

Innovations in Financial Technology: Global Accelerators and Fintech Startups

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Abstract

This article examines the role of global business accelerators in the launch of startup companies in financial technology. Using a database comprising 500 + companies worldwide, we conduct a comparative analysis of the funding of fintech companies that participated in global accelerators versus non-accelerated startups. Supplementing our empirical study of fintech startup funding, we report the results of interviews of fintech entrepreneurs who graduated from leading accelerators. Our investigation reveals a large gap in funding of accelerated and nonaccelerated fintech startups, with the latter group receiving eight times the amount of early stage financing (seed capital + Series A/B/C venture capital) as the accelerated group. Situated at the intersection of scholarly research on fintech and global accelerators, the article illuminates the contributions of business accelerators to fintech startups and the dynamics of startup funding in industry segments with differing financial and technological demands.

Keywords: Fintech, Accelerators, Startups, Funding

1. INTRODUCTION

Innovations in financial technology (“fintech”) are shaking the global financial industry. Exploiting advances in digital technologies (application programming interface, artificial intelligence, cloud computing, data analytics, distributed ledger, etc.), agile startup companies are launching financial services that challenge large industry incumbents.

Fintech startups are developing mobile banking applications that allow tech-savvy millennials to bypass traditional retail banking branches. Alternative lending platforms afford customers in underserved markets access to low-cost, fast-approval credit facilities. Robo-advisory services enable young professionals and middle income households to invest in sophisticated asset classes previously limited to high wealth investors. Blockchain-powered financial products (cryptocurrencies, initial coin offerings, asset tokenization) are transforming the landscape of international transactions. Digitized payment and treasury operations permit the replacement of cumbersome legacy financial infrastructure. Fintech startups are also employing digital algorithms and machine learning to automate compliance with complex financial regulations enacted after the Great Recession.

These developments have stimulated a growing body of scholarly research on fintech. This literature includes works on the role of fintech in industry disruption, commercial applications of innovations in fintech technology, the regulatory implications of fintech's ascent, the increasing visibility of fintech in emerging markets, and related topics.

However, comparatively little scholarly research has appeared on funding of fintech startup companies. Startup funding levels represent a critical element of the global fintech industry insofar as they signal the international investor community's engagement in new and emerging technologies. By this metric, fintech outperforms other technology categories: In 2018, fintech represented 20.4 percent of global startup funding, exceeding artificial intelligence (15.3 percent), life sciences (8.3 percent), clean tech (4.6 percent), advanced manufacturing (3.4 percent), and cybersecurity (2.1 percent) (Startup Genome, 2019).

Advances in financial technology have also spurred the growing involvement of global business accelerators in launching fintech startups. Leading accelerators based in the United States (e.g., Y Combinator, Techstars), United Kingdom (Startupbootcamp, Barclays Accelerator, et al), and other countries are expanding their fintech portfolios. While there is an extensive literature on the role of accelerators and incubators in entrepreneurship, there is limited scholarly research on the specific contributions of these business development organizations to fintech startups.

This article augments the extant literature by integrating two research streams: Fintech startup funding and global business accelerators. Drawing on a database of over 500 companies and interviews of senior managers of selected firms, we analyze funding patterns (seed and venture capital) of fintech startups that participated in business accelerator programs and startups that pursued non-accelerated development paths.

Through this research design, we illuminate the role of business accelerators in the global fintech phenomenon. Accelerators, incubators, and other business development organizations promise major benefits to startup companies seeking to commercialize innovative technologies. However, empirical studies of the business outcomes of the accelerator experience have yielded ambiguous results. Our research methodology (comparative analysis of fintech startup funding in accelerated versus non-accelerated samples, supplemented by interviews of fintech entrepreneurs) augments the current literature by clarifying the actual contributions of business accelerators to fintech startup companies.

The article is organized as follows. We begin by reviewing the current scholarly literature, which reveals gaps in empirical research on fintech startup funding and the activities of business accelerators in the fintech industry. We continue with a description of our research methodology. We then examine fintech funding in the accelerated and non-accelerated groups, elaborating the analysis with a study of funding patterns across key segments of the fintech industry. We summarize the findings of our interviews of fintech entrepreneurs, whose reflections on their accelerator experiences enrich the empirical analysis. We end with a discussion of the conclusions of the study and directions for future research on financial technology.

1. LITERATURE REVIEW

1.1 SCHOLARLY RESEARCH ON FINTECH

Recent scholarly research on fintech engages the following themes:

One thread of this literature examines the role of fintech in industry disruption. Das (2019) surveys the repercussions of advanced digital technologies (artificial intelligence, machine learning, data analytics, etc.) for the financial services industry, emphasizing the potential long-term effects of fintech on the costs of financial intermediation and levels of industry employment. Recent publications address the competitive threats arising from fintech. Mention (2019) shows how major industry players (e.g., Citi, Goldman Sachs, JPMorgan Chase) are investing in advanced financial technologies and collaborating with rising startups via "open innovation" programs. Mills and McCarthy (2017) note the increasing use of "white label" agreements whereby large financial institutions (possessing banking licenses, installed customer bases, and established distribution channels) deliver startup initiated digital services under recognized corporate brands.

Other scholars explore the commercial implications of the fintech revolution. Utilizing a database of fintech patent applications and stock price shifts, Chen, Wu, and Yang (2019) assess the market value of innovations in financial technology. They find that blockchain, IoT (Internet of Things), and robo-advising generate the greatest value for fintech innovators and investors. Lee and Shin (2018) examine the impact of fintech on business models,

citing innovations in payments services, wealth management, crowdfunding, business and personal lending, capital markets, and insurance products. The authors note the regulatory risks facing fintech startups in these industry segments (e.g., liability stemming from faulty investment advice generated by algorithmic robo-advisors). Rogers, Leuschner, and Choi (2016) explore applications of advanced financial technologies in supply chain management, highlighting the use of fintech by leading multinationals (Apple, P&G, Siemens, et al) to facilitate arms-length transactions with global suppliers. By extending payables and accelerating receivables, fintech strengthens the working capital and liquidity positions of both buyers and sellers in complex global supply chains.

Another thread of the scholarly literature focuses on the regulatory dimensions of fintech. For example, Arner, Barberis, and Buckley (2017) analyze the application of digital technologies in financial regulation and regulatory compliance (“regtech”). Oney (2018) examines how the rise of state-chartered fintech companies (whose portfolios include both banking and non-banking services) affect federal-level deposit insurance, discount window, and payment systems. Cumming and Schwienbacher (2018) investigate shifts in venture capital funding of fintech following the 2008 global financial crisis. They conclude that differential enforcement of financial laws enacted after the crisis created regulatory arbitrage opportunities for VCs, which boosted investments in small fintech startups that faced lighter regulations and compliance burdens than large financial institutions.

Other scholars examine the impact of fintech in emerging markets. Chen (2016) traces China’s emergence as a global fintech power, noting the role of Chinese companies (Alibaba, Ant Financial) in the development and commercialization of digitally enabled consumer payments, micro lending, and wealth management. Burns (2018) details the contributions of Kenya-based M-Pesa as a pioneer in mobile banking. Sinha, Pandey, and Madan (2018) explore the application of digital technologies to expand financial inclusion in underserved markets of India.

