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DEVELOPMENT OF FINTECH BUSINESS IN LITHUANIA: DRIVING FACTORS AND FUTURE SCENARIOS

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Abstract. *Purpose* – the research aims to find out the main factors that determine the change in the number of FinTech companies in Lithuania and predict the future development of this sector.

Research object – FinTech business sector, described as the number of FinTech companies.

Research methodology – scientific literature analysis and generalisation, comparative analysis, statistical data collection and systematisation, correlation-regression analysis, scenario method for forecasting.

Findings – the main factors that may determine the growth of the number of FinTech companies in Lithuania were identified and several development scenarios for the segment forecasted. The first part analyses related scientific investigations and FinTech's impact on the financial system as a whole. In the empirical part, a correlation and regression analysis of the factors that may determine the change of a number of FinTech companies was performed and ten main factors identified. The possible evolution of the number of FinTech companies until 2024 under 5 scenarios has been predicted.

Research limitations – the statistical information used in this research comes from different databases and different sources and may not always be free from certain discrepancies.

Practical implications – the obtained results may be of interest for researchers who examine this issue and the Central Bank of Lithuania, performing surveillance of the financial market. The forecast under various scenarios of the economic situation enables the estimation of the impact the FinTech business may have and can be useful for the Ministry of Finance involved in strategic planning.

Originality/Value – an attempt was made to fill in the scientific literature gaps and find out what factors influence the most FinTech sector's development in Lithuania and how this sector might grow in the future.

Keywords: finance, financial innovations, financial market, financial technologies (FinTech), FinTech development, FinTech in Lithuania.

JEL Classification: F37, G17, G20.

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Introduction

The development of information technologies and their use plays an important role in the development of the banking sector. A recent example of the impact of information technologies on finance is the emergence of financial technologies called FinTech. FinTech experienced the most remarkable expansion only after the global financial crisis in 2008. Therefore, it is a rather new area that is growing very fast and has not been fully explored yet.

Globally the field of FinTech has been widely analysed on the topics of interaction between FinTech companies and traditional banks (Blake et al., 2016; Hung & Luo, 2016; Carney, 2017; Foo et al., 2017; Gomber et al., 2017; Li et al., 2017; Omreng & Gjendem, 2017; Alt et al., 2018; Azarenkova et al., 2018; European Commission, 2018; Persmoen & Sandvik, 2018; de Roure et al., 2018; Iman, 2019; Wang et al., 2021). FinTech regulatory and security issues are also explored, and the impact on the shadow banking system is also analysed (Financial Stability Board, 2017; Lee & Shin, 2018; Salampasis & Mention, 2018; Laurent & Sinz, 2019; Nemoto et al., 2019; Svensson et al., 2019). However, there is a lack of research examining the factors that attract FinTech companies to certain countries.

In recent years, Lithuania has been focussing on creation favourable conditions for the FinTech development and attracting the FinTech start-ups. The number of FinTech companies in the country started to be recorded only in 2013 with some 45 companies operating at that time. At the end of 2020, the number has reached 230 (Invest Lithuania, 2021) indicating a 5 times growth during the period.

Haddad and Hornuf (2019), Khatun and Tamanna (2020), Slazus and Bick (2022), etc. have analysed factors that influence the FinTech sector development globally or in specific countries. This provides information for a general understanding of the development-related issues. Nevertheless, certain factors influencing the development of the FinTech sector can be country-specific, e.g. related to promotion and regulation of the business within the segment, therefore analysis of their influence is important too. This research, first of all, aims to find out the main factors that determine the growth of the FinTech segment specifically in Lithuania and, secondly, to forecast its possible future development alternatives.

Research object: FinTech business sector, expressed as the number of FinTech companies in Lithuania.

Research methods: scientific literature analysis and generalisation, comparative analysis, statistical data collection and systematisation, correlation-regression analysis, scenario method for forecasting.

Novelty and originality of this investigation: an attempt was made to fill in the scientific literature gaps related to the analysis of the most significant factors that influence the FinTech sector development specifically in Lithuania and the forecast of growth of this sector in the future. The obtained results could be of interest to researchers who examine these issues as well as to the Central Bank and the Ministry of Finance which are responsible for financial market surveillance.

1. Review of related scientific investigations

The term FinTech originated only in the 21st century. Although Gimpel et al. (2018) state that this term was first used in the 1990s in the title of Citigroup's predecessor project to promote technological collaboration, Schueffel (2016) argues that as early as 1972 the vice president of the Manufacturers Hanover Trust bank in the United States used the term FinTech in his scientific article on the day-to-day problems of banks and their solutions. This shows that neither the time nor the environment of the occurrence of the FinTech term has not yet been unambiguously determined.

