



IMPACT OF FINTECH ON SYSTEMIC RISK IN BANKING: LITERATURE REVIEW

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ABSTRACT: *The finance industry faces disruption when banks, as traditional incumbents, have to deal with growing competition from FinTech and BigTech companies. FinTech institutions are connected to traditional financial institutions like banks via various channels, constituting themselves as a part of the financial market and systemic risk with the possibility of spillover and risk contagion effects. The goal is to provide a literature review to detect theoretical perspectives, topics, and common issues in the connection between FinTech and systemic risk. A systematic approach to literature review was chosen, resulting in the analysis of 20 articles from the Web of Science database. Results confirm the positive connection between financial technology and systemic risk and call for future research.*

KEYWORDS: *Bank, FinTech, Risk, Systemic risk.*

INTRODUCTION

Financial services, including banking, have undergone many changes in the last few decades. Despite macroeconomic turbulence, political factors, and increased regulation, there is one more challenge that the banking industry has been facing for the last several years: competitive pressure from new firms using innovative technologies, generally referred to as financial technology firms (henceforth “FinTech”). The existing disruption of the banking industry is also accompanied by so-called Big Tech companies, but these are not the subject of this paper. To build new knowledge, we need to establish where the current frontier of knowledge is. Following this premise, the paper shall serve as a background for an empirical study in the future, provide theoretical context, and especially identify a gap in the literature.

1. THEORETICAL BACKGROUND

Financial technology has developed rapidly, and innovative firms leveraging new technologies are playing an increasingly important role in the financial system. According to the Financial Stability Board (2017), FinTech can be 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.*” The use of technology in providing financial services is the key to FinTech (Thakor, 2020).

Financial institutions that have large risk contributions to aggregate systemic risk may be deemed “*systemically important*”. Systemic risk has some universally accepted characteristics. It is a risk that has (a) a large impact, (b) is widespread and (c) creates a ripple effect that endangers the viability of the economic system. Systemic risk is an attribute of the economic system and not that of a single entity. Its measurement should have two important features:

- quantifiability - it must be measurable on an ongoing basis and
- decomposability - aggregate system-wide risk may be broken down into risk contributions from all financial entities in the system (Das, 2019).

As new entrants, FinTech players are intrinsically linked to traditional financial institutions for the following three main reasons:

- they compete in similar market segments and in similar businesses (Dorfleitner et al., 2017; Yao et al., 2017; Kommel et al., 2018);
- they cooperate closely (Románova & Kudinska, 2017); and
- there is increasing investment from traditional financial institutions into FinTech companies (Lee & Shin, 2018)

Because of these multiple interconnections, the risks inherent to the FinTech institutions could spill over to traditional financial institutions, possibly causing systemic risk (Li, 2020).

As any new theory should be built on our existing knowledge, the goal of the proposed semi-systematic review is to detect current theoretical perspectives, topics, and common issues of the *connection between FinTech and systemic risk*.

2. MATERIAL AND METHODS

The goal of the proposed literature review is to detect theoretical perspectives, topics, and common issues connected between FinTech and Systemic Risk.

The following research question (henceforth “RQ”) was stipulated: What is the recent knowledge regarding the connection between FinTech and Systemic Risk?

Our theoretical standpoint regarding the relevancy of RQ is following: As stated in Section 1 of this paper, the current body of knowledge indicates, that FinTech institutions are connected to traditional financial institutions like banks via various channels, constituting themselves as a part of the financial market and systemic risk with the possibility of spillover and contagion effects. In order to synthesize and compare evidence regarding the relationship between FinTech and Systemic Risk, the chosen approach for this literature review is *systematic research*, as the synthesis and comparison of evidence are required.

For the sake of the timely manner of conducting this paper, the sampling strategy was systematic, but it was limited only to the Web of Science database (hereinafter referred to as “WoS”). Therefore, the research sample consisted of articles from WoS and for future research, we would also include Scopus, ProQuest, and EBSCO databases, possibly including “grey literature”, such as conference proceedings, theses, and reports (Wong et al., 2013), available mainly in the Google Scholar database, but in this paper, these sources were not included. This is also a limitation of this paper. The quality of the literature review is highly dependent on the literature collected for the review (“garbage-in, garbage-out”), so the decision was to start with the most promising and acceptable database, like WoS.