The fintech literature also includes a number of valuable company-specific case studies: e.g., Ant Financial (Zhu, Zhang, Palepu, Woo, and Dai, 2018); Lufax (Malloy, Cohen, and Woo, 2018); Elixer (King, 2018); and Scotiabank (Hsieh; 2017).

The extant literature lacks a detailed empirical investigation of global trends in fintech startup funding. The levels, types, and modes of funding of startup companies are key indicators of the international investor community’s assessment of the commercial potential of new and emerging technologies. Startup funding patterns also shed light on the business development strategies of fintech startups occupying industry segments with differing capital needs, market demands, and technological requirements. Our study of fintech startup funding thus fills a gap in the scholarly literature on financial technology.

1.2 SCHOLARLY RESEARCH ON GLOBAL ACCELERATORS AND INCUBATORS

There is an expanding body of scholarly research on the role of accelerators and incubators in spurring the global business development of startup companies. This literature includes studies of the organizational design of business accelerators (Cohen, Bingham, and Hallen, 2019), the selection criteria and exit policies of accelerators (Bruneel, Ratinho, Clarysse, and Groen, 2012; Yin and Luo, 2018), the service offerings of accelerators (Fernández, Jiménez, and Roura, 2015; Köhler and Baumann, 2015), the contributions of accelerators to startup development (Bliemel, M., Flores, De Klerk, and Miles, 2019; Yusubova, Andries and Clarysse, 2019), the role of incubators in business innovation and technology development (Bacalan, Cupin, Go, Manuel, Ocampo, Kharat, and Promentilla, 2019; Mian, Lamine, and Fayolle, 2016; Morrish, Whyte and Miles, 2019), the impact of accelerators on transnational entrepreneurship (Brown, Mawson, Lee, and Peterson, 2019), the links between seed accelerators and corporate venture capital (Mayya and Huang, 2019), and the rising visibility of corporate accelerators (Mahmoud-Jouini, Duvert, C., and Esquirol, M., 2018; Richter, Jackson, and Schildhauer, 2017).

Other scholars have produced single- and multi-country studies of accelerators/incubators in developed market economies (Aerts, Matthyssens, and Vandenbempt, 2017; Albort-Morant and Pejvak, 2016; Barrehag, Fornell, Larsson, Mårdström, Westergård, and Wrackefeldt, 2012; Bøllingtoft, 2012; DaSilva and Gurtner, 2017; Dushnitsky and Sarkar, 2018; Iyortsuun, 2017; Pauwels, Clarysse, Wright, and Van Hove, 2016; Rubin, Aas, and Stead, 2015;) and emerging markets (Dutt, Hawn, Vidal, Chatterjii, and Mitchell, 2016; Mrkajic, 2017; Mulolli and Skenderi, 2017; Pietrasienski, 2013; Rogova, 2014).

In theory, high-potential startups stand to reap significant benefits from participation in business accelerators and incubators: enhanced technology development; elucidation of value propositions; refining of go-to-market strategies; introductions to prospective investors and partners; immersion in global alumni networks (Lall, Bowles,

and Ross, 2013). However, empirical research on the actual business outcomes of the accelerator/incubator experience yields mixed results.

In their investigation of business incubation in the United States, Harper-Anderson and Lewis (2018) find that the characteristics of incubators (quality of services, managerial experience, operational practices, board membership, etc.) are strongly related to incubatee outcomes. However, the benefits of the incubator experience are concentrated in the tenancy period and diminish after graduation. Gonzalez-Uribe's and Leatherbee's study of Start-Up Chile (2015) finds that entrepreneurship schooling combined with startup capital and co-working space provide concrete benefits in startup fund raising and scaling. But the authors conclude that basic accelerator services alone do not boost new venture performance. In their study of incubators in Northern Italy, Sedita, Apa, Bassetti, and Grandinetti (2019) find that the incubator experience strengthens the innovative capabilities of participating firms, measured as the share of sales of new-to-market products. However, Lukeš, Longo, and Zouhar's large-N investigation of Italian business incubators (2019) finds that the incubator experience may actually have negative effects on the short-term revenues of participating firms, whose operations in the protective milieu of the incubator pampers and shields startups from external competitive forces.

This article augments the current literature by examining the role of business accelerators in the fintech industry. Our research design (comparison of funding levels of accelerated versus non-accelerated firms, drawing on a global database on fintech startup funding and interviews of selected fintech graduates of leading accelerator programs) gives us analytical purchase on the specific contributions of accelerators to fintech startups.

2. RESEARCH METHODOLOGY

Our investigation focuses on the fintech portfolios of 10 global accelerators. While commonly viewed as interchangeable with "incubators", we treat "accelerators" as distinctive business development organizations. Accelerators possess a number of features that distinguish them from incubators: for-profit entities that take equity positions in portfolio firms; highly competitive application processes with low rates of acceptance; short, focused programs that concentrate the attention of admitted firms and speed time to market (Cohen, 2013; Pauwels, Clarysse, Wright, and Van Hove, 2016).

While there are hundreds of registered business accelerators operating around the world, empirical studies indicate that only the top accelerators (e.g., Y Combinator) have produced measurable effects on the business trajectories of startup firms. The rigorous selection procedures of these elite accelerators filter out all but the most promising startups. The intensive residency programs of leading accelerators (which typically conclude with "demo days" when portfolio firms deliver pitches to investors) certify graduates for venture capital funding and hasten their go-to-market campaigns (Hallen, Bingham, and Cohen, 2014; Smith and Hannigan, 2015). Moreover, well capitalized global accelerators like Y Combinator are moving beyond seed capital into early stage VC funding, further advancing the growth prospects of high-potential startups that gain admission to elite programs.

Profiles of our target accelerators are provided in FIGURE 1. We selected these particular accelerators owing to (1) their status as established business development organizations with demonstrated track records of success in launching technology startups, and (2) their holding of significant portfolios of fintech startups.

