

POSSIBILITIES FOR FINANCIAL TECHNOLOGY SECTOR DEVELOPMENT AND ITS IMPACT ON BANKING SECTOR PROFITABILITY IN LITHUANIA

Greta Keliuotytė-Staniulėnienė¹, Gintarė Smolškytė²

¹Vilnius University, Vilnius, Lithuania, greta.keliuotyte-staniuleniene@evaf.vu.lt

²Vilnius University, Vilnius, Lithuania, g.smolškyte@gmail.com

Abstract

Research purpose. The development of financial technology sector (*fintech*) poses a challenge for traditional financial institutions. Therefore, it is important to analyze not only how financial technologies can change, but also how the fintech sector affects banks and their profitability. The aim of the paper is to analyze the possibilities for the development of financial technology sector and quantitatively evaluate its impact on the banking sector's profitability in Lithuania.

Design / Methodology / Approach. After the analysis of academic literature and statistical data, the authors used expert evaluation method in order to identify development opportunities of *fintech* in Lithuania and correlation-regression analysis was applied to evaluate the impact of *fintech* on the profitability of the Lithuanian banking sector.

Findings. According to the results of expert assessment research, Lithuania possesses favorable conditions for *fintech* enterprises to enter the Lithuanian finance market; it is expected that this sector will continue to rapidly expand mostly in payments and banking business models. Correlation-regression analysis showed that *fintech* indicators has an effect on the banking sector's profitability but the effect is not very significant. The significance of the connection is lower because banking sector adapts technologies and is influenced by *fintech* from inside and outside the environment.

Originality / Value / Practical implications. The *fintech* sector in Lithuania is still new and so far very little researched. The outcomes of this research have expanded the scope of research of the Lithuanian *fintech* sector. The obtained results would be useful and relevant to (i) the government sector to manage risks and ensure stability in the financial sector; (ii) financial sector entities to monitor possible developments and prepare them accordingly; and (iii) banking sector to analyze the impact of technology and *fintech* entities on them and take strategic decisions in this regard.

Keywords: Financial technologies; Financial services; Banking sector; Profitability.

JEL codes: G23; Q55; G21.

Introduction

The role of financial technologies (hereinafter in the present paper referred to as FinTech) has assumed prominence in the 21st century with the accelerated development and broader applicability of information technologies. The increasing application of FinTech produces a positive effect on the finance sector by increasing the efficiency of the financial system and contributing to the growth of the national economy. In view of the rapidly growing possibilities to apply new technologies in the finance sector, increasing numbers of FinTechs, the new-type of business entities, started appearing around the world. Although conventional banks are considered to be the key players in the financial sector (Lévy-Bencheton, 2016), it is increasingly often argued that the growing FinTech sector seeks to take over the position of the principal financial services provider from traditional banks (Dabrowski, 2017).

The importance of financial technologies is obviously very important; however, the results of research in this area are not always unambiguous. DeYoung (2005), Kagan et al. (2005) have reported a wider applicability of technologies and the development of new channels for provision of financial services as adding to increase the profit margins of banks. On the other hand, there is evidence that in some countries technological changes can bring down the profits of banks (Tunay et al, 2015, Titko et al., 2015), or will affect their performance to only a marginal extent. In response to emergence of FinTech, banks seek to

improve the financial services they provide, and, in particular, in view of the new competitors emerging in the financial sector that can negatively affect the profitability of banks ((Lee et al., 2017, Dabrowski, 2017, Lévy-Bencheton, 2016). However, research efforts regarding the possibilities of how financial technologies will develop as well as on the FinTech entities operating in the market have been scarce (Titko et al., 2015, Levišauskaitė et al., 2004). Given the level of the subject being examined and in view of the development of the FinTech sector, it is becoming increasingly important to analyze the sector, and especially considering that the research literature has not yet produced any unambiguous and reliable conclusion on the impact of financial technologies upon the profitability of banks. Therefore the scientific problem of the study presented in the present paper – there is no unambiguous evidence of the potential of the financial technology sector in Lithuania and the impact it has on the profitability of the banking sector. In view of this situation, the main research question is whether there exists a favorable environment for FinTech development in Lithuania and whether the development of FinTech will have a significant impact on banking sector in the country.

Objective of the paper: The present paper seeks to analyze the possibilities for the development of financial technologies sector in Lithuania and produce a quantitative estimate of its impact upon the profitability of the banking sector.

Tasks of the paper: Carry out a theoretical analysis of the correlation between the financial technologies and the banking sector; develop a methodology for a study of the potential of financial technologies and the impact of such technologies on the profitability of the banking sector; identify the possibilities for the development of financial technologies in Lithuania; assess the quantitative aspect of the impact of financial technologies on the Lithuanian banking sector. An analysis of the research literature in the area, expert evaluation and correlation-regression analysis methods were used for analyzing the objectives of the paper.