The sample characteristics are based on secondary data from the Web of Science Core Collection (hereinafter referred to as “WoS”) database. The review within this paper was conducted in line with the 8-step process of systematic literature review proposed by Xiao & Watson (2019):

- *Step 1* – formulate the problem, it is covered in first section of this paper.
- *Step 2* – develop and validate the review protocol, it is covered by aforementioned objective of the study, research questions and search strategy; while inclusion criteria and screening procedures are following: we search WoS Core Collection with searching request “fintech” AND “systemic risk”. Excluded items are articles with content outside the scope of the study. After these steps, the narrowing of the body of work took place, starting with
- *Step 3* – search the literature: search of WoS with aforementioned search request resulted in 47 items. Then we applied filters: period 2018 – 2022 (45 items), language “English” (44 items). The number of articles to review was 44. Then we identified 9 articles which were not available to download, so the number declined to 35 articles.
- With these 35 articles to review, we continued with *Step 4* – screen for inclusion. Abstracts of these articles were reviewed in terms of their relevancy to the scope of this paper, they either fell within inclusion boundaries or were excluded: 15 articles were excluded as they were focused mainly on mathematics, cryptocurrencies, etc. with insignificantly marginal findings on FinTech or systemic risk.
- *Step 5* – Assess quality, was based on a review of full text of 20 articles.
- Then we continued with extraction of data from these articles as a *Step 6*, by applying methods of content and thematic analysis.
- *Step 7* – analyze and synthesize data was conducted with focus on identification of common topics, similarities and differences across 20 articles.
- *Step 8* – report findings led to finalization of the paper itself.

An expected contribution of this review is to synthesize and organize the state of knowledge in the field of innovation risk and the connection between FinTech and Systemic Risk and create an agenda for further research.

3. RESULTS

Li et al. (2020) analysed the risk spillovers between FinTech firms and several major types of traditional financial institutions, including banks, diversified financials, insurers, and real estate lenders, during a period of fast technological advances. By considering several different types of financial institutions, Li et al. (2020) provided a fuller picture of the complex interactions in the financial system and showed how the emergence of new players impacts risk spillovers. In addition, the authors also provided an approach that constructs three types of spillover networks (downside-to-downside, centre-to-centre, and upside-to-upside) to study the risk spillovers. Using the stock returns of the institutions, they estimated pairwise risk spillovers by employing the Granger causality test across quantiles. This approach allowed us to contribute to the literature by comprehensively examining the risk spillovers in multiple cases. In this empirical analysis, based on the stock returns of U.S. financial institutions and FinTech firms, the authors found that the risk spillovers between FinTech and traditional financial institutions are indeed different in the tails compared to the centre of the distribution. In particular, there is evidence of stronger spillovers during periods of downturn. Both the risk spillovers between FinTech and traditional financial sectors and those within sectors in the bearish case are the strongest. We also provide evidence that the risk spillover from FinTech to traditional financial institutions has a positive relationship with, and even could be a potential cause of, the systemic risk of traditional financial institutions. We argue that the results of this study have important policy implications and suggest the need for closer monitoring of the risk spillover from FinTech institutions to traditional financial firms, particularly as supervisors aim at maintaining financial stability. It agrees with the results of Chaudry et. al (2022), whose measure of systemic risk (or spillover risk), such as expected joint crashes and multivariate spillover risk, show that finance firms are more connected as they cause distress in other finance firms more than the technology firms.

Thakor (2020) analysed how P2P lending, as one part of the FinTech movement, may affect bank stability. He builds on the widely accepted and proven concept of whether increased competition faced by banks hurts or helps financial stability:

- The usual channel is that more competition leads to lower rents for banks from relationship lending, which increases the attractiveness of risky investments for banks. The problem is exacerbated by deposit insurance, with banks' incentives to take the risk to maximize the value of the deposit insurance being strongest when their relationship lending rents are the lowest.
- An alternative theoretical argument that focuses on the effect of bank competition on borrowers and their risk-taking incentives. When banking is more competitive, loans are cheaper for borrowers, and the low borrowing cost reduces the borrower's incentive to engage in risk shifting, thereby, decreasing default risk and improving financial stability.