Foo et al. (2017) described Peer-to-peer (P2P) lending as a fast-growing financial technology (FinTech) trend that can displace traditional retail banking. According to the International Organization of Securities Commissions (2017), the concept of FinTech is designed to describe the diversity of innovative business models and new technologies that have the potential to transform the financial services industry. Kashyap et al. (2016) described FinTech as a dynamic segment at the intersection of the financial services and technology sectors where technology-focused start-ups and new market entrants innovate the products and services currently provided by the traditional financial services industry. Kalmykova and Ryabova (2016) wrote that FinTech is an economic sector where companies offer different financial services by using new technologies to make this process more efficient and convenient for customers. According to the European Banking Authority (2017), FinTech is 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" and has the potential to transform further the provision of financial products and services.

Ministry of Finance of the Republic of Lithuania (2017) highlights that the concept of FinTech arose from the combination of financial services and innovative technology sectors. The Central Bank of Lithuania (2020b) writes that FinTech refers to 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.

FinTech is based on innovation, ever-changing and evolving technologies. As Zavolokina et al. (2016) state "FinTech is a living body with a flexible and changing nature rather than a stable notion that is transparent and clearly understood by both academia and the media".

Lee and Shin (2018) have investigated the FinTech ecosystem and defined that it consists of 5 elements: FinTech startups, Government, traditional financial institutions, financial customers, and technology developers. The government regulates the activities of the financial sector and other elements are technology developers – IT specialists, who make financial technologies a reality and traditional financial institutions, such as various commercial banks, insurance companies, securities companies, etc., which can become both competitors and business partners. All these elements contribute to the emergence of innovation, the stimulation of the economy, the facilitation of cooperation, and the creation of competition in the financial system that benefits consumers of financial services (Lee & Shin, 2018). Thus, FinTech is a technology-based financial innovation that works harmoniously in a system made up of a variety of different objects.

Due to the novelty of the topic and the lack of data, it has been observed that researchers are usually conducting their research in the form of a survey, thus avoiding the problem of data shortages. In recent years, however, there has been an increase in research based on statistics. A review of investigations conducted on the FinTech area shows that researchers are increasingly interested in this topic (Table A1 in Appendix).

The other discussable issue is what factors affect FinTech sector's development. Ernst & Young (2019) highlighted that "FinTech adoption tends to be higher in developing markets by digitally active consumers". According to Demirguc-Kunt et al. (2017), FinTech business sector growth has largely been driven by digital payments, government policies, and a new generation of financial services accessed through mobile phones and the internet. Guild (2017) pointed out the key factors of FinTech growth, such as: "digital cash transfer services, peer-to-peer lending platforms, complementary government policies, and regulatory frameworks". Haddad and Hornuf (2019) have investigated related factors, but the research is based on relatively old data from 2005–2015. They found that "more FinTech startups formate when the country's economy is well-developed and venture capital is readily available. Furthermore, the number of secure Internet servers, mobile telephone subscriptions, and the available labor force has a positive impact on the development of FinTech". So it can be assumed that the general situation of information technology and innovation in the country should also be analysed as factors that potentially determine the development of FinTech. Chong et al. (2019) has highlighted that security of technologies are very important for the FinTech sector: "the security concern is significant and positively influences one's intention to adopt FinTech, as the trustworthiness of new technologies is important to ensure secured personal data". Khatun and Tamanna (2020) analysed Bangladesh's financial sector and proved that "users feel convenient and wish to be connected with Fintech if it is easily understandable to them". According to Zarrouk et al. (2021), "the availability of resources through venture capital is vital to the success and survival of FinTechs. However, financial barriers, the regulatory environment, and legal issues have a detrimental impact on facilitating the creation and growth of FinTech ventures". Slazus and Bick (2022) have made a case study of South Africa and identified 6 influencing FinTech development factors: four enabling and two inhibiting factors. "The enabling factors that positively influenced FinTech adoption were: Utility, Socio-Economic Influencers, Mobile Device Trust, and Youth. The two inhibiting factors were: Perceived Risks and Associated Costs".