Literature Review

In the narrow sense of the word, financial innovations are ordinarily associated with the development of new financial instruments (Frame, White, 2002); however, in the broad sense financial innovations can be understood as all new solutions and changes in the financial system, i.e. markets, institutions, instruments and regulation (Blach, 2011). Zovolokina et al. (2016) referred to FinTech as a "marriage" between the financial and the technology sectors, while Mouilleron (2017) saw FinTech as the use and the presence of technologies for the purpose of improving the financial sector. Arner et al. (2015) defined financial technologies as technologies used for the implementation of financial solutions. Zovolokina et al. (2016) identified a range of functions for the application of financial technologies: develop new services, upgrade the current services and thus reduce the prices, develop new business models and promote competition. Such identification of the functions allowed a conclusion that FinTech focuses upon the development of new services, processes and products designed to meet the existing and emerging needs of the consumers. Blach (2011) listed a number of functions performed by FinTech, such as increase of liquidity, enhancement of investment possibilities, increase in financing and borrowing opportunities, and enhancement of risk management efficiency. Glomber (2017) claimed that FinTech adaptation should expand financing and lending opportunities, increase independent investment opportunities, improve settlement methods, and facilitate access to and provision of insurance services. It then makes it appropriate to conclude that the functions of FinTech include upgrading of services, processes and products, and risk management under different FinTech operation models in which the functions are applied individually in order achieve the most efficient and best results.

Several key factors promoting the development of FinTech are the following: technologies, regulation, macroeconomic environment or the ecosystem (Frame et al. 2002, Schindler, 2016, Puchmann, 2016), as well as changing consumer behavior (Puchmann, 2016, Blach, 2011). Changes in consumer behavior pushes for the introduction of new financial instruments. Macroeconomic factors call financial institutions to protect themselves from the increased volatility of market parameters (Blach, 2011). The impact of regulatory factors has been mixed: an important factor is that regulation does not prevent any further development of FinTech, but rather protects the financial sector from possible risks. In some sources an "innovation spiral" has been referred to as a factor of FinTech, a process when appearing new innovation triggers an appearance of another innovation (Shindler, 2016).

FinTech targets innovations in financial services mostly promoted by new financial sector participants in the financial ecosystem mainly due to favorable conditions for entering the market. Such participants include FinTech companies that are focused on specific activity areas or include several electronic commerce areas and technology companies; however, conventional financial services institutions also seek to apply FinTech innovations and compete with new participants. The literature sources define the following areas of FinTech activities: payment, asset management, loans, pooled financing, insurance services, and capital market (Lee et al., 2017, Schindler, 2016, Dorfleitner et al., 2017, Glomber, 2017).

The introduction of new business models into the financial sector expands the financial sector and shows to what extent the sector has adapted to the changing needs of consumers by offering enhanced services and new financial solutions. However, the newly emerging business models are increasing the number of new entities in the financial sector, thus prominently increasing the competition for traditional players who enjoy the largest market share. Changes in the financial sector calls for an analysis of the potential development in the sector and whether traditional financial institutions will be replaced by new entrants.

The first innovations promoted by the development of technologies that marked the beginning of FinTech era were applied in the banking sector. As a result of such innovations, the traditional banking sector has undergone a number of changes ranging from the cheque system used, ATMs, electronic cards, electronic payments, online and mobile banking to digital banking (Wonglimpiyarat, 2017). Most of such changes were initiated by banks themselves (Puchmann, 2016), (Varga, 2017). The application of technologies in the banking sector only strengthened the banks and paved the way for a further expansion of their activities at the same time increasing their efficiency (Bratasanu, 2017), by promoting new services and products and also reducing the costs required for operations and processes (Levišauskaitė et al., 2004).

DeYoung (2005), Kagan et al. (2005), and Tunay et al. (2015) concluded that the introduction of internet banking increased the profitability of banks. However, DeYoung (2005) noted that for banks it will be more reasonable to maintain service provision in both traditional banks and the online space rather than fully relocating to the cyber space, as customer preferences for different channels will remain. Sadr (2013) observed that innovative payment services favorably affected the profitability of the banking sector. Bratasanu (2017) analyzed the impact of financial innovations to the income in the banking sector in general, rather than the impact produced by payment-focused technologies. Bratasanu concluded that financial technologies help banks to ensure better and stronger relations with their customers.

On the other hand, changes in the finance ecosystem have opened a path for new entities in the FinTech sector (Lévy-Bencheton, 2016) – FinTech companies now have become quite a challenge to banks. By using new technologies, FinTech companies offer more efficient ways and methods for already existing services and products (Navaretti et al., 2017) and thus compete with banks (Wonglimpiyarat, 2017). In terms of their operating models, FinTech companies are similar to banks and focus mainly on the lending and payment operations (Lévy-Bencheton, 2016, KPMG, 2017), which is the main area of operations and source of profit for banks. FinTech companies offer alternatives to the services provided by banks, making such services accessible (e.g. pooled financing). Thus, there is a growing perception that these new financial sector actors would become the principal competitors for the banks (Dermine, 2017, Lévy-Bencheton, 2016). Beaird (2017) claimed that the entry of FinTech companies into the market could reduce the revenues of banks by about 10-40 per cent by 2025. However, Sorkin (2016) sees two possible scenarios: first, the impact of FinTech on the banking sector will be negative in terms of performance, or, second, FinTech will have no significant impact as the banking system is too powerful and new players in the sector would not be able to compete with it. Both Bratasanu (2017), and Lévy-Bencheton (2016) noted that banks and FinTech companies could not only compete but also cooperate in improving the systems of conventional banks.