Figure 1

Profiles of Global Accelerators

ACCELERATOR	Founding Date	Headquarters	Global Operations	Programs	Funding	Portfolio
SOSV	1995	Princeton, NJ	US, UK, China, Taiwan	4 months, on-site	Seed Debt Early stage VC	Diversified
Y Combinator	2005	Mountain View, CA	US, China	3 months, on-site 2 cohorts per year	\$150,000 seed for 7% equity Early stage VC Debt	Diversified
Techstars	2006	Boulder, CO	US, Canada, UK, France, Germany, Spain, Israel, UAE, India, Korea, Australia	3 months, on-site	\$20,000 seed capital for 6% equity with repurchase option \$100,000 convertible note	Diversified
Plug and Play	2006	Sunnyvale, CA	US, UK, France, Germany, Italy, Poland, Mexico, China, Singapore, Malaysia	3 months, on-site	\$120,000 seed capital	Diversified
500 Startups	2010	San Francisco, CA	US, Mexico	4 months, on-site	\$150,000 seed capital for 6% equity Early stage VC	Diversified
Startupbootcamp	2010	London	UK, US, Mexico, Italy, Netherlands, Qatar, UAE, Egypt, Australia, South Africa	3 months, on-site	Seed capital	Diversified
Fintech Innovation Lab	2011	London	US, Asia-Pacific	3 months, on-site	Seed capital Early stage VC	Fintech
Level39	2013	London	UK	Mentorship Networking Shared workspace	Investor access	Diversified
Barclays Accelerator	2013	London	Partnership with Techstars in US	3 months, on-site	Seed capital Early stage VC	Fintech
Founders Factory	2015	London	UK	6 months, on-site	£ 30,000 seed capital for 4-7 % equity	Diversified

Using Crunchbase, company Web sites, and other sources, the authors constructed a global database on funding of fintech startups. The database reports funding amounts (USD, seed capital + Series A/B/C venture capital) received by fintech startups in two groups: Accelerated Firms (fintech startups that participated in formal accelerator programs), and Non-Accelerated Firms (fintech startups that launched without the support of accelerator organizations). The accelerated group comprises 251 companies; the non-accelerated group 302 companies. The database includes fintech startups headquartered in the United States, United Kingdom, Continental Europe, Asia-Pacific, Middle East/Africa, and Latin America.

By tracking seed and venture capital investments in accelerated fintech startups (and assembling a control group comprising fintech startups that did not participate in accelerator programs) we gauge the impact of the accelerator experience on fintech funding.

Parallel with the construction of a startup funding database covering the accelerated and non-accelerated groups, we organized the fintech funding data into 10 industry segments:

- Payments
- Alternative Lending
- Consumer Finance
- Insurance
- Digital Banking
- Real Estate
- Capital Markets
- Investment Management
- Regtech
- Blockchain

The fintech industry comprises a number of segments ranging from large, well established market groups (e.g., payments, alternative lending) to new and emerging categories (e.g., blockchain, regtech). While exhibiting some complementarities, these fintech segments display important differences: market size, barriers to entry, competitive structures, customer bases, user needs, scale economies, technological demands, financial requirements. The inclusion of segment-specific funding data provides additional insights on the fintech industry and the specific role of business accelerators in fintech startups.

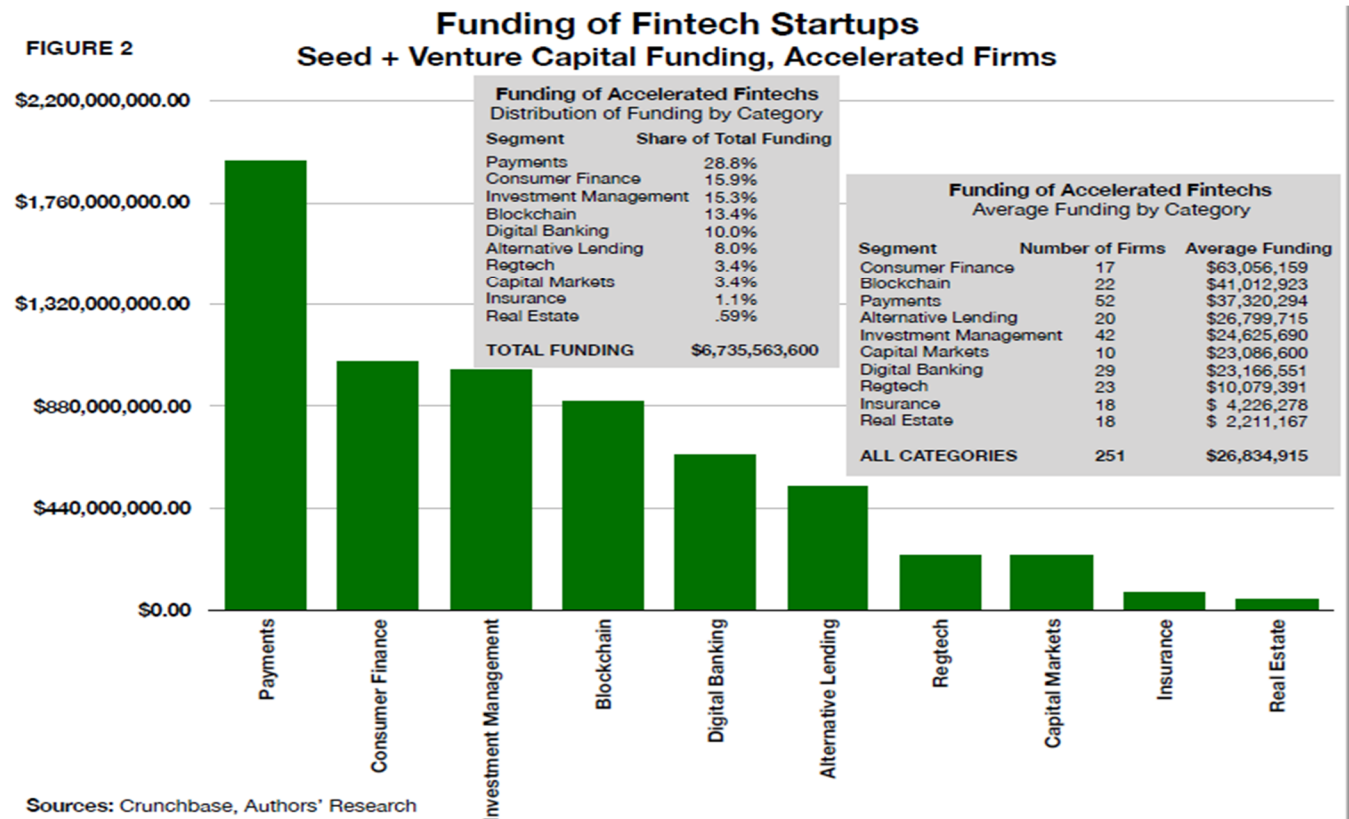
Supplementing the funding database, we conducted interviews of selected fintech startups that participated in the target accelerators. Some of these interviews were conducted on site with senior company managers; others were conducted telephonically.