Meanwhile, the number of FinTech companies in Lithuania has been recorded only since 2013 (Invest Lithuania, 2020a), there is a lack of related investigations on factors influencing FinTeh sector growth in Lithuania. So far, they can only be speculated based on the factors that determine the development of any type of company. For example, it is known that the issue of the country's competitiveness and, in particular, the competitive advantage of small and medium-sized businesses among the countries of the European Union with the desire to improve it – to ensure stable, rapid economic growth, living standards – has been raised in the country for some time (Garuckas et al., 2007; Staskevičiūtė & Tamošiūnienė, 2010; Rakauskienė & Tamošiūnienė, 2013). Stundžienė and Bliekienė (2012) have studied the impact of the economic environment on enterprises and their activities. They concluded that changes in the number of enterprises directly depend on the change of GDP in the country

over the year and confirmed that the economic situation has a significant impact on enterprise performance. Danilevičienė and Lukšytė (2017) analysed the impact of foreign direct investment on the competitiveness of the country's economy and identified their importance for the country's continuous development, increasing productivity, integration into the global economy, etc.

Invest Lithuania (2020b), the official agency for Foreign Direct Investment and Business Development in the country, uses various global rankings to present Lithuania and other various aspects describing the business environment – for example, Lithuania is in the top ten EU countries in terms of ease of paying taxes, online services business is also among the countries with one of the lowest corporate income tax rates in Central and Eastern Europe, etc. Besides, other aspects are also mentioned, among them extremely good personnel skills for innovation in the country, high number of educated people. This suggests that all the above mentioned and other factors can stimulate the growth of FinTech segment locally and attract them to Lithuania from abroad in the future.

Several initiatives have been launched in Lithuania to attract FinTech companies to the country, among them the experimental financial innovation environment (Sandbox) created by the Bank of Lithuania in 2018. The submission of applications for those wishing to try out their innovative financial products in Lithuania was started by the Bank of Lithuania (2020a). The Bank of Lithuania has also separately developed the LBChain platform based on blockchain technology, which aims to provide regulatory and technological advice to FinTech companies by providing access to a test environment (Invest Lithuania, 2020a; Bank of Lithuania, 2020c). Parallel to promotion, the Bank of Lithuania focuses on risk reduction measures related to the growth of the FinTech segment and provision of digital financial services (Invest Lithuania, 2020a).

This shows that Lithuania as a country tries to be proactive in stimulating the growth of the FinTech segment through creation of favourable business environment and implementation of measures, which reduce the related risks.

2. FinTech in Lithuania

In recent years, Lithuania has become increasingly noticeable among FinTech start-ups. In 2019, according to the fDi Intelligence, investment unit of the Financial Times rating, Vilnius became the city that attracts the most technology start-ups (fDi Markets, 2019). In the international FinTech ranking prepared in the United Kingdom, which evaluates various elements of the FinTech ecosystem, Lithuania was ranked the 4th among various 65 countries in the world in 2019 (a rise by 14 positions during the year), whereas payments, lending and banking were considered to be areas that are the most developed in Lithuania (Findexable, 2020). Year later, Lithuania maintained its leadership in FinTech and was ranked the 10th among 83 countries in the world in 2020 (Findexable, 2021).

According to Invest Lithuania (2021), in 2013, when monitoring of FinTech activities was started, only 45 of these companies operated in Lithuania. In 2020, there were already 230 of them showing the 5 times growth (Figure 1).

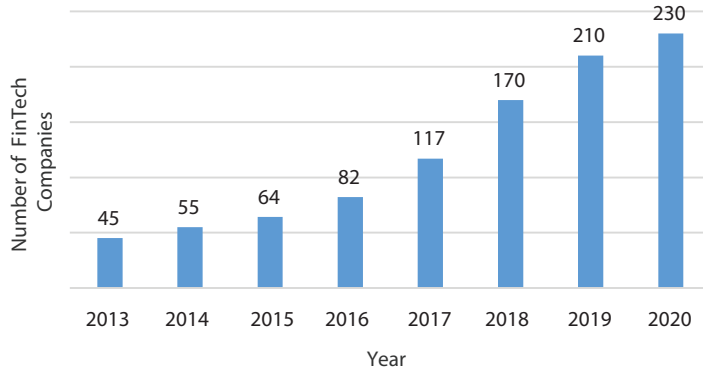


Figure 1. Number of FinTech companies in Lithuania at the end of the year (source: created by authors, according to data based on Invest Lithuania, 2021)

According to Invest Lithuania (2020a), out of 170 companies that were in the FinTech companies list in 2018, 20 had to be removed next year due to closure or mismatch with the FinTech concept, thus in 2019, the number of new companies increased by 60. Although the pandemic slowed economic growth in the country, 20 new companies were established in 2020, which increased the FinTech sector up to 230 companies (after corrections to the list of companies in 2019). The core activities of these companies are: payments (30%), financial software (20%), and lending services (13%) (Invest Lithuania, 2021).

International ranking organisations admit the presence of conducive regulatory and supervisory ecosystem as well as fostering innovation in the financial system of the country.

3. Methodology of the research

This section describes the methodology of the research. The study comprises 4 stages (Table 1).