Although the majority of the research papers on the topic of FinTech is theoretical, rather than empiric in nature (Blach, 2011, Arner et al., 2015, Vaškelaitis, 2010, Dorfleitner et al., 2017, Puschmann, 2016, Schindler, 2016, Walker, 2017, Kalmykova et al., 2015), they provide definitions of financial technologies, define the development stages and operating models, analyze the existing regulations and the impact of technologies, and emergence of risks; however, in view of the further development of the FinTech sector, other areas have also attracted the interest of researchers (Kagan et al., 2005; DeYoung,

2005; Cyree et al., 2009; Trivedi, 2015, Tunay et al., 2015; Yen, 2013, Heffernan et al., 2008; Buss et al., 2017; Bratasanu, 2017; Mwaura et al., 2016; Levišauskaitė, 2004; Vargas, 2008; Gimpel, 2015; Lee et al., 2017; Mansilla-Fernandez, 2017), focusing more on the level of FinTech development of the country, the impact of the sector upon the national economy, the financial sector, or the possibilities of further development of the FinTech sector. For instance, Vargas (2008) found that banks employ financial technologies to a lesser extent than FinTech companies, but their role remains important and banks are likely to increase the use of financial technologies in the future. When studying the factors that impact the level of use of financial technologies, Mwaura et al. (2016) established significant links between the new technologies and price stability, and the variables of new products and technologies. When analyzing innovations in online banking area, Levišauskaitė (2004), DeYoung (2005), Tunay et al. (2015), Kagan et al. concluded that the FinTech technologies did have a positive effect upon banks. A study carried out by Trivedi (2015) demonstrated that the impact of the deployment of innovations and their potential to affect profitability is not completely clear, because such technologies affect both profitability and the stability of banks' operations. In the light of the above, it is important to analyze whether the FinTech sector significantly affects the financial sector.

Methodology

(1) As was noted by Vargas (2008), the information about the FinTech sector is quite complex to collect; therefore, interviews were defined as the most efficient method to assess the sector. This method for the purpose of a few studies in the area was used by a number of researchers, such as Gimpel (2015), Levišauskaitė (2004), PwC (2017), and Deloitte (2017). Another method applied for the purpose of the FinTech analysis is expert evaluation (Baležentis, Žalimaitė, 2011, Erman, 2017). The latter method requires special expert knowledge and specific professional expertise possessed by only a limited number of specialists. Expert evaluations may be used also in situations when the information is not sufficient (Rudzkiene et al., 2009). Thus, a study of the possibilities for the development of financial technologies sector in Lithuania was carried out using the expert evaluation method. The method is used to obtain and collect the information about the FinTech sector, the factors affecting it, likely problems and the prospects for the development of the sector in Lithuania.

Considering the fact that within the expert evaluation models there is a rapidly diminishing nonlinear link between the answers and the number of respondents, and the number of experts recommended in the literature (Libby, 1978, Cohen et al., 2000, Rudzkiene et al., 2009), the opinion of eight experts was analyzed for the purpose of this study. A number of criteria were referred to for the purpose of selecting the experts, such as position occupied (executive position in the company – development, projects, strategy manager, director); higher university education (Master's degree in areas related to business development, economics, finance and technology); and professional experience in financial technologies (more than 2 years). The questionnaire was drawn up based on the surveys of companies carried out by PwC and Deloitte for the purpose of assessment of FinTech potential on the global level, also by individual researchers (Frame et al., 2002, Gimpel, 2015). The questionnaire is made up of 15 questions: nine closed type and six open type questions (Table 1). Assessment of compatibility of expert opinions using the Kendall Concordance Coefficient (Podvezko et al., 2005, Rudzkiene et al., 2009).

Table 1. Expert evaluation questionnaire (Source: author's compilation)

Questions
K1. The sector that the FinTech you represent belongs to?
K2. Please evaluate the performance of the FinTech in each of the areas (rate three statements presented next to the sector at a scale 1 to 5, 1 being the lowest score, and 5 – the highest score) according to the results achieved and the attention currently dedicated to them).
K3. Please evaluate the performance of the FinTech in each of the areas (rate three statements presented next to the sector at a scale 1 to 5, 1 being the lowest score, and 5 – the highest score) depending on the strategic objectives that the Company seeks to achieve within five years.
K4. Do you think the environment in Lithuania is conducive to the establishment and operation of FinTech companies?

K5. Which reasons in your opinion make the environment in Lithuania conducive to appearance of FinTech companies?
K6. To what extent in your opinion the regulatory environment in Lithuania is conducive to the establishment and operation of FinTech companies?
K7. In which areas you discern regulatory deficiencies for innovations in FinTech?
K8. Which conditions in your opinion will to a largest extent affect the development of FinTech in the course of the next five years?
K9. Which of the financial sector areas will be most triggered/ disturbed by FinTech companies (i.e., which are will be expanding most) in the course of the next five years?
K10. Which are the threats related to the FinTech growth in your sector?
K11. What are the opportunities related to the growth of FinTech growth in your sector?
K12. Do you work with conventional financial institutions (e.g. banks)?
K13. What challenges do you usually face when you work with conventional financial institutions?
K14. Do you apply the 'blockchain' technology?
K15. How do you apply the 'blockchain' technology, do you see any benefit in applying the blockchain' technology?

(2) For the purpose of assessing the impact of certain developments on the banking sector, researchers often use a correlation (Larionova et al., 2014, 2017, Jasevičienė et al., 2013, Biswas et al., 2018, Bikker, 2010) and regression analysis (Milič et al., 2017, Tunay et al., 2015). Furthermore, most frequently for analyzing the impact of financial technologies on banks, researchers use the correlation-regression analysis method (DeYoung, 2005, Mwaura et al., 2016, Mustapha, 2015, Mansilla-Fernandez, 2017, Tunay et al., 2015, Shah et al., 2014). For the purpose of the present paper, the impact of the FinTech sector on the banking sector in Lithuania was assessed using the correlation and multidimensional linear regression analysis.

