L(Y_{i,t}) = {} & \beta_0 + \beta_1 * GDP\ per\ capita_{i,t-2} + \beta_2 * commercial\ bank\ branches_{i,t-2} + \beta_3 \\ & * banking\ intermediation\ rate_{i,t-2} + \beta_4 * soundness\ of\ banks_{i,t-2} + \beta_5 \\ & * share\ of\ cooperative\ banks_{i,t-2} + \beta_6 * latest\ technology_{i,t-2} + \beta_7 \\ & * mobile\ phone\ subscriptions_{i,t-2} + \beta_8 * internet\ penetration_{i,t-2} + \beta_9 \\ & * efficiency\ of\ legal\ framework_{i,t-2} + \beta_{10} * easiness\ to\ challenge\ regulations_{i,t-2} + \beta_{11} \\ & * strength\ of\ legal\ rights_{i,t-2} + \beta_{12} * public\ trust\ in\ policy_{i,t-2} + \beta_{13} * power\ distance_{i,t-2} + \\ & + \beta_{14} * degree\ of\ individualism_{i,t-2} + \beta_{15} * cluster\ development_{i,t-2} + \beta_{16} * labor\ force_{i,t-2} \end{aligned} \quad (1)$$

where, $Y_{i,t}$ is the number of fintech startup formation in country i and year t, $\beta_{1,\ldots,}\beta_{16}$ are the regression coefficients for the independent variables, and $L(.)$ represents the link function for the negative binomial distribution function (Dobson, 2002).

4. RESULTS AND DISCUSSION

The descriptive statistics, which are shown for the dependent and independent variables in Table 3, reveal two issues we have to take into account for the subsequent analyses. First, a number of not available data is present, especially for the years 2000 to 2003 and for the share of cooperative banks. For this variable, we have data only for 25 (predominantly European) of the 76 countries. As we do not want to completely omit this variable from the analyses, we have to form two subgroups. For the first subgroup – consisting of (fintechs of) all countries – we omitted this variable. For the second subgroup, we included only the 25 countries for which all variables including the share of cooperative banks can be analyzed. The years 2000 to 2003 had to be omitted from the analysis because too many input variables were completely missing. So the analyses include values for the dependent variable starting from 2006 and values for the independent variables starting from 2004. The second issue to be taken into account is that three variables (GDP per capita, commercial bank branches and labor force) show right-skewed and heavy-tailed distributions. Thus, we took their natural logarithms for further analyses. Descriptive statistics for the three logarithmized variables reveal that both skewness and kurtosis were substantially reduced.

Table 3. Descriptive statistics of the dependent and independent variables from 2000 to 2017

Variable	*n*	*mean*	*median*	*sd*	*min*	*max*	*skewness*	*kurtosis*
Total number of fintechs	1216	2.33	0	12.77	0	202	10.84	134.01
Asset management fintechs	1216	0.17	0	1.01	0	19	11.93	180.14
Financing fintechs	1216	1.38	0	7.85	0	136	11.46	152.10
Payment fintechs	1216	0.47	0	2.44	0	44	10.90	145.92
Other fintechs	1216	0.30	0	2.03	0	37	11.53	155.92
GDP per capita	1169	20769.33	13346.20	20381.01	235	119225.40	1.54	2.92
Commercial bank branches	1013	23.10	18.22	18.79	0.39	116.08	1.97	5.12
Bank intermediation rate	1053	45.68	41.28	26.68	0.34	99.79	0.27	-1.02
Soundness of banks	849	5.42	5.50	0.92	1.40	6.90	-0.89	1.07
Share of cooperative banks	381	13.16	10.00	11.01	0.10	38	0.75	-0.54
Latest technology	852	5.20	5.30	0.93	2.60	6.90	-0.44	-0.54
Mobile phone subscriptions	1139	90.59	95.82	44.11	0.21	235.61	-0.14	-0.22
Internet penetration	1200	43.29	43.10	28.45	0.10	97.30	0.05	-1.32
Government tech procurement	851	3.78	3.80	0.61	2	5.60	0.22	-0.12
Efficiency of legal framework	849	4.24	4.20	1.05	2	6.60	0.17	-0.95
Burden of government regulations	851	3.37	3.30	0.75	1.70	5.70	0.53	0.03
Strength of legal rights	848	5.95	6.00	2.45	0	12	0.12	-0.89
Public trust	851	3.36	3.20	1.27	1.30	6.50	0.54	-0.69
Power distance	1056	0.60	0.62	0.72	0.11	1	-0.17	-0.92
Degree of individualism	1056	0.46	0.40	0.23	0.13	0.91	0.30	-1.22
Cluster development	860	4.10	4.00	0.72	2.70	5.60	0.17	-0.92
Labor force	1168	35629446.17	8411078	104389552.7	144991	787109802	5.72	34.49