Table 1. The research framework (source: authors)

Steps of the research	Methods	Results
1. Identification and selection of factors that may determine the emergence of FinTech segment	Scientific and professional literature analysis	3 factor groups selected: – Factors indicating country's economic performance; – Factors defining business environment (obtained by World Economic forum expert evaluation); – Other country-specific factors.
2. Selection of the most significant factors influencing the growth of FinTech segment	Correlation analysis is performed. Pearson correlation coefficient, *p*-value comparison with α coefficient was used to check statistical significance	The most correlated factors with the number of FinTech companies were selected from each group.

End of Table 1

Steps of the research	Methods	Results
3. Simple linear regression equations compilation with selected variables from each group. Formation of a multiple linear regression equation with factors selected for simple linear regression equations	Linear regression analysis: simple and multiple. Criteria used to ensure the eligibility of the regression: – Coefficient of determination; – the *p*-value of ANOVA analysis of variance; – Student's criterion *p*-value; – Durbin-Watson statistic to check for autocorrelation; – VIF to determine multicollinearity; – Cook's measure to detect data exceptions; – Kolmogorov-Smirnov and Shapiro-Wilk criteria for verifying the presumption of normal data distribution.	– Based on the assumptions of the eligible regression equation, simple linear regression equations are constructed that allow estimation the effect of variables one-by-one on the number of FinTech companies. – Using the selected most significant variables for simple linear regression equations, one multiple linear equations with two variables is formed.
4. Using a multiple linear regression model, the change of Fintech companies is predicted till 2024	Forecasting is performed using 5 developed scenarios: – optimistic; – neutral; – slightly pessimistic; – strongly pessimistic; – crisis.	The forecast of changes in the number of FinTech companies in various situations are determined till the year 2024.

3.1. Selection and grouping of factors that may influence the change in the number of FinTech companies

Firstly, it has been established with certainty that the economic situation of a country has a significant impact on companies' decisions to set up a Fintech start-up in Lithuania. Also, analysing the field of FinTech specifically, Lithuania is characterised by certain aspects that distinguish it from other countries.

A total set of 40 suitable variables were selected (Table 2). According to the method of data acquisition, it was decided to distinguish data that was calculated quantitatively and that was received by the World Economic Forum using expert estimates. Therefore, it was decided to group data into three separate groups:

– the group of factors indicating the economic performance of Lithuania consists of 17 variables;
– the group of factors obtained during the expert assessment consists of 9 variables and they are named as describing the business environment in Lithuania;
– the remaining factors are included in the study as "Other country-specific factors that distinguish Lithuania" – these include Lithuania's ratings from general lists that compare the countries of the world in a certain aspect, factors determining Internet use in the country and others, filling in this group by 14 factors.

Table 2. Selected and grouped factors according to three separate groups (source: authors)

Factors indicating the economic conditions of Lithuania	Factors defining the Lithuanian business environment	Other factors distinguishing Lithuania
– Central government deficit/surplus (% of GDP) – General government deficit/surplus (% of GDP) – Local government deficit/surplus (% of GDP) – Social protection funds deficit/surplus (% of GDP) – Central Government debt – (end of the year, millions EUR) – Foreign direct investment at the end of the period (millions EUR) – Change in OMX Vilnius share prices (%) – Average earnings (hourly gross) – GDP (per capita, EUR) – Labor force (thousands) – Seasonally adjusted unemployment rate (%) – GNI (EUR, millions) – Inflation (annual change, %) – General government revenue (annual change, %) – General government expenditure (annual change, %) – Central government revenue (annual change, %) – Central government expenditure (annual change, %)	– The efficiency of the legal framework in settling disputes (1–7) – The efficiency of the legal framework in challenging regulations (1–7) – Pay and productivity – (1–7) – Hiring and firing practices (1–7) – The extent of market dominance (1–7) – Venture capital availability (1–7) – The soundness of banks (1–7) – Cluster development – (1–7) – The burden of government regulation (1–7)	– "Index of economic freedom" rating (0–100) – Regular internet users (% of individuals) – Households having Internet access – Fixed broadband internet subscription (per 100 people) – Mobile broadband subscriptions (per 100 people) – Cost of business start-up procedures (% of GNI per capita) – "Ease of doing business" rating – Total tax rate (% of the profit) – "Global Innovation Index" rating – Government integrity (0–100) – Business freedom (0–100) – Labor freedom (0–100) – Monetary freedom (0–100) – Trade freedom (0–100)

3.2. Data selection and limitations

Most of the data for the first group of factors was collected from the database of the Official Statistics Portal of Lithuania (2020). The second set of data was collected from the Global Competitiveness Report, which presents the results of the expert assessment. According to the World Economic Forum (2020), the representatives of the Lithuanian Department of Statistics were responsible for collecting the answers, which were answered by the managers of various companies.