Table 2. FinTech indicators used in research (Source: author's compilation)

Indicator	Research
R&D costs in the financial sector	Heffernan et al. (2012), Ekpu (2015).
Market structure (number of FinTech companies)	Mansilla-Fernandez (2017), Pejkovska (2018), Bikker (2010).
Investment in FinTech	Bakker (2015), Mansilla-Fernandez (2017).
Payment in non-cash	Mansilla-Fernandez (2017), Pejkovska, (2018), Cyree et al. (2009), Ekpu (2015).
Number of payment cards	DeYoung (2005), Ekpu (2015), Titko et al. (2015).
Total online banking users	Tunay et al. (2015), Kagan et al. (2005), Cyree et al. (2009), Ekpu (2015), Mustapha (2018), Titko et al. (2015).
Total mobile banking users	Kagan et al. (2005), Cyree et al. (2009), Ekpu (2015), Mustapha (2018).
Total payment card readers	Ekpu (2015), Mustapha (2018), Titko et al. (2015).

An overview of the research in the area concerned (DeYoung, 2005, Cyree et al., 2009, Bikker, 2010, Yen, 2013, Shah et al., 2014, Trivedi, 2015, Tunay et al., 2015, Kagan et al., 2005, Bektas, 2014) concluded that the key indicators used to evaluate the profitability in the banking sector are return on equity (ROE), return on assets (ROA) and the net interest margin (NIM). Thus ROA and ROE were selected as dependent indicators of the study and the efficiency of management of assets and equity, and NIM (allows assessing the profitability of one of the main activities, i.e., granting of loans) was rated.

For the purpose of selecting the independent variables, some research papers presenting quantitative FinTech indicators (Table 2) were analyzed. With regard to Table 2 and the data accessibility in the case of Lithuania, certain indicators were used to assess the impact of the FinTech on the banking sector.

Since the multidimensional linear regression model is most suitable for projecting when all the variables strongly correlate with the dependent variable, and do not correlate among themselves (Janilionis, 2011), for the purpose of the study the regression model is formed only with those independent variables that

are statistically significantly related to the dependent variables. In the light of the arguments for selecting dependent and independent variables the authors produced the following multidimensional linear regression model:

$$Per_t = \alpha_{it} + \beta_1 FinTech + \beta_2 Card + \beta_3 PosT + \beta_4 Intbank + \beta_5 Innov + \beta_6 Mobbank + \beta_7 TUI + \beta_8 Nonpmnt + \varepsilon_{it} \quad (1)$$

where:

- Peri – banking sector’s ROA, ROE and NIM;
- FinTech – total number of FinTech companies;
- Card – total number of bank cards;
- PosT – total number of bank card readers;
- Intbank – total number online banking users;
- Innov – total expenses for innovations;
- Mobbank – total number of mobile banking users;
- TUI – total investment in the financial sector;
- Nonpmnt – non-cash money payment value.

The survey using the interview method was carried out in April and May 2018 and the correlation-regression analysis was carried out using the data of 2010–2017.

Results

In Lithuania, the FinTech sector is clearly rapidly developing; nevertheless, it is still quite young and its growth specifically accelerated in 2015 (Fig. 1), when the number of FinTech companies in the country doubled by 2017, i.e. out of total 53 licenses issued, 35 licenses were issued in the course of the past several years.

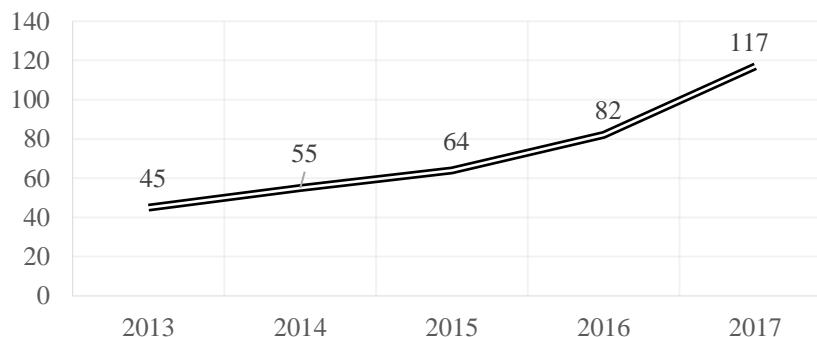


Fig. 1. Total FinTech companies in Lithuania, 2013–2017 (Source: Invest Lietuva, 2017)

Although ensuring the development of financial technologies contributes to the creation of new jobs, attracts foreign direct investment, increases the rating of Lithuania as a highly innovative country (Invest Lietuva, 2018), thereby increasing the competitiveness of the country, however, for banks, which are entities accounting for the largest share of the Lithuanian financial sector, this may create a threat of losing the market share they hold (Powell, 2017, Wonglimpiyarat, 2017).