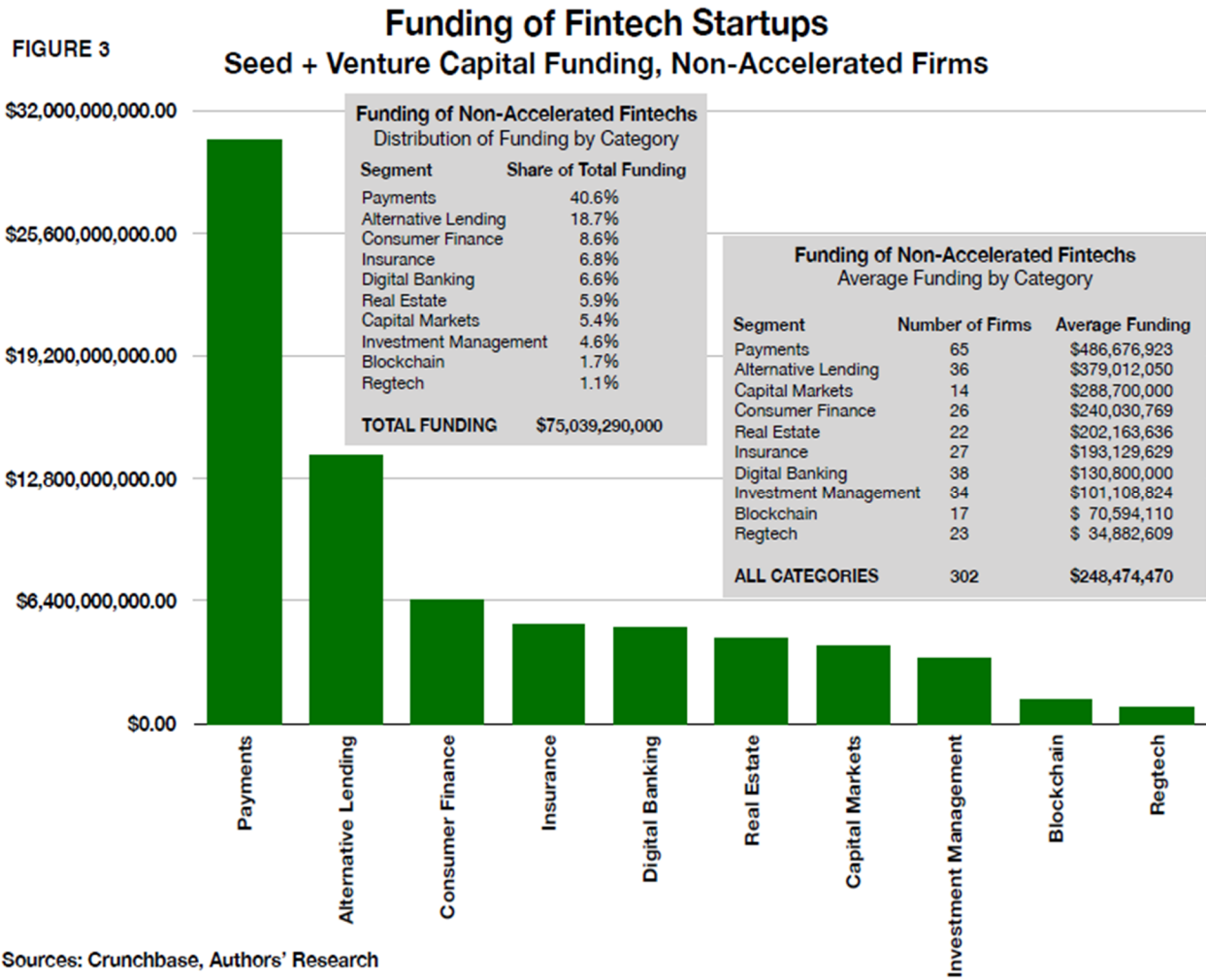
Our fintech startup interviews addressed the following questions:

- The business development services delivered by the accelerator
- The activities the startup company undertook under the auspices of the accelerator
- The benefits of the company’s experience in the accelerator

3. FUNDING OF ACCELERATED AND NON-ACCELERATED STARTUPS

The results of our analysis of fintech funding by startup type and segment are reported in FIGURE 2 (accelerated startups) and FIGURE 3 (non-accelerated startups) below:





The data reveal a large gap between the funding of accelerated and non-accelerated fintech startups (\$6.7 billion vs. \$75 billion). The high figure of the non-accelerated group reflects the inclusion of several Chinese firms that have generated unusually large amounts of funding. Ant Financial alone accounts for \$22 billion, augmented by Alibaba's acquisition of 33 percent equity share in February 2018. Adding other large Chinese fintech cases (ZhongAn \$1 billion, Lufax Holding \$3 billion) raise China's share of non-accelerated fintech funding to over one-third of the global total.

But even discounting the outsized Chinese cases leaves an eight-fold funding gap between the accelerated and non-accelerated groups. We therefore considered alternative explanations of the accelerated/non-accelerated funding gap:

One potential explanation focuses on the larger size of the non-accelerated fintech group (302 firms vs. 251 firms in the accelerated group). But the nine-fold differential in average funding levels in the two groups (\$248.5 million/firm vs. \$26.8 million) weakens explanations based on gross sample size. The large gap in the funding ranges of the two groups (\$15,000–\$793.5 million for accelerated startups; \$1.2 million–\$2.3 billion for nonaccelerated startups, excluding the Chinese outliers noted above) further undermines accounts based on sample size.

A second explanation of the funding gap addresses the age of firms in the two groups. A larger share of non-accelerated firms was founded before 2010 than firms in the accelerated group. The funding gap thus reflects the inclusion of older, more mature fintech firms in the non-accelerated group that migrated from seed to venture capital funding. But adjusting the two datasets to include only firms founded after 2010 still leaves a large gap in funding of accelerated and non-accelerated startups.

A third explanation draws on the weighting of the non-accelerated group toward startups situated in capital-intensive segments of the fintech industry. Two such segments account for nearly 60 percent of startup funding in the non-accelerated group. 40.6 percent of funding of non-accelerated startups went to firms positioned in Payments, the largest of the fintech industry segments with well-established incumbents (e.g., PayPal) and comparatively high barriers to entry. 18.7 percent of funding in the non-accelerated went to firms in Alternative Lending, another mature segment with large scale economies. By contrast, Payments and Alternative Lending represent smaller shares (28.8 percent and 8.0 percent respectively) of funding in the accelerated group.

Adding weight to explanations focusing on the composition of the samples, the accelerated group comprises larger shares of fintech startups situated in new and emerging segments employing advanced digital technologies whose funding requirements differ from those of well-established industry segments like payments and alternative lending: e.g., Investment Management (15.3 percent of accelerated group funding vs. 4.6 percent of nonaccelerated group funding); Blockchain (13.4 percent vs. 1.7 percent); Regtech (3.4 percent vs. 1.1 percent).

These results raise the following hypothesis: The aggregate funding gap between accelerated and nonaccelerated fintech startups stems not from differences in sample size or the relative ages of represented firms, but from differences in the segmental composition of the two groups.

4. FINTECH INDUSTRY SEGMENTS

We organize the fintech industry into 10 segments, whose product/service portfolios are summarized in FIGURE 4 below. These industry segments are not discrete: there is considerable overlap between particular categories (e.g., Payments and Digital Banking; Investment Management and Capital Markets; Real Estate and Consumer Markets). Moreover, a number of fintech startups in our study operate in multiple segments. However, this categorization scheme enables us to examine funding trends across key industry segments.