The third group of data was collected using various sources. This set of data aimed at examining other country-specific factors that distinguish Lithuania, but are not directly related to country's economic performance. This set al.o includes data, which was obtained during the non-expert assessment. Several factors are obtained from the Ease of Doing

Business (The World Bank, 2020) report. Lithuania's ranking from the Global Innovation Index (WIPO, 2021) and the Index of Economic Freedom (The Heritage Foundation, 2021) reports were also used. The remaining factors were obtained from the database of the Official Statistics Portal of Lithuania, the Global Competitiveness Report, and other sources.

Research limitations: Due to the novelty of the topic and the lack of data, the statistical information used in this research comes from different databases and different sources and may not always be free from certain discrepancies.

3.3. The setup of regression analysis

The Pearson correlation coefficient *r* was used to estimate the strength of the linear relationship, which can take values from –1 to +1. If $r = 0$, then the dependence between X and Y variables does not exist, when $r = 1$, the relationship between the variables is direct and completely accurate, if $r = -1$, the relationship is an inverse (Čekanavičius & Murauskas, 2014). The *p*-value of the Pearson correlation coefficient obtained using the SPSS program was compared with the selected significance level α. If $p > \alpha$, correlation of variables is not confirmed and if $p < \alpha$ – correlation confirmed. (Pukėnas, 2005).

As correlation coefficient itself only assumes the existence of relationships, but does not allow to quantify it, the following linear regression models were used, which make it possible (Pabedinskaitė & Činčikaitė, 2016):

$$Y = a_0 + a_1 X + \varepsilon, \tag{1}$$

where:

a_0 – intercept (constant term);

a_1 – slope coefficient for explanatory variable;

x_n – explanatory variables ε – model residuals.

The coefficient a_1 expresses the effect, that the change of independent variable X by one unit has on the dependent variable Y. If $a_1 > 0$, the increase of X will cause the increase of *Y*, and vice-versa.

For multiple linear regression analysis, the following equations were used:

$$Y = a_0 + a_1 X_1 + a_2 X_2 + \ldots + a_n X_n + \varepsilon, \tag{2}$$

where:

a_0 – intercept (constant term);

$a_{1,2\ldots n}$ – slope coefficients for each explanatory variable;

x_n – explanatory variables;

ε – model residuals.

By using the SPSS program, non-standardised coefficients used in equations and the beta value of standardised coefficients were identified. The higher the beta, the more significant is the variable.

In multiple regression analysis, ANOVA (analysis of variance) statistic was used.

Multicollinearity was tested using variance inflation factor (VIF), which indicates a correlation between variables when VIF > 4 (Čekanavičius & Murauskas, 2014). According to Ghinea et al. (2016), if VIF < 1, the independent variables do not correlate with each other,

if 1 < VIF < 5, the independent variables correlate very insignificantly, and VIF > 5 or 10 show a high correlation.

The Durbin-Watson significance criterion was used to assess whether there is no autocorrelation between residual errors. Durbin-Watson statistics vary from 0 to 4. It is calculated according to the following formula (Martišius & Vaičiūnas, 2001):

$$d = \frac{\Sigma_{i=2}^{n}\left(\hat{e}_i - \hat{e}_{i-1}\right)^2}{\Sigma_{i=1}^{n}\hat{e}_i^2}, \tag{3}$$

where $\hat{e}$ – residual error.

To elucidate the issue of autocorrelation, the critical values of the lower band (dL) and top band (dU) were found in the Durbin-Watson significance table (Figure 2), depending on the number of observations n and the number of factors k included in the model.

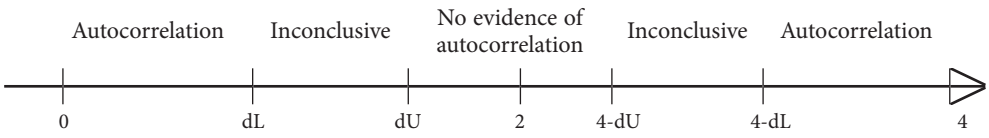


Figure 2. Interpretation of Durbin-Watson statistical values (created by authors according to Brooks, 2019)

The residues are stated to be independent when the Durbin-Watson criterion is obtained between the dU and 4-dU ranges.

Several assumptions were made in the analysis. First, the Kolmogorov-Smirnov and Shapiro-Wilk tests were used to verify whether the applied assumption on normal data distribution was correct. The null hypothesis that the variable is normal – if the p-value of the test obtained is less than the significance level $\alpha = 0.05$, the null hypothesis is rejected.