Notes: The number of data varies depending on the variable because for the years 2000 to 2003 and for the share of cooperative banks some data are missing. sd = standard deviation.

Next, we checked for multicollinearity by calculating variance inflation factors (VIF) for all independent variables. For each independent model variable *j*, linear regression is performed with this variable as a function of the other independent variables. Then, $VIF_j = 1/(1 - R_j^2)$, where R_j^2 is the coefficient of determination of this regression. The higher the VIF, the higher the multicollinearity. As a rule of thumb, if VIF_j exceeds 10, which corresponds to R_j^2 >= 0.9, variable *j* is considered to be highly multicollinear (Gujarati & Porter, 2009). The variable efficiency of the legal framework indicates a high variance inflation factor of 11.69 (the other variables range from 2.05 to 8.20). Pairwise correlations with the other independent variables show a high correlation (0.82) with public trust. For this reason, we omitted the variable *efficiency of the legal framework* from further analyses (so that the highest level of the variance inflation factor is now 6.92).

Altogether, this leads to three different models for the total sample: One model for the reduced sample of 25 countries, for which the share of cooperative banks has been measured, one model for all countries without the share of cooperative banks as an independent variable, and a third model for the latter, but excluding the U.S. in the sense of a robustness check as the U.S. represents the largest sub-sample. The results are displayed in subsequent Table 4 for the total fintech sample (analogous tables for each of the four basic fintech types are available upon request from the corresponding author). For each model, the parameter estimates are presented, significant parameters are marked with asterisks (* p < 0.1; ** p < 0.05; *** p < 0.01).