Figure 4

Fintech Categories Product/Service Portfolios in Key Industry Segments

Payments Mobile payments Payments processing Billing Invoicing E-commerce SME transactions Point of Sale applications Debt collection Payroll services Expense management Accounts payables Accounts receivables	Investment Management Portfolio management Wealth management Asset management Retirement planning Social impact investing Venture capital Structured investment Securities trading Data analysis Investment research Forecasting Underwriting	Alternative Lending Digital lending Crowdfunding Childcare financing Education financing Litigation financing Peer-to-peer lending Financing in emerging markets Portfolio risk management Covenant monitoring Digitized loan closing Emergency financial services Fundraising for non-profits	Insurance Health insurance Auto insurance Crop insurance Risk insurance Consumer insurance Alternative underwriting Claims administration Sales Distribution Customer services Brokerage platforms Fraud detection	Capital Markets Securities trading Options trading Equity sales OTC derivatives Fixed income instruments Auctions Swaps Pricing & quoting Financial market analysis Collateral management Market infrastructure Treasury operations
Digital Banking Online banking Mobile banking Voice banking Adaptive banking Personal finance Reloadable debit cards Startup financing Money transfers Remittances	Real Estate Mortgage processing Mortgage brokering Real estate investing Commercial property Property management Appraisals Leasing Bridge loans Home refinancing	Blockchain Cryptocurrency exchanges Bitcoin Ethereum Cyber threat monitoring Transaction management Due diligence Validation Real-time tracking Global procurement	Regtech Regulatory compliance Auditing Authentication services Data certification Automated oversight Smart contracting Anti-money laundering Transaction monitoring Identity verification	Consumer Finance Credit cards Transactional data Consumer behavior analysis Expanded credit access Credit scoring Rebuilding credit Credit risk analysis Credit fraud mitigation Automated loan decisions

Our segment-specific analysis reveals the following patterns in fintech startup funding: The funding gap between the non-accelerated and accelerated is most pronounced in Payments, Alternative Lending, and Capital Markets. This reflects the relative maturity, large scale requirements, and high capital costs of technology commercialization in those fintech segments. The funding gap is also substantial in Insurance and Real Estate, segments for which the fintech portfolios of the target accelerators are comparatively small and participating firms are mostly at seed stage. The funding gap is narrower in Consumer Finance, Digital Banking, and Investment Management, categories in which a number of accelerated fintech startups have graduated from seed to venture funding. The gap is also

relatively narrow in Regtech and Blockchain, new and rapidly growing market segments in which recently formed startups are making significant inroads under the tutelage of accelerators.

4.1 PAYMENTS

Payments is the largest of the fintech segments, representing nearly 30 percent of startup funding in the accelerated group and over 40 percent of the non-accelerated group. The high funding levels reflect payment's standing as the oldest and best established fintech segment, which dates back to the formation of PayPal in 2008. Acquired by eBay in 2012 and spun off as independent public company in 2015, PayPal now generates over \$15 billion in global revenue. The world's first accelerated fintech (Y Combinator's launch of TextPayMe in 2005) was also situated in the payments segment. Amazon's 2006 acquisition of TextPayMe (which pioneered the application of SMS to payments) demonstrated the market potential of digitally enabled payments amid the international expansion of ecommerce (Cartwright and Allayannis, 2017).

Our investigation reveals a major gap in average funding of payments-related fintech startups in the accelerated and non-accelerated groups (\$37.3 million vs. \$486.7 million). This gap reflects the inclusion of two exceptionally large Chinese cases in the non-accelerated group: Ant Financial (which received \$22 billion of venture funding before its acquisition by Alibaba in 2018) and Beijing-based Qudian (\$873.6 million).

But even discounting these Chinese outliers, funding of non-accelerated payments startups well surpasses that of accelerated firms in the payments segment. Exclusion of Ant Financial and Qudian reduces average funding in the non-accelerated payments group to \$116.4 million per firm, over three times the level of accelerated payments startups.

Among 52 startups in the accelerated payments group, only 6 firms have received funding exceeding \$100 million: San Francisco-based Stripe (Y Combinator, \$793.5 million), New York-based Dashlane (Fintech Innovation Lab, \$210.9 million), Seattle-based Remitly (Techstars, \$200 million), Boston-based Flywire (500 Startups, \$143.2 million), London-based GoCardless (Y Combinator, \$122.3 million), and San Francisco-based Qwil (500 Startups, \$107.1 million). Moreover, the accelerated group comprises a number of recently formed early stage companies whose funding is limited to seed capital provided by the accelerator (e.g., the \$120,000 grants awarded to startups in Y Combinator's highly competitive accelerator program). By contrast, the non-accelerated payments group is populated with companies that have progressed from seed stage and accumulated large volumes of Series A/B/C venture funding. The high funding levels of these nonaccelerated firms reflect their relative maturity (mostly founded in the early 2000s) and positioning in sub-segments of the payments market with heavy infrastructural and scaling requirements.

Well-funded payments startups in the non-accelerated group include Stockholm-based Klarna (\$774.7 million), which offers zero-interest POS financing to retail shoppers worldwide; AvidXchange (Charlotte, \$545.3 million), which delivers automated billing and invoicing services to global suppliers; Toast (New York, \$502 million), which has developed a digital payments platform for restaurants that includes POS, online ordering, and payroll; and San Francisco-based Gusto (\$316.1 million) and Zenefits (\$583.6 million), which provide digital platforms to streamline employee onboarding, payroll, and benefits administration.

4.2 ALTERNATIVE LENDING

The Alternative Lending segment comprises fintech companies offering innovative services in global credit markets underserved by large commercial banks. The target customers of alternative lending startups include (1) students and young professionals who are highly receptive to digital technologies but lack credit histories qualifying them for conventional bank loans, (2) small and medium enterprises frustrated with the slow pace and high transaction costs of loan approval by traditional banks, (3) non-profit and philanthropic organizations exploiting advances in crowdfunding, peer-to-peer lending, and other digitally enabled financial mechanisms, (4) niche credit markets seeking alternatives to conventional banking loans (e.g., childcare, education, litigation) and (5) unbanked communities in China, India, and other developing and emerging markets where large populations lack credit access (Ahlstrom, D., Cumming, & Vismara, 2018; Jagtiani & Lemieux, 2018; Kendall, 2017; Lu, CK, 2018; Lu, CK, Lee, A., Gupta, A., Sau, M. & Maita, K., 2018; Mills. & McCarthy, 2017; Mnohohitnei, Scorer, Shingala, & Thew, 2019; Palladino, 2019).

Similar to the payments segment, the alternative lending segments shows a large gap in both aggregate funding (\$536 million vs. \$14 billion) and average funding (\$26.8 million vs. \$379 million) of fintech startups in the accelerated and non-accelerated groups. The funding differences illustrate the relative maturity of the non-accelerated firms in the data set and their positioning in sub-segments of the alternative lending category with comparatively high capital requirements.

The non-accelerated alternative lending group includes three firms that received \$1 billion + in funding: London-based Prodigy Finance has developed a global investment platform to support post graduate student loans and student loan refinancing. Also based in London, Oaknorth provides a range of lending services (growth capital, structured debt, managed buyout financing) to entrepreneurial firms, SMEs, property developers, and other customers. San Francisco-based Affirm offers POS (point of sale) credit services to retail customers who choose among a menu of interest rate and payment options.

By contrast, the accelerated alternative lending group includes just two firms with funding exceeding \$100 million: Y Combinator's LendUp (San Francisco, \$361.5 million), which offers payday loans and other personal credit services; and 500 Startups' Konfio (Mexico City, \$102.8 million), which specializes in small business loans.