Another assumption made relates to the consistency of error variance, called homoskedasticity. It was checked graphically, deferring standardised residual errors on the Y-axis. Lastly, for determining the exceptions in the data, the Cook measure D_i was used.

3.4. The setup of the forecast

One of the popular ways to create a forecast is to apply the scenario method, which takes place in two stages: first, a comprehensive set of scenarios is created, and then a forecast is developed within the framework of a specific scenario (Adomavičienė et al., 2012).

The Bank of Lithuania has used the scenario method to assess the potential impact of coronavirus on the Lithuanian economy. The scenarios depict a possible form V decline (3.4 percent decrease in GDP), form U decline (11.4 percent decrease in GDP), or a prolonged form U decline (20.8 percent decrease in GDP) (Bank of Lithuania, 2020d).

By applying similar approach, it was decided to use the set of 5 scenarios in this study for the forecast of FinTech companies' number change in Lithuania till 2024.

The following scenarios were analysed:

1. an optimistic scenario, which would allow assessing the growth of FinTech companies in a period of faster economic growth, improvement of the business environment in Lithuania, and other important factors in the absence of coronavirus;

2. a neutral scenario, where the situation in the country changes insignificantly compared to the last years (the factors remain sufficiently stable);
3. a slightly pessimistic scenario, which would allow assessing the tendencies of FinTech companies' establishment in Lithuania in case of economic downturn, which the Bank of Lithuania has identified as having a V-shape;
4. a strongly pessimistic scenario that would reflect a possible U-shaped decline;
5. a crisis scenario that would forecast the development in the event of a prolonged U-shaped decline.

Depending on the predictive factors identified during the study, a specific percentage change of the number of FinTech companies was also modelled.

4. Results of the empirical research on factors influencing the FinTech sector development in Lithuania

Paired correlation analysis allowed us to identify 19 factors that have a significant strong dependence ($r > 0.7$) on the number of FinTech companies. From the first group of factors indicating the economic condition of Lithuania, 8 out of 17 variables were significant, i. e. GNI (EUR, millions), GDP (per capita, EUR), foreign direct investment at the end of the period (EUR million), average earnings (hourly gross), general government expenditure (annual change, percentage), unemployment rate (seasonally adjusted), central government debt (end of year, EUR, millions), General government revenue (annual change, percentage).

From the second group of factors, describing the business environment in Lithuania, 4 out of 9 variables were significant: hiring and firing practices, soundness of banks, the efficiency of the legal framework in settling disputes, availability of venture capital.

Of the third group of factors, indicating other country-specific factors distinguishing Lithuania, 7 out of 14 variables were significant: households having internet access (percentage), regular internet users (percentage of all individuals), freedom of trade, freedom of business, freedom of work, "Ease of doing business" annual rating and mobile broadband usage (per 100 inhabitants of the country). This shows that all three selected groups of factors were selected appropriately and are almost equally significant for the number of FinTech companies.

The performed correlation analysis allowed the selection of the most appropriate factors for regression analysis. First, they are used to develop simple linear regression equations, thus re-assessing their significance by checking various assumptions and rejecting the factors found to be insignificant at this stage. As a result, the selected factors were used to create a multiple linear regression equation, which provides an opportunity to determine the impact of several factors acting simultaneously on the number of FinTech companies.

Firstly, equations were constructed with only one independent variable in the equation at a time. The performed simple linear regression analysis made it possible to create 10 statistically significant models (Table 3). The remaining linear regression models with corresponding 9 factors were discarded due to discrepancies in the assumptions. Assumptions were described in Table 2.

Table 3. Statistically significant equations for simple linear regression (source: authors)

Group of Factors	Number of FinTech companies =	
1.	1.	–420.874 + 0.013 × GNI + ε
	2.	–326.869 + 0.031 × GDP per capita + ε
	3.	–477.189 + 0.037 × Foreign direct investment + ε
	4.	23.579 + 1661.924 × General government expenditure (annual change) + ε
	5.	–408.285 + 0.035 × Central Government Debt + ε
2.	1.	–616.205 + 154.631 × Soundness of banks + ε
	2.	–875.899 + 265.417 × Efficiency of legal framework in settling disputes + ε
	3.	–466.308 + 195.471 × Venture capital availability + ε
3.	1.	6226.612 – 70.223 × Trade freedom + ε
	2.	909.490 – 10.221 × Business freedom + ε

Then, all possible multiple linear regression models consisting of independent variables identified during the simple linear regression analysis were constructed. Out of 10 independent variables, a total of 45 different models were composed of two independent variables in each. The coefficients of determination, *p*-values, Durbin-Watson statistics for autocorrelation, Cook's criteria for exclusions, VIF multicollinearity analysis, Kolmogorov-Smirnov, and Shapiro-Wilk tests to confirm normality were analysed for each of them. The Durbin-Watson autocorrelation limits for a model with 2 independent variables are set as follows (Figure 3).