Table 4. Drivers of worldwide fintech startup formations from 2000 to 2017

	Total number of fintechs																	
	Model 1 incl. share of coop. banks incl. U.S.						***Model 2 excl. share of coop banks incl. U.S.***						***Model 3 excl. share of coop. banks excl. U.S.***					
	Estimate	Std. est.	Std. error	z value	Pr(> |z|)	Signific.	Estimate	Std. est.	Std. error	z value	Pr(> |z|)	Signific.	Estimate	Std. est.	Std. error	z value	Pr(> |z|)	Signific.
Intercept	-23.676		4.555	-5.198	0	***	-21.434		2.172	-9.867	0	***	-22.003		2.281	-9.647	0	***
Ln GDP per capita	1.052	0.098	0.384	2.737	0.006	***	0.495	0.046	0.171	2.895	0.004	***	0.653	0.061	0.173	3.764	0	***
Ln commercial bank branches	0.011	0.001	0.362	0.03	0.976		0.054	0.004	0.166	0.327	0.743		0.12	0.008	0.156	0.773	0.439	
Banking intermediation rate	-0.002	-0.003	0.005	-0.293	0.77		0.01	0.02	0.004	2.484	0.013	**	0.011	0.024	0.004	3.139	0.002	***
Soundness of banks	-0.04	-0.003	0.104	-0.383	0.702		0.022	0.002	0.069	0.32	0.749		0.026	0.002	0.069	0.372	0.71	
Share of cooperative banks	0.002	0.001	0.011	0.145	0.885													
Latest technology	-0.015	-0.001	0.27	-0.055	0.957		0.016	0.001	0.174	0.091	0.928		-0.012	-0.001	0.178	-0.069	0.945	
Mobile telephone subscriptions	-0.013	-0.045	0.007	-1.957	0.05	*	0.001	0.003	0.003	0.305	0.76		0.002	0.006	0.003	0.593	0.553	
Internet penetration	0.015	0.034	0.011	1.42	0.156		0.006	0.013	0.007	0.885	0.376		-0.01	-0.022	0.007	-1.44	0.15	
Government tech procurement	-0.019	-0.001	0.251	-0.076	0.939		0.415	0.02	0.182	2.282	0.022	**	0.565	0.027	0.177	3.193	0.001	***
Efficiency of legal framework	*Excluded due to high correlation with public trust*						*Excluded due to high correlation with public trust*						*Excluded due to high correlation with public trust*					
Burden of governmental regulations	0.412	0.024	0.259	1.587	0.112		0.474	0.028	0.17	2.779	0.005	***	0.279	0.016	0.173	1.615	0.106	
Strength of legal rights	-0.004	-0.001	0.059	-0.067	0.947		0.033	0.006	0.039	0.854	0.393		0.086	0.016	0.039	2.172	0.03	**
Public trust	-0.197	-0.019	0.161	-1.218	0.223		-0.346	-0.034	0.103	-3.354	0.001	***	-0.277	-0.027	0.104	-2.676	0.007	***
Power distance	1.51	0.026	1.841	0.82	0.412		-0.108	-0.002	0.649	-0.167	0.867		-0.181	-0.003	0.625	-0.29	0.772	
Degree of individualism	4.021	0.072	1.366	2.944	0.003	***	2.436	0.043	0.684	3.561	0	***	2.378	0.042	0.674	3.528	0	***
Cluster development	0.049	0.003	0.227	0.216	0.829		-0.064	-0.004	0.177	-0.362	0.717		-0.142	-0.008	0.178	-0.797	0.425	
Ln labor force	0.554	0.075	0.16	3.468	0.001	***	0.688	0.093	0.083	8.245	0	***	0.618	0.029	0.083	7.438	0	***
Year 2007	0.19		0.188	1.012	0.311		0.049		0.217	0.227	0.82		0.216		0.328	0.659	0.51	
Year 2008	0.404		0.213	1.9	0.057	*	0.245		0.216	1.132	0.257		0.549		0.308	1.781	0.075	*
Year 2009	0.441		0.266	1.66	0.097	*	0.391		0.255	1.533	0.125		0.947		0.316	3.001	0.003	***
Year 2010	0.689		0.331	2.081	0.037	**	0.728		0.272	2.672	0.008	***	1.274		0.334	3.812	0	***
Year 2011	1.12		0.356	3.144	0.002	***	1.092		0.286	3.816	0	***	1.747		0.346	5.056	0	***
Year 2012	1.268		0.339	3.746	0	***	1.229		0.286	4.293	0	***	1.973		0.338	5.83	0	***
Year 2013	1.474		0.344	4.286	0	***	1.553		0.319	4.873	0	***	2.338		0.354	6.597	0	***
Year 2014	1.544		0.352	4.382	0	***	1.655		0.317	5.223	0	***	2.532		0.36	7.043	0	***
Year 2015	1.225		0.351	3.486	0	***	1.421		0.344	4.126	0	***	2.322		0.369	6.289	0	***
Year 2016	0.761		0.4	1.903	0.057	*	0.666		0.353	1.887	0.059	*	1.649		0.395	4.171	0	***
Year 2017	-0.625		0.467	-1.338	0.181		-0.458		0.47	-0.974	0.33		0.965		0.428	2.254	0.024	**
Log Likelihood	-387.104						-828.712						-760.944					
AIC	834.2						1715.4						1579.9					
BIC	938						1846.1						1710					
Observations	243						669						657					
Countries	25						64						63					