(1) When analyzing the possibilities for FinTech development in Lithuania, the primary task for the authors was to determine how the performance of FinTech companies is assessed in the areas of customer management, value enhancement, internal operations management, data management and change management, and the prospects of the activity in the course of the next five-year period. After estimation of the mean response of the experts in individual areas, it was concluded that the weakest area of activity is change management. The most prominent changes are expected to take place in the areas of customer management, digital value enhancement and change management area. Among the areas to which FinTech companies intend to dedicate less attention in the course of the coming five

years is data management and value enhancement. To assess the compatibility of expert opinions on these issues, the calculated concordance coefficients were equal to 1.00 and 0.997, respectively, and as the estimated value of χ^2 exceeded the critical value, it was concluded that expert assessments related to FinTech business areas currently and in the future have been aligned and are similar.

The survey of the conditions for the establishment and operation of FinTech companies in Lithuania showed that all experts assessed the environment in Lithuania as conducive to the formation of such companies – rating it 5 out of 8 as conducive rather than non-conductive (3 out of 8); the main reasons for such ratings were highly competent employees always seeking to develop professionally, quality and price ratio, well-developed infrastructure and business conditions. The experts also noted that the public sector in Lithuania seeks to support companies by adapting to the pace of technology-driven companies for the purpose of providing the required services to businesses. On the other hand, the experts also pointed out several significant deficiencies in a number of areas of the regulatory apparatus, such as procedures and legislation to be enforced in order to stop illegal generation of income, e-money/crypto currencies, new business models, and digital identification.

An overview of the factors affecting the development of the FinTech sector in Lithuania concluded that in the course of the next five years, the major factors affecting the development of the FinTech sector will be the developing technologies and consumer conduct, in addition to another nonetheless important factor of changing financial ecosystem and regulation. The expert evaluation also identified several key threats arising from the development of FinTech: loss of a part of market, threat to information protection and privacy, or some risks arising from regulatory changes.

As regards possible impact on the different areas of the financial sector, experts claimed that in the course of next five years, the largest impact will be produced in the banking sector (6 experts), payment operations (7 experts) and crediting area (3 experts). Since FinTech companies essentially focus on provision of more modern, faster and more affordable daily services, any related areas will be most notably affected. A global survey on FinTech impact carried out by PwC (2017) noted that among the areas that will be most significantly affected in the course of the coming five years are banking and payment sectors, and both on the global scale and in Lithuania the trends are very similar.

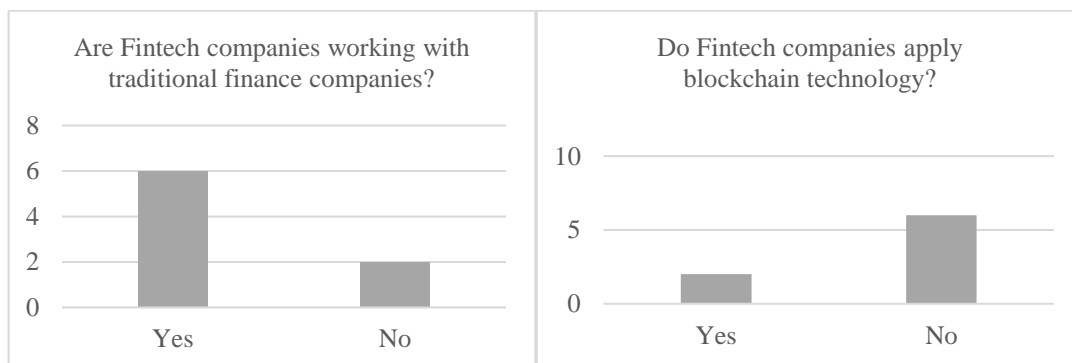


Fig. 2. Cooperation of Lithuanian FinTech companies with conventional financial institutions and the application of the ‘blockchain’ technology (Source: author’s compilation)

Another objective pursued as part of the expert evaluation was to identify some initial insights regarding the interface between the banking and the FinTech sectors. The results of the survey showed that the largest part of the FinTech sector cooperates rather than competes with the conventional financial institutions (Fig. 2); nevertheless, when cooperating with banks, significant challenges arise because of the differences in the applied business models, operation processes, required financial investment and the incompatibility of the IT systems. Cooperation between financial institutions and FinTech companies has been also confirmed by the data of the Lithuanian Department of Statistics (Statistics Lithuania); in 2014–2016, in the area of financial services and insurance activities, as many as 61.7 per cent of the companies cooperated with their partners.

An assessment of the application of "blockchain" technologies showed that so far only a small part of the FinTech sector companies in Lithuania apply the technique (Fig.2); however, undoubtedly there is a clearly discernible potential for the technology to be applied in and benefit a number of areas, such as electronic settlement infrastructure, securities swaps management of digital identity, compliance, audit or loan syndication.

(2) The survey of the impact of financial technologies upon the profitability of Lithuanian banks primarily focused upon the link between the FinTech indicators and the ROA, ROE and NIM of the banking sector. A table of the link between the significance of the variables was drawn up with regard to the computed correlation coefficients and the significance levels (Table 3). It appeared that the links of not a single FinTech indicator is statistically significant for the ROE ratio. At the same time a negative relation between negative ROA and the non-cash money payments was identified; But a statistically significant correlation between NIM and internet banking, mobile banking and the number of bank card readers was observed.