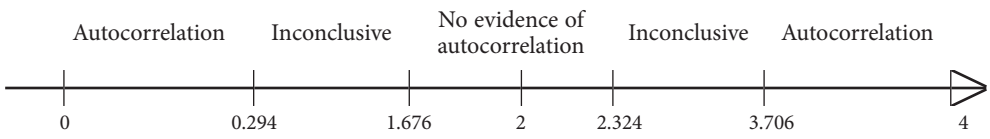


Figure 3. Interpretation of Durbin-Watson statistical values in a multiple linear regression analysis with two independent variables (source: authors)

Of all the 45 models, the *p*-value of only two models confirmed the significance of both independent variables in the equation, but multicollinearity was found in one of them. Thus, the most accurate multiple linear regression model is in Table 4.

Table 4. Coefficient of determination of a multiple linear regression equation, ANOVA *p*-value, and Durbin-Watson statistics (source: authors)

Model	Determination coefficient	ANOVA *p*-value	Durbin-Watson statistic
Number of FinTech companies, General Government expenditure (annual change, %), Efficiency of legal framework in settling disputes (1–7)	0.968	0.001	2.863

The coefficient of determination shows that the annual change in government expenditure (measured as a percentage) and the effectiveness of the legal system in resolving disputes (assessed by experts from 1 to 7) allow estimating as much as 96.8 percent change in the number of FinTech companies in the country. The *p*-value of the ANOVA only confirms that both independent variables have a relationship to the dependent variable. However, the result of Durbin-Watson statistic falls within the range in which it is not possible to determine whether autocorrelation exists. On the other hand, one of the variables in the model is derived from expert assessment, the autocorrelation of which is a deliberate rejection, because it is investigated only in case of suspicion. However, it can only be stated that autocorrelation cannot be ruled out.

The coefficients of the model equation and other statistics are given below in Table 5.

Table 5. Coefficients of the multiple linear regression equation, *p*-value, and VIF factor (source: authors)

Model	Non-standardised coefficients		Standardised coefficients	*p*-value	VIF
	B	Residual error	Beta		
Intercept	–443.379	129.254		0.027	
General Government expenditure (annual change, %)	1176.909	208.579	0.658	0.005	1.701
Efficiency of legal framework in settling disputes (1–7)	132.717	36.637	0.422	0.022	1.701

Based on the Beta value of the standardised coefficients, the annual change in government expenditure is a slightly more significant variable than the effectiveness of the legal system in resolving disputes. The *p*-value confirms the significance of both variables, and the VIF does not indicate a risk of multicollinearity ($1.701 < 4$).

When checking the residual errors of this model, it is observed that their average is zero. Heteroskedasticity is also not determined from the resulting residue graph. The remaining criteria are further examined (Table 6).

Table 6. Verification of the normal distribution of data resides in the multiple linear regression equation (source: authors)

Model	Cook's measure D_i	Kolmogorov-Smirnov test *p*-value	Shapiro-Wilk test *p*-value
Number of FinTech companies, General Government expenditure (annual change, %), Efficiency of legal framework in settling disputes (1–7)	0.422	0.146	0.193

No inconsistencies in the model are observed when analysing the rest of the criteria. The Cook's measure is $0.422 < 1$, so there are no exceptions in the data; both criteria for normal distribution are higher than $\alpha = 0.05$, so the null hypothesis of normal residue distribution is accepted.

Thus, a multiple linear regression model with the following equation is obtained:

$$\textit{Number of FinTech companies in Lithuania} = -443.379 + 1176.909 \times \textit{General Government expenditure (annual change)} + 132.717 \times \textit{efficiency of legal framework in settling disputes} + \varepsilon \quad (4)$$

Based on the coefficient of determination, this multiple linear equation explains 96.8 percent of the change in the number of FinTech companies. After checking the assumptions of the reliability of the model, it was found that there is no multicollinearity, the residues are distributed according to the normal distribution, their mean is zero, and the heteroskedasticity of the residues is not observed. However, it should be noted that the autocorrelation of the residues could not be confirmed or ruled out, so the full adequacy of the equation cannot be confirmed.