Thakor concludes that the answer depends on the conditions of a given financial market: *"I suspect that the specific attributes of banks and the degree of concentration of the credit market will determine whether an increase in competition—such as that provided by P2P lenders - will increase or diminish financial stability"* (Thakor, 2020, p. 8) and also states that there does not seem to be any compelling cause for alarm with respect to the potentially harmful effects of the growth of P2P lending on financial market stability. Thakor's answer corresponds with the opinion of Goetz (2018) and addresses this question empirically. Using a novel way to capture changes in bank competition by examining how the exogenous state-specific process of U.S. banking deregulation gradually lowered entry barriers into urban banking markets, he finds that an increase in banking competition improved banking stability by increasing bank profitability and asset quality. It indicates that competition forces banks to be more efficient, perhaps reducing their propensity to overlend and engage in evergreening. Also, the extent to which banks contribute to global systemic risk will also depend on bank capital. Bostandzic & Weiß (2018) provide interesting empirical evidence that banks contribute more to global systemic risk when they have lower capital. Contrary to the opinion of Thakor, Mahalle, Young & To (2021) asserted that the engineering of financial products and developing product offerings serviceable over mobile devices

may lead to fast adoption and rapid growth in financial markets, which also paves way for systemic risk due to misconduct in lending practices. Regarding P2P lending, Bavoso (2020) stated that the emergence of P2P securitisation raises a number of regulatory and policy questions, because the longer intermediation chains typical of securitisation may well defy the social and economic purposes under which the idea of P2P developed. Furthermore, questions of systemic risk inevitably resurface in these types of transactions. Ozili (2021) adds that the emerging trend of financial inclusion is socioeconomically positive, but it can transmit systemic risks to the formal financial sector and that financial inclusion and exclusion are pro-cyclical with changes in the economic cycle.

Omede (2019) also warns that the risk of systemic failure deriving from consumer credit is insignificant compared to the consumer vulnerabilities resulting from the exposure of consumers to unregulated products in the informal market. Lee (2019) warns that parts of FinTech businesses like equity crowdfunding offer investment rewards but also have risks of fraud, herding, insolvency, and dilution of shareholder equity. Zetzsche & Preiner (2018) approach crowdfunding platforms and state that crowdfunding platforms are neither "*too big to fail*" nor "*too connected to fail*", but crowdfunding platforms compete with heavily regulated intermediaries. It is widely known that regulation imposes costs; therefore, in light of the emerging trend of crowdfunding, it is natural to expect that crowdfunding will sooner or later have the status of "too connected to fail". At the same time, the level of protection provided to retail funders is low. Overall, the position of regulated 'well-governed' intermediaries and their regulators is weakened as the business is shifted to unregulated entities. Money laundering may also be a concern, as crowdfunding could well be a form of "shadow funding." As a result, Zetzsche & Preiner (2018) call for *Systemic Risk Prevention*. Regulation is a natural response to negative externalities like systemic risk caused by asymmetric information, adverse selection, and lemon problems. Das (2019) warns that modern hardware, cloud infrastructure, and software tools have enabled the rapid development of sophisticated FinTech platforms by very small teams, enabling entrants with minimal funding to compete in this space. Rapid development also has a dark side. Moreover, Lo (2017, p. 17) ideologically on this topic agrees with Das (2019, p. 984) who points out that "*the unintended consequences of technology-leveraged finance include firesales, flash crashes, botched initial public offerings, cybersecurity breaches, catastrophic algorithmic trading errors, and a technological arms race that has created new winners, losers, and systemic risk in the financial ecosystem.*" Uddin, Mollah & Ali (2020) stressed cybersecurity as a concern for FinTech businesses, as it is needed to maintain stable business. Podrugina & Tabakh (2020) summarized that, despite providing lower transaction costs and other beneficial results of FinTech, there are two main aspects of emerging systemic risks: uncontrolled development and unsupervised risk sources.

Li (2022) examined online lending as the primary research subject to quantitatively measure FinTech risk in China. A theoretical model was built to analyse the relationship between the assets and liabilities of peer-to-peer platforms and the risk of the entire online lending industry. He concluded that platforms selected through the market mechanism do not only have stronger capital absorption capacity but also have better risk control. However, FinTech institutions might not be able to properly handle market risks. The results of Jiang & Zhang (2020) are similar to the previous findings of Li (2022), as they evaluated the contributions of 16 China's listed banks to systemic risk. They concluded that for China, the systemic importance of a bank could not be simplified by the bank size rankings. Besides, the bank size rankings are not always positive and are sometimes even negatively correlated with the rankings of systemic risk indicators (i.e., rankings of systemic importance) in the digital economy era. The conclusion still holds when we assume that a bank is in an extreme circumstance or consider the effects of FinTech and non-bank financial institutions.