Table 3. Statistical significance of the correlation between the FinTech indicator and the profitability of the banking sector (Source: author's compilation)

<i>p</i> <0.05	ROA	ROE	NIM		<i>p</i> <0,1	ROA	ROE	NIM
FINTECH	s.n.	s.n.	s.n.		FINTECH	s.n.	s.n.	s.n.
TUI	s.n.	s.n.	s.n.		TUI	s.n.	s.n.	r.n.
INNOV	s.n.	s.n.	s.n.		INNOV	s.n.	s.n.	s.n.
NONPMNT	r.n.	s.n.	s.n.		NONPMNT	r.n.	r.n.	s.n.
INTBANK	s.n.	s.n.	r.t.		INTBANK	s.n.	s.n.	r.t.
MOBBANK	s.n.	s.n.	r.t.		MOBBANK	r.t.	s.n.	r.t.
CARD	s.n.	s.n.	s.n.		CARD	s.n.	r.n.	r.n.
POST	s.n.	s.n.	r.t.		POST	s.n.	s.n.	r.t.
s.n. – statistically insignificant, r.n. – significant negative, r.t. – significant positive								

Authors in the area (Dallal, 2012) have been using different levels of significance depending on the need (from 0.01 to 0.1). When assessing the impact at a significance level 0.1, more significant links between ROE and FinTech indicators were identified. The significant negative correlation between ROE and the non-cash money operations values and the card number indicators, and the significant negative correlation between ROA and the non-cash money operations, showed that competition in the area of settlement and payment negatively affects the profitability of banks. In five out of eight FinTech companies, the link with NIM appeared statistically significant.

Table 4. Regression models for ROA, ROE and NIM indicators (Source: author's compilation)

	ROA model	ROE model	NIM model
Determination coefficient	0.896	0.843	0.775
Adj. determination coefficient	0.803	0.711	0.600
Durbin-Watson coefficient	2.430	2.415	2.194
Sig.	0.068	0.141	0.256

Further, regression models were constructed for each of the dependent variables, using the non-cash money payment, mobile banking and payment card number ratios (Table 4). It is obvious that the changes in the financial technologies sector best explain the movements in ROA and ROE, because the indicators defining the characteristics of the regression model constructed for the ratios are most

significant. The determination coefficient for all models is sufficiently high, thus in all models the changes in such financial technologies explain the movement in the profitability ratios. Concerning the level of significance of the most significant ROA and ROE ratios, they are significant only with a 90 per cent significance level, i.e. $p < 0.1$. The Durbin-Watson test shows that there is no significant autocorrelation problem.

From the results obtained by correlation-regression analysis, several key insights were identified. First of all, in two out of three models, the FinTech indicator impact upon the performance of the banking sector is statistically significant, which allows a conclusion that technologies in the payment area produce significant impact upon the profitability indicators of the banking sector.

Second, the analysis of correlation showed that there are both positive and negative correlations between the FinTech indicators and the banking sector profitability ratios. This suggests that the costs of banks allocated for deployment of technologies reduce their profitability due to increased expenses; in selected areas, banks are less innovative than FinTech companies.

And finally, having concluded a strong or medium significant link between the number of payment cards, non-cash money payments, mobile banking and the profitability ratios of banks, and within the regression models, the ratio of payments accurately describes the movement in the bank's profitability. So it may be concluded that the payment technologies mostly affect the banking sector. That is consistent with the conclusions of Tunay et al. (2015), DeYoung (2005) and Wonglimpiyarat (2017), who have reported a significant impact on the profit margins of banks produced by online banking, mobile banking and the operations performed on such platforms. Thus the models that have been constructed for the purpose of the study are best suitable for examining the impact of the related technologies on the profitability of the banking sector.

Conclusions

There is no unanimous opinion in the research literature concluding how FinTech actually affects the profitability of the banking sector. On the one hand, the FinTech may affect the profitability of banks negatively because of an easier adaptation to the new technologies, and forming of new operating models in the financial sector. On the other hand, some other studies suggested that FinTech does not actually have significant impact upon the profitability of the banking sector, as banks are capable of adapting to new technologies also due to the fairly obvious cooperation opportunities between the two sectors.

The results of the completed expert evaluation made it possible to identify the following factors potentially supporting the development of FinTech in Lithuania: expand the customer base with a view not to lose the market share currently held, apply technologies to improve products and services, apply the data analysis at a larger scale for ensuring operational efficiency, apply other technologies, such as 'blockchain', cooperate with conventional financial institutions, thus reducing competition and seeking to retain the market share currently held.

Assessment of Lithuanian environment showed that Lithuanian economic environment is assessed as favorable for appearance of new FinTech entities, primarily due to highly competent employees, well-developed infrastructure, and conditions favorable for business development. Moreover, it can be well expected that the impact of the development of FinTech will be most prominently manifested in the payment and the banking sector. On the other hand, FinTech companies clearly tend to continue cooperating with the banking sector, rather than competing with it.

After the evaluation of the impact of Fintech on profitability of banking sector, a significant link between the profitability indicators of the banking sector and the innovative payment services was revealed. It can be concluded that the profitability of the banking sector is significantly affected by online and mobile banking, and the operations performed on such platforms.

Finally, a quantitative assessment of the impact of financial technologies on the Lithuanian banking sector showed that in Lithuania FinTech companies do not cause any significant competition, as no significant negative link with the number of new FinTech entities has been established.