4.3 CAPITAL MARKETS

Startups in the Capital Markets segment are developing digital technologies that reduce the duplications, inefficiencies, and complexities of legacy clearing and settlement infrastructures. Applications of fintech to capital markets include treasury operations, securities trading, fixed income instruments, and over-the-counter derivatives (Gozman, Liebenau, & Mangan, 2018).

Similar to the payments segment, the high average funding level (\$288.7 million) of non-accelerated startups in the capital markets segment reflects the impact of Chinese outliers, notably Shanghai-based Lufax that has received \$3 billion funding to support the development of an international financial asset exchange. Kyriba (San Diego, \$312.5 million) has developed a digital platform to streamline cash management and corporate treasury operations. Trumid (New York, \$142.3 million) employs advanced data analytics for corporate bond trading.

The accelerated capital markets group includes Fintech Innovation Lab's ChartIQ (Charlottesville, VA, \$22.3 million), which has launched a desktop application that permits integrated asset management. Level39's WiseAlpha (London, \$6.2 million) has developed a digital technology to expand investor access to the corporate bond market. 500 Startups' Origin (London, \$2.2 million) has introduced a platform that facilitates transactions in fixed income instruments. The rest of the accelerated capital markets group comprises recently formed startups at seed stage focusing on the application of next generation technologies (e.g., machine learning) to asset management and treasury operations.

4.4 INSURANCE

Fintech startups in the Insurance segment are applying digital technologies to underwriting, sales, marketing, distribution, pricing, policy activation, claims processing, and fraud detection. Insurtech firms are writing algorithms to facilitate risk analysis, developing AI platforms to enable personalized customer service, using computer vision systems for automated damage assessment, and employing virtual reality and drone technology for claims inspection and claims decisions (Chester, Ham, Johansson, and Olesen, 2018; KPMG, 2019; McKinsey & Company, 2018).

Within the non-accelerated group, a number of well funded startups are applying these technologies across key segments of the global insurance industry. Gryphon (London, \$234 million), Singapore Life (Singapore, \$83 million), and Ladder (Palo Alto, \$54 million) are deploying digital technologies for life insurance. Bright Health (Minneapolis, \$440 million) and Devoted Health (Waltham, \$342 million) are leveraging digital technologies for health insurance products. Metromile (San Francisco, \$295 million) and Root (Columbus, \$177.5 million) provide digitally enabled auto insurance products.

Within the accelerated group, only a handful of insurtech startups have progressed to venture funding. This includes 500 Startups' PolicyPal (Singapore, \$20 million) and Embroker (San Francisco, \$14.4 million). The rest of the accelerated insurtech group comprises seed-stage companies in early development of innovative products with strong commercial potential. For instance, Tel Aviv-based Oko is integrating satellite, weather forecasting, and mobile device technologies for crop insurance applications.

4.5 REAL ESTATE

Beset by manual loan processing and slow mortgage approval, the Real Estate segment is highly vulnerable to disruption by nimble fintech startups. Detroit-based Rocket Mortgage was a pioneer in the application of digital technology in real estate finance, now providing online mortgage products through Quicken Loans (Gomber, Kauffman, Parker & Weber, 2018).

The non-accelerated group includes a number of well capitalized startups offering digitally based home mortgage and home refinancing products: Lendinvest (London, \$700 million), Ribbon (New York, \$225 million), Lending Home (San Francisco, \$165.9 million), Blend (San Francisco, \$160 million), Cadre (New York, \$133.3 million).

The accelerated real estate group displays the lowest level of funding in the entire sample, with total funding of just \$39.8 million and average funding of \$2.2 million. Two companies represent 41 percent of funding in the accelerated real estate group: 500 Startups' Reali (London, \$10.2 million) and Fintech Innovation Labs' Canopy (London, \$6.1 million).

4.6 CONSUMER FINANCE

The Consumer Finance segment comprises fintech startups providing credit cards, credit scoring, credit fraud mitigation, and related services. Through advanced digital technology, service providers in this segment automatically transfer funds between accounts to pay off credit balances ahead of schedule, lowering clients' credit utilization ratios and improving their credit scores (Gozman, Liebenau, and Mangan, 2018).

The average funding of accelerated firms in the consumer finance category (\$63 million) exceeds that of all other fintech segments in the accelerated fintech group. Leading the list is 500 Startups' Credit Karma (San Francisco, \$868 million), which provides free credit scoring to 75 million customers while collecting fees from partner lending institutions.

The average funding of consumer finance startups in the non-accelerated group (\$240 million) reflects the impact of one outlier: SoFi, the Utah-based provider of student loan products that has received \$2 billion of venture funding. Other heavily funded startups in the non-accelerated group include 51 Credit Card Manager (Hangzhou, \$459 million), which delivers credit billing management services; Future Finance (Dublin, \$459 million), which offers private student loans as an alternative to government-funded education loans; and Zest Finance (Los Angeles, \$217 million) which has developed a machine learning platform to support credit underwriting.

4.7 DIGITAL BANKING

Digital banking startups seek to "democratize banking" with mobile services that challenge traditional branch-based retail banks. Fintech startups in this segment target millennial generation customers with cloud-based deposit and savings accounts, personalized applications, and low fee fund transfer services. Industry incumbents are responding to this competitive challenge by partnering with startups to develop API-based "open banking" platforms that permit secure sharing of customer data with third party service providers (Gomber, Kauffman, Parker, and Weber, 2018; KPMG, 2019; Townsend, 2019).

The accelerated digital banking group includes one major funding success: London-based Revolut (\$336.4 million), launched in 2014 under Level39. Since that time, Revolut has built a global base of 8 million users of low-fee international money transfers, no-cost ATM withdrawals, and instant payment notifications. Other firms in the accelerated group have advanced to VC funding: Plug and Play's Dwolla (Des Moines, IA, \$51.4 million), which provides digital banking services to small businesses; Fintech Innovation Lab's Bud (London, \$22.0 million), which aggregates multiple services on a single API-based open banking platform; and 500 Startups' Simple (Portland, \$15.3 million), which offers mobile deposit and checking services.

The non-accelerated digital bank group includes established players such as Atom Bank (Durham, \$480 million), which stakes claim as the United Kingdom's first all-mobile bank; N26 (Berlin, \$512.8 million), which offers a full range of digital banking services throughout the European Union; and TransferWise (London, \$480.7 million), which specializes in low-cost international money transfers. Significantly, the best financed digital banking startup in the non-accelerated group is São Paulo-based Nubank, whose funding success (\$1.1 billion) illustrates Brazil's expanding profile in fintech.

4.8 INVESTMENT MANAGEMENT

Analogous to efforts by digital banking startups to reach underserved markets, startups are leveraging digital technologies to democratize investment management. Digital wealth management systems permit automated portfolio allocation and lower transaction costs, giving millennials and middle class households access to sophisticated asset classes previously limited to high wealth investors. Robo-advising platforms enable intelligent data collection and information processing, generating investment recommendations with limited or no human intervention and obviating resort to fee-based financial advisors (Ashta and Biot-Paquerot, 2018; CB Insights, 2018; D'Acunto, Prabhala and Rossi, 2019; Gomber, Kauffman, Parker and Weber, 2018; Gozman, Liebenau and Mangan, 2018; Viceira and Ciechanover, 2017).