Chaudhry et al. (2022) empirically evaluated the tail risk and systemic risk of technology firms and provided evidence that the tail risk of technology firms is higher than that of financial firms, whereas they are less likely to be in distress conditional upon a shock from the system. However, this finding for technology firms reverses when we use recent data via our six-year rolling estimates. They concluded that similar to finance firms, there should be tighter regulations for technology firms since they are riskier than finance firms.

However, FinTech has not changed the nature or risk attributes of financial business. Its openness, interoperability, science, and technology, among other characteristics, make the concealment, infectivity, universality, and sudden characteristics of financial risks more obvious, and the potential systemic risks more complex. Building on this nature of FinTech, Pi et al. (2022) stated that the complexity of FinTech's business model has led to the continuous renovation of the manifestations and connotations of financial risk, which increases the difficulty of risk identification and the speed of risk transmission. Technology itself is not only the driving force in the development of Fintech but also its biggest risk.

Nenavath (2022) suggests that the FinTech movement should grow and actively participate in green finance projects to protect the environmental quality and development of new financial institutions to promote FinTech and green finance, while also reducing the systemic risk in FinTech, particularly in the finance and banking sectors. Though minimizing the risk of FinTech stances, policymakers should inspire FinTechs to take part in environmental quality protection inventiveness that actively encourages green consumption. On the other hand, Nenavath (2022) showed that the systemic risks of FinTech increased while doing more transactions of environmental projects.

Ashta & Herrmann (2021) approach the formation of systemic risk in the FinTech industry from a different point of view - the potentially harmful effects of excessive use of artificial intelligence ("AI") in financial services. AI is creating a blast of opportunities in the financial sector, but financial institutions need to be aware of the risks inherent in the use of this technology. Financial institutions are integrating AI in their operations: in-house, outsourced, or ecosystem-based. The growth of AI-based FinTech firms has encouraged several mergers and acquisitions among financial service providers and wealth managers as they grapple with volatility, uncertainty, complexity, and ambiguity. AI's unique promise of combined cost reduction and increased differentiation makes it generally attractive across the board. However, perhaps other than fraud detection, these benefits depend on the scale of an organization. Risk arises from nonrepresentative data, bias inherent in representative data, the choice of algorithms, and human decisions, based on their AI interpretations (and whether humans are involved at all once AI has been unleashed). Risk reduction requires a vigilant division of labour between AI and humans for the foreseeable future.

4. DISCUSSION AND FUTURE RESEARCH

In the current economic climate, businesses face major competitiveness challenges. Banking services are not an exception; on the contrary, disruption is typical for today's financial services. Banks need to respond flexibly to the changing business environment and customer requirements. Meeting such variable requirements puts constant pressure on innovation.

While there is much apocalyptic hype about the financial services industry's "disruption" by FinTech in the media, we have little doubt that digital entrants will change the industry in profound ways (Mills & McCarthy, 2017). One of the key issues at the heart of the current academic, practitioner, and policy debate on banking and FinTech (Chiu, 2016; Gurdgiev, 2016; Zetzsche, Buckley, Arner & Barberis, 2017) is whether these new entrants will eventually displace traditional banking institutions much in the same way as digital media has disrupted traditional publishing and advertising or hurt banks' profitability, as is currently the case with online education eroding higher education industry profits.

While the results of Zhao et al. (2022, p. 456) show that FinTech innovation truly reduces the profitability of traditional banks, according to these authors, banks have their own FinTech capabilities and focus more on *"the rising capabilities of FinTech technology than its difficulties and what the competition is doing"*. Even in the conditions of the banking sector of the Czech Republic, it might be truly seen that *"small banks can particularly achieve business process reengineering and innovation more reliably by actively cooperating with FinTech companies."*

Based on the summarized results of current research in Section 3 of this paper, it is clear that there is a risk spillover from FinTech firms to traditional financial institutions, and it is also positively correlated with the systemic risk of traditional financial institutions. In addition, the risk spillover from FinTech to traditional financial institutions could cause systemic risk for the latter but not vice versa. These results provide empirical evidence that the spillover from FinTech could affect traditional financial institutions'

systemic risk. These results have important policy implications and suggest that closer monitoring of the risk spillover from FinTech institutions to traditional financial firms is necessary for maintaining financial stability.

There are few regulations for BigTech firms. We conclude that there should be tighter regulations for technology firms, similar to the strict regulations for financial firms, in order to avoid a global crisis in the future and to avoid a situation where taxpayers' money is used to bail out these big firms.