References

- Arner, D. W., & Barberis, J. N., & Buckley, R. P. (2015). *The Evolution of FinTech: A New Post-Crisis Paradigm?* Hong Kong: The University of Hong Kong. [Accessed 05.11.2018] Available from Internet: <https://hub.hku.hk/bitstream/10722/221450/1/Content.pdf>
- Bakker, E. (2015). *The fintech ecosystem report: Measuring the effects of technology on the entire financial services industry*. BI Intelligence. [Accessed 15.12.2018] Available from Internet: <https://edoclogica.com/wp-content/uploads/2018/01/Technology-changing-FinTech-Markets-J.Jefferys-and-Randy.pdf>
- Baležentis, A., & Žalimaitė, M. (2011). Ekspertinių vertinimų taikymas inovacijų plėtros veiksnių analizėje: Lietuvos inovatyvių įmonių vertinimas. *Management theory and studies for rural business and infrastructure development*, 3 (27), 23-31.
- Beard, J. *How the Rise of Fintech Could Affect Your Bank*. [Accessed 19.11.2018] Available from Internet: <https://www.whitlockco.com/fintech-and-your-bank/>
- Bektas, E. (2014). Are the determinants of bank net interest margin and spread different? The case of North Cyprus. *Banks and Bank Systems*, 9(4).
- Bikker, A. J. (2010). Measuring Performance of Banks: An Assessment. *Journal of Applied Business and Economics*, 11(4).
- Biswas, S., & Hossain, A., & Poddler, K. A., & Hossain, N. Md. (2017). A Canonical Analysis on the Relationship between Banking Sector and Stock Market Development in Bangladesh. *International Journal of Economics and Finance*, 10 (1).
- Błach, J. (2011). Financial innovations and their role in the modern financial system – identification and systematization of the problem. *Financial Internet Quarterly „e-Finanse”*, 7 (3), 13-26.
- Bratanu, V. (2017). Digital innovation the new paradigm for financial services industry. *Theoretical & Applied Economics. Special Issue*, 24, 83-94.
- Buss, A., Uppal, R., Vilkov, G. (2017). *Financial Innovation and Asset Price*. INSEAD Working Paper. [Accessed 13.11.2017] Available from Internet: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3015208
- Cohen, I., & Manion, L., & Morrison, K. (2000). *Research Methods in Education*. Fifth edition. RoutledgeFalmer, London.
- Cyree, B. K., & Delcours, N., & Dickens, R. (2009). An examination of the performance and prospects for the future of internet-primary banks. *Journal of Economics and Finance*, 33.
- Dabrowski, M. (2017). Potential impact of financial innovation on financial services and monetary policy. *CASE Network Studies & Analyses*, 488, 1-26.
- Dallal, E. G. (2012). *Why p=0.05?*. [Accessed 01.12.2018] Available from Internet: <http://www.jerrydallal.com/lhsp/p05.htm>
- Deloitte, (2017). *A tale of 44 cities: Connecting Global FinTech: Interim Hub Review 2017*. Global FinTech Hubs federation. [Accessed 05.12.2017] Available from Internet: <https://www2.deloitte.com/content/dam/Deloitte/uk/Documents/Innovation/deloitte-uk-connecting-global-fintech-hub-federation-innotribe-innovate-finance.pdf>
- Dermine, J. (2017). Digital Disruption and Bank Lending. *European economy banks, regulation, and the real sector*, 2, 63-76.
- DeYoung, R. (2005). The Performance of Internet-Based Business Models: Evidence from the Banking Industry. *The Journal of Business*, 78 (3), 893-948.
- Dorfleitner, G., & Hornuf, L., & Schmitt, M., & Weber, M. (2017). *FinTech in Germany*. Springer International Publishing AG.
- Ekpu, V. (2015). *Measuring and Reporting Financial Innovation Performance and its Impact: a review of methodologies*. Financial Regulators and Supervisors seminar, Dubai. [Accessed 03.12.2018] Available from Internet: https://www.researchgate.net/publication/311806757_Measuring_and_Reporting_Financial_Innovation_Performance_and_its_Impact
- Erman, C., (2017). *Financial technologies effect on financial services from an open innovation perspective*. [Accessed 03.12.2018] Available from Internet: https://www.researchgate.net/publication/316145220_