Investment management startups figure prominently in the portfolios of the global accelerators featured in our study. Leading this group is Palo Alto-based Robinhood, which has received \$862 million funding under the guidance of Techstars. Robinhood has launched a digital platform for commission-free trading in stocks, options, gold, and cryptocurrency. Other well funded accelerated firms in the investment management segment include Y Combinator's Clear Tax (Bangalore, \$65.4 million), Techstars' Visible Alpha (London, \$38 million), and 500 Startups' Neighborly (San Francisco, \$30.7 million).

In the non-accelerated group, the best funded investment management startup is Dataminr (New York, \$577 million), which has developed an AI platform to provide investors with real-time information on breaking events. A number of startups in this group offer digital wealth management services: Personal Capital (Redwood City, \$265.3 million); Acorns (Irvine, \$207 million); Addepar (Mountain View, \$205.8 million); Wealthfront (Irvine, \$204.5 million); Carta (Palo Alto, \$147.8 million); Mofit (Rancho Cordova, \$126.5 million).

4.9 REGTECH

The rapid growth of the Regtech segment stems from the proliferation of financial regulations following the 2008-09 global crisis. This development includes a series of regulatory directives by the European Union, notably MiFID (Markets in Financial Instruments Directive), PSD2 (Second Payment Services Directive), and GDPR (General Data Protection Regulation). Other advanced industrialized countries responded to the global financial crisis with new and complex regulatory schemes (e.g., Dodd-Frank in the United States). At the multilateral level, international banks confront the rigorous capital adequacy and liquidity requirements of Basel III.

Facing mounting regulatory compliance costs, banks and non-bank financial institutions have turned to regtech companies for digital alternatives to cumbersome manual processes: regulatory mapping; automated compliance tracking; fraud detection; identity verification; enhanced reporting systems; improved data security (Anagnostopoulos, 2018; Arner, Barberis & Buckley, 2017; Mnoghithnei, Scorer, Shingala, & Thew, 2019; Yang & Li, 2018)

Within the accelerated group, Plug and Play is the leader of the regtech segment. That accelerator's regtech portfolio includes Onfido (London, \$44.9 million) and Preempt Security (San Francisco, \$27.5 million), both specialists in identify verification. Truulio (Vancouver, \$80.8 million) has developed an advanced KYC (Know Your Customer) platform. BehavioSec (San Francisco, \$25.7 million) employs behavioral biometrics for authentication of digital identities.

Major players in the non-accelerated group include Signifyd (San Jose, \$185 million), which offers PSD2 compliance solutions; Digital Reasoning (Nashville, \$104 million), which has developed a regulatory mapping application for healthcare providers; and Shift (Paris, \$99.8 million), which specializes in fraud detection systems.

4.10 BLOCKCHAIN

As the pioneer in the application of Blockchain in international finance, Bitcoin holds a commanding market share (70 percent) in cryptocurrency. Other early movers (e.g., Ethereum, Litecoin) are expanding their positions in the global cryptocurrency market. Facebook's launch of Libra signals the growing interest of nonfinancial multinational companies in cryptocurrency.

Fintech startups are developing applications of blockchain technology in areas adjacent to the core cryptocurrency market, including ICOs (Initial Coin Offerings), asset tokenization, digital security solutions, international trade

finance, and clearing/settlement of global supply chain transactions (CB Insights, 2018; Dhar, V. and Stein, 2017; KPMG, 2019; Li, A., 2018; Townsend, 2019).

Within the accelerated group, the blockchain segment exhibits the second highest average funding level after consumer finance. The difference in average funding between accelerated and non-accelerated startups in blockchain (\$41 million vs. \$70 million) is narrower than in all other fintech segments in the study.

The best funded blockchain startup in the entire dataset is Y Combinator’s Coinbase (San Francisco), which has received \$547.3 million to develop a digital currency wallet and ICO platform. Techstars’ Chainanalysis (New York, \$47.6 million) applies blockchain for data analysis and transaction monitoring. Plug and Play’s Abra (Mountain View, \$35.5 million) offers cryptocurrency investing services. Level39’s Babb (London, \$21.8 million) leverages blockchain technology for peer-to-peer banking.

Leading blockchain startups in the non-accelerated group include Circle (Boston, \$246 million), which specializes in cryptocurrency exchanges; Bitfury (Amsterdam, \$170 million), which develops cryptocurrency mining servers and related blockchain infrastructure; Kyber Network: (Singapore, \$106 million), which focuses on international token transactions; and Ledger (Paris, \$88 million), which offers a suite of crypto security products.

5. FINTECH STARTUP INTERVIEWS

Supplementing our funding analysis, we conducted interviews with founders and senior managers of a select group of accelerated fintech startups. The results of these interviews are summarized in FIGURE 5 below. The subject startups (mostly headquartered in New York) represent a range of fintech industry segments. To preserve confidentiality, we have excluded the identities of the companies and their associated business accelerators.

FIGURE 5 **Fintech Startup Interviews**
Summary of Interviews of Selected Accelerated Fintech Startups

Company	Headquarters	Segment	Products/Services	Results of Accelerator Experience
Fintech A	New York	Digital Banking	Savings/deposits Money transfers Debit cards Transaction notification	Connections with large institutions Immersion in startup ecosystem No impact on funding High cost of program—6 percent equity
Fintech B	New York	Regtech	Credit ratings Credit monitoring Dynamic risk analysis Country risk modeling	Strategy development Refinement of company operations Access to financial industry resources Large equity share taken by accelerator
Fintech C	New York	Regtech	Unstructured data analysis Financial data extraction Pattern recognition Workflow automation	Mentoring Introductions to banking clients Access to investors Limited impact on funding
Fintech D	New York	Blockchain	Know Your Customer Global trust provisioning Customized rule compliance Mobile interface	Training by startup practitioners Introductions to senior advisors Development of proof of concept Limited impact on funding
Fintech E	Antwerp	Capital Markets	Cash flow forecasting Working capital analytics Financial reporting Smart treasury operations	Introductions to financial institutions Development of branding strategy Refinement of competitive positioning Preparation for investor pitches
Fintech F	New York	Alternative Lending	Scientific research funding Crowdfunding Challenge grants Collaborative research	Access to accelerator alumni Introductions to prospective users Preparation for investor meetings Post-program guidance & support
Fintech G	Washington	Alternative Lending	Education funding Social funding Capital campaigns University endowments	Framing value proposition Guidance on go-to-market strategy Exposure to investors High cost of program—7 percent equity

Elaborating on the findings of our fintech startup interviews:

Echoing the preceding quantitative analysis, our interviewees indicated that their accelerator programs did not have a significant impact on funding. Some (but not all) of the target accelerators provide modest seed grants to startups admitted to competitive programs. Large, well-capitalized accelerators like Y Combinator are now migrating into the venture capital space by taking equity positions in program graduates and non-affiliated startups exhibiting strong commercial potential. But the direct impact of the accelerator experience on fintech startup funding appears limited.