Notes: The variable efficiency of the legal framework indicates a high variance inflation factor of 11.69. Pairwise correlations with the other independent variables show a high correlation, especially with public trust (0.82). For this reason, we omitted this variable from further analyses. Std. est. = Standard estimate; Std. err. = Standard error.
*Significant parameters are marked with asterisks: * p < 0.1; ** p < 0.05; *** p < 0.01.*

Table 4 shows the estimates for the total number of worldwide fintech startup formations based on the negative binomial error distribution model as outlined in Section 3. The model underscores the role of economic, technological, legal, and cultural factors in shaping the formation of this new industry. Thus, we find a significant positive relationship between *ln* (*GDP per capita*) and fintech startup formations, with a high statistical significance ($p < 0.01$) in all three models. The standardized estimates show the highest resp. second highest values (Model 2) of all independent variables making this variable the most important. Furthermore, we find with a low *banking intermediation rate* another significant evidence (at least in Models 2 and 3) for an economic factor ($p < 0.05$ and $p < 0.01$). Although there is no proof for the impact of the number of *ln* (*commercial bank branches*) on fintech startup formations, we cannot reject hypothesis 1a that these formations occur more frequently in countries with well-developed capital markets (regardless of the U.S. being included in the sample or not). On the contrary, *H1b* has to be rejected due to a lack of significant relevance of the *soundness of banks* and the *share of cooperative banks* on worldwide fintech startup formations (regardless of the model)[5].

For Models 2 and 3, we find a positive significant relationship between *government tech procurement*, with relatively low values for the standardized estimates, and fintech startup formations (while in Model 1, the *mobile phone subscriptions* are weakly significant). We thus cannot reject *H2* that this new industry occurs more frequently in countries where the latest technology is readily available. Nevertheless, there is no evidence that *internet penetration* has an impact on fintech startup formations. Furthermore, our results show in Model 2 a significant positive relationship ($p < 0.01$) between a low *burden of government regulations* and fintech startup formations. Although the variable *strength of legal rights* is not significant in Model 2 (as the model with the most observations), we cannot reject *H3* that fintech startup formations occur more frequently in countries with an advantageous legal/regulatory environment.

In line with *H4*, we detect (for all of the three models) a significant positive relationship between a cultural factor like the *degree of individualism* and fintech startup formations, with relatively moderate values for the standardized estimates. While there is a significant negative relationship between *public trust* and fintech startup formations (at least for Models 2 and 3), we do not find any significant relationship between the cultural factor of *power distance* and fintech startups. The influence of cultural factors, therefore, is – due to significant positive and negative relationships – not unambiguous. The findings might stem from the fact that fintech startup formations are not driven by trust in policy in the sense of reliability and transparency, but rather by distrust in politics due to the banking and financial crisis. According to this mixed picture of cultural factors, we cannot reject *H4* completely.

Statistics of each fintech category are calculated with two models (inclusive and exclusive share of cooperative banks; a model excluding the U.S. is not calculated due to small sample size) and reveal similar significant results as the total sample. The coefficients of *ln* (*GDP per capita*) and *banking intermediation rate* are positive and significant for three subcategories: financing, asset management, and other fintechs. Moreover, the variable *government tech procurement* has a positive and significant effect on the formation of fintech startups for financing and other fintechs. Fintech startups providing asset management and payment solutions apparently do not require the latest technology for their businesses. Furthermore, the variable *burden of government regulation* is positive and significant for financing and asset management fintechs, whereby a lower burden of regulation is obviously more conducive to such business models. In line with the total sample, all four categories are negative (partly significantly) correlated with the variable *public trust*. Finally, the variable *degree of individualism* has a positive and significant effect on the formation of fintech startups for all categories, underlining the fundamental role and importance of the individual, especially in Western cultures. Contrariwise, it can be stated that for payment fintechs the variable *degree of individualism* is positive and significant as well but much weaker than for the other fintechs, which could result from the fact that in Asian cultures the relevance of the community is more important than the individual and second, as already mentioned in Section 3, Asian cultures are still partially underbanked, so that payment solutions are more important.