FINANCIALTECHNOLOGIES_EFFECT_ON_FINANCIAL_SERVICES_FROM_AN_OPEN_INNOVATION_PERSPECTIVE

- Frame, W. S., & White, J. L. (2002). *Empirical Studies of Financial Innovation: Lots of Talk, Little Action?: Working paper*. Federal reserve bank of Atlanta.
- Gimpel, H., & Röglinger, M. (2015). *Digital Transformation: Changes and Chances – Insights based on an Empirical Study*. Fraunhofer Institute for Applied Information Technology.
- Invest Lietuva, (2017). *Lithuanian Fintech Report 2017*. [Accessed 24.05.2018] Available from Internet:<https://investlithuania.com/wp-content/uploads/2018/02/Lithuanian-Fintech-Report-2017.pdf>
- Jasevičienė, F., & Valiulienė, V., (2013). Main risks in the Lithuanian Banking sector: analysis and evaluation. *EKONOMIKA*, 92(1).
- Kagan, A., & Acharya, N. R., & Rao, S. L., & Kodepaka, V. (2005). Does Internet Banking Affect the Performance of Community Banks? *American Agricultural Economics Association Annual Meeting*.
- Kalmykova, E., & Ryabova, A. (2015). FinTech Market Development Perspectives. *SHS Web of Conferences*, 28.
- KPMG (2017). *2017 Fintech100: Leading Global Fintech Innovators*. [Accessed 24.05.2018] Available from Internet:<https://home.kpmg.com/content/dam/kpmg/qm/pdf/H2-Fintech-Innovators-2017.pdf>
- Larionova, N., & Varlamova, J., (2014). Correlation analysis of macroeconomic and banking system indicators. *Procedia Economics and Finance* 14 (2014), 359-366.
- Lee, I., & Shin, Y. J. (2017). Fintech: Ecosystem, business models, investment decisions, and challenges. *Business Horizons*, 61, 35 - 46.
- Levišauskaitė, K., & Rakevičienė, J. (2004). Elektroninė bankininkystė Lietuvoje: Plėtros tendencijos ir problemos. *Pinigų studijos*, Kaunas.
- Libby, R., & Blashfield, R., (1978). Performance of a composite as a function of a number of judges. *Organizational Behavior and Human Performance*, 21, 121-129.
- Mansilla-Fernandez, M. J. (2017). Fintech and Banks: Friends or Foes? *European economy banks, regulation, and the real sector*, 2017.2, 31-40.
- Milič, D., & Soleša, D. (2017). The analysis of macroeconomic determinants of the banking sector liquidity with role in financing agricultural sector. *Economics of Agriculture* 2/2017.
- Mouilleron, E., & Bruggink, D. (2017). Success factors for the deployment of financial technology: an Interview. *Journal of Payments Strategy & Systems*, 10, (4), 396-400.
- Mustapha, A., S. (2018). E-payment Technology Effect on Bank Performance in Emerging Economies – Evidence from Nigeria. *Journal of Open Innovation: Technology, Market and Complexity*.
- Mwaura, W., H., & Nasieku, T., (2016). Factors influencing the growth of financial innovation at the Nairobi stock exchange. *International Journal of social Science and Information Technology*, 2(4).
- Navaretti, B. G., & Calzolari, G., & Pozzolo, F. A. (2017). Fintech and Banks: Friends or Foes? *European economy banks, regulation, and the real sector*, 2017.2, 9-29.
- Pejkovska, M. (2018). *Potential negative effects of Fintech on the financial services sector, Examples from the European Union, India and United States of America*. Helsinki Metropolia University of Applied Sciences.
- Powell H., J. (2018). *The Federal Reserve's Framework for Monitoring Financial Stability*. [Accessed 09.12.2018] Available from Internet: <https://www.federalreserve.gov/newsevents/speech/powell20170303b.pdf>
- Puschmann, T. (2016). Fintech. *Bus Inf Syst Eng* 59(1), 69-76.
- PwC, (2017). *Explore the data: Redrawing the lines: FinTech's growing influence on Financial Services*. Global FinTech Report 2017. [Accessed 12.04.2018] Available from Internet: <https://www.pwc.com/gx/en/industries/financial-services/fintech-survey/report/data-explorer.html>
- Rudzkiene, V., & Augustinaitis, A. (2009). *Lietuvos e. valdžios gairės: ateities įžvalgų tyrimas*. Kolektyvinė monografija. Vilnius: MRU.
- Sadr, S., M., H. (2013). Consideration the effect of E-Banking on bank profitability; Case study selected Asian countries. *Journal of Economics and Sustainable Development*, 4.

- Schindler, J. (2017). *FinTech and Financial Innovation: Drivers and Depth: Working papers*. U.S. Federal Reserve Board's Finance & Economic Discussion Series.
- Shah, Q. S., & Rizwan, J. (2013). Analysis of Financial Performance of Private Banks in Pakistan. *Procedia - Social and Behavioral Sciences*, 109(2014), 1021 – 1025.
- Sorkin, R. A. (2016). *Fintech Firms Are Taking On the Big Banks, but Can They Win?* The New York Times, April 7, 2016. [Accessed 19.11.2018] Available from Internet: <https://www.nytimes.com/2016/04/07/business/dealbook/fintech-firms-are-taking-on-the-big-banks-but-can-they-win.html>
- Titko, J., & Skvarciany, V., & Jurevičienė, D. (2015). Drivers of bank profitability: Case of Latvia and Lithuania. *Intellectual Economics*, 9(2), 120-129.
- Trivedi, R. S. (2015). Banking Innovations and New Income Streams: Impact on Banks' Performance. *The Journal for Decision Makers*, 40(1).
- Tunay, B. K., & Tunay, N., & Akhisar, I. (2015). Interaction Between Internet Banking and Bank Performance: The Case of Europe. *Procedia - Social and Behavioral Sciences*, 195.
- Varga, D. (2017). Fintech the new era of financial services. *Budapest Management Review*, 48 (11), 22-32.
- Vargas, R. A. (2008). *Assessing the contribution of financial innovations to the production of implicit services of financial intermediation in Costa Rica*. Proceedings of the IFC Conference on "Measuring financial innovation and its impact", 31.
- Vaškelaitis, V. (2010). Finansinės inovacijos: turinys, prieštaravimas, rizikos valdymas. *Ekonomika ir valdyba: aktualijos ir perspektyvos*, 1 (17), 133-139.
- Walker, G. (2017). Financial technology law: a new beginning and a new future. *International Lawyer*. 50(1), 137-215.
- Wonglimpiyarat, J. (2017). FinTech banking industry: a systemic approach. *Foresight*, 19 (6), 590-603.
- Yen, F. Y. (2013). The impact of bank's human capital on organizational performance: How innovation influences performance. *Innovation*, 15(1).
- Zavolokina, L., & Dolata, M., & Schwabe, G. (2016). The FinTech phenomenon: antecedents of financial innovation perceived by the popular press. *Financial Innovation*, 2.