One of our interviewees suggested that participation in an accelerator program may actually be a hindrance to venture funding: many investors associate accelerators with very early stage companies, and are reluctant to divert resources from mature non-accelerated firms that have well developed business connections.

What funding-related benefits accelerators provide to their portfolio companies are largely indirect: (1) providing intensive preparation for investor pitches, which typically take place at the conclusion of the accelerator program with “demo days” attended by pre-qualified investors, (2) facilitating introductions to angel investors, VCs, and strategic investors that in some instances culminate in advanced venture funding, and (3) generating “halo effects” from association with a globally branded accelerator, whose imprimatur signals the startup’s standing as a high-potential company and boosts its credibility with the investor community. For the fintech startups in our interview sample, the foremost benefits of their accelerator experience stemmed from business development activities conducted under the guidance of seasoned industry mentors and startup practitioners: critical questioning of the assumptions underlying the startup’s business model; specification of the company’s value proposition; refinement of the company’s go-to-market strategy.

The interviewees also noted the value of immersion in entrepreneurial ecosystems with extensive cross-fertilization between startups. These network effects were particularly pronounced for fintech startups that participated in accelerator programs in the San Francisco Bay Area. Even for companies headquartered in other regions of the US or abroad, admission to short-duration accelerator programs in the Bay Area provided access to a world class ecosystem (“Belly of the Beast”) renowned for its density of investors, technology startups, multinational companies, and research universities.

Our interviewees further emphasized the importance of integration into the global alumni networks of accelerators and provision of continuing strategic guidance by accelerator partners after graduation. While the accelerator programs usually did not generate short-term funding benefits, the enduring business relationships forged during the accelerator experience have proven of significant long-term value.

Finally, our fintech startup interviews underscored the costs of accelerator programs. The internationally recognized accelerators featured in this study typically demand 6-7 percent equity shares in startups admitted to their programs. For fintech startups with strong commercial prospects, conceding such ownership stakes at an early stage of business development may prove unduly costly and heighten the allure of non-accelerated paths.

6. CONCLUSIONS

Our empirical investigation of fintech startup funding yields the following conclusions:

The research design of the article (comparing fintech funding of accelerated and non-accelerated firms) provides important insights on the role of global accelerators in the business development of technology startups. The study reveals a large gap in funding of fintech startups in the accelerated and non-accelerated groups. This gap reflects (1) the larger size of the non-accelerated sample, (2) the inclusion in the non-accelerated group of a number of Chinese outliers that received exceptionally large amounts of funding, and (3) differences in the age of fintech firms in the two groups, with the non-accelerated cohort comprising older, more mature companies that have progressed from seed to venture funding.

But even controlling for these factors leaves a sizable funding gap between accelerated and non-accelerated fintech startups, which we attribute to differences in the segmental composition of the two groups. In the non-accelerated sample, heavy amounts of funding flowed to established industry segments (Payments, Alternative Lending, Capital Markets) with high capital costs and scale requirements. Within the accelerated sample, startup funding was most robust in newer industry segments (Consumer Finance, Digital Banking, Investment Management, Regtech, Blockchain) that leading global accelerators are now prioritizing.

The latter group contains several examples of highly funded startups that illuminate the fintech strategies of the global accelerators profiled in our study. 500 Startups' Credit Karma is the best funded fintech startup in the accelerated group, having raised over \$800 million (Series A/B/C/D, 7 rounds) to finance the deployment of digitally-enabled consumer finance products. Techstars' Robinhood has raised a similar amount of venture funding (Series A/B/C/D/E in 8 rounds) to support the launch of a digitally-powered brokerage platform. Robinhood's investors include leading VCs including Menlo Park-based Sequoia Capital and Hong Kong-based DST Global. DST Global is also a lead investor in Level39's Revolut, the London-based startup whose digital platform aims to democratize banking. In these cases, accelerators guided their startups from technology development to business modeling to strategy formulation, demonstrating sufficient commercial potential to generate significant venture funding.

Accelerated startups in other fintech segments display different funding patterns. In Blockchain, Y Combinator's Coinbase raised nearly \$500 million over 9 rounds in advanced venture funding from a variety of investors, including Silicon Valley-based VCs (Andreessen Horowitz, Institutional Venture Partners), global investment firms (New York-based Tiger Global Management), and a major international commercial bank (Bank of Tokyo). Highlighting its movement into the VC arena, Y Combinator itself is a Series E investor in Coinbase.

As the lead accelerator in the Regtech segment, Plug and Play has steered a small cluster of startups from seed to venture funding: BehavioSec (Series A/B, 4 rounds), Preempt Security (Series A/B, 3 rounds), Onfido (Series A/B/C, 9 rounds), and Trulioo (Series A/B/C, 8 rounds). In addition to investments by venture capitalists, the latter two startups in Plug and Play's regtech portfolio received funding from strategic investors (Microsoft in Onfido, Goldman Sachs in Trulioo), signaling the corporate sector's growing interest in innovative regulatory compliance products under development by startups.

However, the overall pattern indicates that startup funding does not represent the primary contribution of accelerators to the fintech industry. Substantiating the quantitative findings of the study, our interviews of founders/managers of accelerated fintechs stressed the non-funding benefits of their accelerator experiences: cross-fertilization of ideas and best practices; mentoring by experienced entrepreneurs; elaboration of value propositions; refinement of business models; formulation of go-to-market strategies. Admission to the highly selective accelerator programs addressed in this article also affords membership in global alumni networks, an asset not readily available to non-accelerated startups.

These accelerator-related activities (along with introductions to venture capitalists and strategic investors and formal preparations for investor pitch sessions) do boost the public visibility and market credibility of fintech startups and thereby strengthen their fundraising capacity. But our investigation suggests that fledgling fintech companies contemplating global accelerator programs should not view venture funding as the foremost value of their accelerator experiences.

7. DIRECTIONS FOR FUTURE RESEARCH

Building on the results of our analysis of fintech startup funding, we identify the following topics for future research on financial technology:

1. Many of the fintech startups addressed in our study are at early stages of development (seed or early VC). By tracking the funding activities of those companies, researchers can (a) determine whether the recent surge in fintech startup funding is sustainable, and (b) identify the particular segments of the fintech industry exhibiting the greatest investor interest.
2. Our fintech funding database reveals a paucity of liquidity events, with most IPOs occurring in China and strategic acquisitions serving as the preferred exit mode in other countries. By tracking fintech exit events (coded by location, mode, and valuation), researchers can gauge the funding strategies of fintech startups as they progress to commercialization.
3. Large commercial banks and other industry incumbents have responded to the fintech startup challenge by forging non-equity strategic alliances (strategic partnerships, technology licensing, open innovation) with young companies developing commercially promising products and services. Further research on this subject will show how the global financial industry is integrating advanced technologies emanating from the startup community.

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