Accordingly, the following implications for (prospective) fintech entrepreneurs, their competitors, and also potential regulators/ policymakers can be derived from our results and against the backdrop of previous research:

- GDP is an important driver for fintech evolution. Evolution therefore could be inhibited in times of a (pandemic or economic) crisis. Accordingly, fintechs in countries with little fintech evolution could benefit from measures that promote GDP (e.g., tax incentives for companies or interest rate subsidies).
- Financing fintechs could have emerged due to traditional funding gaps (especially in countries with low banking intermediation rates) and less flexible incumbent financial intermediaries (according to innovation) that small and medium-sized firms face worldwide, confirming the intermediate relevance of fintechs.
- The influence of the regulatory burden is ambivalent. On the one hand, further funding constraints according to increased regulation after the financial crisis subsequently contributed to the dynamic evolution of fintech startups. On the other hand, the empirical data show that a low regulatory burden is just starting to promote fintech startups. Therefore, countries with high regulatory burden should make regulatory processes more effective and efficient if they want to push fintech evolution.

[5] For the model with a one year lag, internet penetration became also significant (beta = 0.019, p = 0.069) compared to p = 0.156 for the 2 years lag. This can be a hint that internet penetration is useful for a short term boost of the total number of fintechs, whereas in the long run, other variables are more relevant.

• Government tech procurement is another relevant driver of fintech startup activity. Accordingly, countries with low government tech procurement had to invest in IT infrastructure if they want to support fintech growth.

• Entrepreneurial activities often take place in specific regions perceived as startup or fintech hubs and require highly specialized individuals (underlining the factor of individualism), who can quickly implement their business idea using existing cluster networks. Nevertheless, new fintech business models can easily be copied by incumbent financial intermediaries due to these institutions' (financial) capability to initiate projects of the size of a new fintech undertaking rather promptly.

5. CONCLUSION

Using an evolutionary economics approach, our paper analyzes different economic, technological, legal, and cultural factors and their relation to fintech startup activity in 76 countries. We find that the U.S. – at least until 2017 – is the largest fintech market according to startup activity, followed by the United Kingdom, which – despite the Brexit – still is a center of global fintech. Nevertheless, the Chinese and Indian fintech market has grown substantially in recent years which can be recognized by the fact that one-third of the fintech unicorns are meanwhile located in these countries. The empirical data show that since 2015 a consolidation of fintech activity has taken place at a high level. Likewise, the paper shows that the worldwide fintech activity was impacted unequally after the dot.com crisis and the subprime/financial crisis according to a different technology affinity of these crises.

Categorizing this new and innovative industry in the subcategories of financing, asset management, payment, and other fintechs, the paper demonstrates that financing is by far the most relevant segment in the worldwide fintech market. Moreover, it can be stated that in countries with a high GDP per capita, low banking intermediation rate, support by government tech procurement, the low burden of regulation, and a high degree of individualism, fintech activity is more pronounced.

As fintechs still evolve with a strong growth rate of the number of companies and the volumes invested, these financial institutions will constantly produce new phenomena that could be subject of economic analysis, as illustrated by the recent discussion of (big) fintechs and the (systemic) risk involved (Carstens, 2019; Stulz, 2019). Regarding our research question directed at the drivers of fintech evolution, the aforementioned limitations of our paper suggest that the following questions could be considered for future work, besides an extension of our analysis to further countries/regions:

• In how far do various fintech types show different paths and patterns of development (growth, market share, etc.)?

• Which are the predominant strategies of traditional financial intermediaries in response to fintechs (e.g., based on the seminal concept of "make or buy?") and in how far do they differ in regions of strong (weak) fintech evolution?

• Are regulatory responses in line with fintech evolution within the respective area of (national or supranational) regulation?

And obviously, in some years there should be thorough taking stock of fintech evolution vs. banking evolution to show in how far the former de facto endangered or even replaced the latter. Not only recent governance-related scandals suggest that fintech euphoria could be followed by fintech disillusion (extensively, see Zeranski and Sancak, 2020). It is also the banks, which existence has been challenged since they exist, and which have shown enough competitive resilience to endure these challenges, albeit by institutional change.

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