Future research ideas are following, additional commentary follows:

- a strong focus on robust technology to manage this problem,
- use of RegTech and Data Analysis to better capture the interconnectedness of traditional banking system and FinTech (e.g. speed of risk transmission),
- risk identification within traditional banks (e.g. innovation risk),
- propose better regulation (Mahalle, Young & To, 2021),
- analyze the possibility of Sand Boxes in the local environment (Li, 2022; Alaassar, Mention & Aas, 2021).

We should first clarify the basic characteristics of the Fintech risks, such as complexity, endogeneity, non-equilibrium, and variability. Secondly, we should further identify and quantify the new risks brought by financial technology, especially those involving technological change. Finally, we should use regulatory technologies (RegTech) such as big data, artificial intelligence, and cloud computing to enrich regulatory means, and strengthen the construction of financial technology infrastructure, including financial technology platforms, compliance technology applications, financial security and anti-fraud technology development, and prevent financial technology risks and their impact on the existing risk system. The need for improving the methodology of any systemic risk related incident investigation shall be accompanied by the improved risk culture within financial institutions (Lakatos, Drégelyi-Kiss, 2021).

Mahalle, Young & To (2021) also call for better regulation as the data-driven business model, connected customers over mobile phones, and several financial services demand a new regulatory framework that also protects consumers and prevents systemic risk in the economy.

As a necessary complement, regulatory sandboxes would be needed to spur a shift in institutional philosophy to a principles-based regulatory regime. In other words, the regulatory attitude of FinTech regulation should be humble and light-touch to promote innovation for improving digital financial inclusion, albeit on the premise of containing potential systemic risk and protecting consumer interest in the meantime.

Regulation has failed to consider the rise of FinTech firms and the fundamental changes they have ushered in on a variety of fronts, from the way that banking works, to the way that capital is raised - even to the very form of money itself. These changes call for a wide-ranging reconceptualization of financial regulation in an era of technology-enabled finance. In particular, this paper argues that regulators' focus on preventing the risks associated with "too big to fail" institutions overlooks the conceptually distinct risks associated with small, decentralized financial markets. In many ways, these risks can be greater than those presented by large institutions because decentralized FinTech markets are more vulnerable to adverse economic shocks, less transparent to regulators, and more likely to encourage excessively risky behaviour by market participants.

Innovation has raised the stakes for fixing this structural flaw in finance and potentially in other heavily regulated industries. If allowed to compete fully, financial technology challengers could bring large consumer welfare advances and reduce the size of "too big to fail" banks, thereby lessening the chances of a financial crisis. If allowed to grow unchecked, FinTechs or the big banks acquiring them may reach the kind of digital market dominance seen in Google, Facebook, and Amazon, thereby increasing systemic risk.

Neither financial technology nor systemic risk is an invention of the 21st century, but both seem to be more connected than ever. The mutual dependencies between modern FinTech and systemic risk must

be discussed in further research. Besides systemic risk affecting FinTech, in particular, FinTech's ability to contribute to systemic risk should be explored. We conclude that if risks are left uncontrolled and are not treated soon, they will create systemic risks that can create substantial costs. For this reason, early detection needs to be done in the context of prevention before a crisis occurs (Amelda, Bernadetta & Jesselyn, 2020).

As mentioned by Zetzsche et al. (2020), Europe's path to digitization and datafication in finance rests on four pillars:

- extensive reporting requirements imposed after the global financial crisis of 2008/2009 to control systemic risk and financial sector behaviour;
- strict data protection rules reflecting concerns about dominant actors in the data and technology industries;
- the facilitation of open banking to enhance competition in banking and payments;
- systems for digital identification for individuals and legal entities designed to further the Single Market and enhance financial integrity and transparency.

CONCLUSION

We recommend that future studies intend to fill the gap outlined by the literature review in this paper (Templier & Paré, 2015; Xiao & Watson, 2019). To conclude, the European Union needs a functional institutional environment that creates opportunity and allows its financial and start-up subjects to trigger a transition to data-driven finance while balancing their willingness to take a risk and the interlinked systemic and unsystemic risks of these efforts. As the global financial crisis taught us, creating such an environment should be balanced by adequate supervision of financial services. It creates a new set of questions about the readiness of supervisors to face the challenging landscape of financial services. An approach to these issues will underpin the future of digital financial services in the European Union while developing regulatory approaches to the intersection of data, finance, and technology.

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