The resulting equation can be interpreted in this way: when other factors remain unchanged, a 1 percent increase in government expenditure will lead to an increase of 1176 companies in the FinTech sector, and a 1 point improvement in the efficiency of the legal framework in settling disputes will lead to 132 new businesses. However, it should be noted that general government expenditure varied between 0.01 and 0.10% during the study period. Therefore, it would be worthwhile to provide a more detailed interpretation of this factor in the equation: without other factors, a 0.01 percent increase in general government expenditure would lead to the establishment of 11 more FinTech companies in the country.

It can be speculated that general government expenditure is significant for the number of FinTech companies in Lithuania, because the government has started to pay a lot of attention to innovation and attracting such companies – as already mentioned "Sandbox", "LBChain" were established in the country. Also, the activities of Invest Lithuania, the official agency for Foreign Direct Investment and Business Development in Lithuania, which had to require certain expenses (investments), are actively carried out. The legal framework is also recognised as one of the most important factors in its effectiveness in resolving various disputes, possibly related to adaptation to various regulations which needs to be adapted for FinTech companies or new ones needs to be created, as not all old ones that are suitable for various other companies are effective for FinTech start-ups. In addition, the more efficient and transparent the legal system in a country, the easier it is for businesses to set up.

5. Future growth forecast for FinTech sector in Lithuania

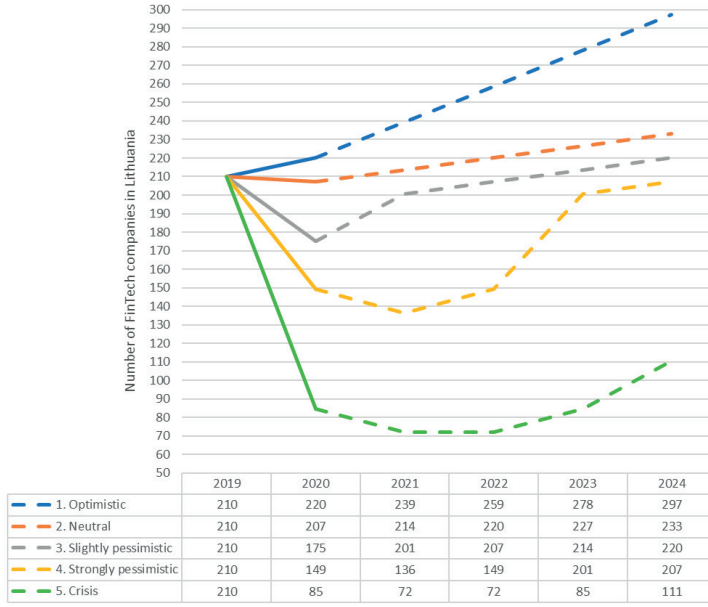
The obtained multiple linear equation is used to forecast the number of FinTech companies. The changes (compared to the previous years) of the factors used in the scenarios are shown in Table 7.

Using the changed values of the factors and the multiple linear equation, the following changes in the number of FinTech companies till year 2024 were obtained according to five scenarios (Figure 4).

The results of the first-optimistic-scenario reveal how the FinTech sector in Lithuania would expand if the country continues to foster an innovation-friendly environment, government funds would be allocated to Sandbox and other initiatives of the Bank of Lithuania, and

Table 7. Changes used in the factors for forecasting scenarios of the multiple linear regression model (source: authors)

Scenarios	2020	2021	2022	2023	2024
Optimistic	+3%	+3%	+3%	+3%	+3%
Neutral	+1%	+1%	+1%	+1%	+1%
Slightly pessimistic	–4%	+4%	+1%	+1%	+1%
Strongly pessimistic	–8%	–2%	+2%	+8%	+1%
Crisis	–18%	–2%	0%	+2%	+4%



	2019	2020	2021	2022	2023	2024
1. Optimistic	210	220	239	259	278	297
2. Neutral	210	207	214	220	227	233
3. Slightly pessimistic	210	175	201	207	214	220
4. Strongly pessimistic	210	149	136	149	201	207
5. Crisis	210	85	72	72	85	111

Figure 4. The changes of Fintech companies under 5 scenarios till 2024 (source: authors)

the legal framework, addressing various problems of FinTech sector related to its regulations, would improve. With both factors of the regression model increasing by 3 percent each year, the establishment of 20 new FinTech companies is forecasted annually, reaching 297 companies in the country at the end of 2024.

The second scenario predicts factors improving at a slower rate – increasing by 1 percent each year. This can be interpreted as a gradual, steadily improving environment for the business environment in Lithuania, with the government sector investing a slightly increasing amount. Under such conditions, the establishment of 6–7 new companies per year is forecasted. At the end of 2024, 233 FinTech companies would operate in Lithuania in this case.

The third scenario, designed to mimic the V-shaped decline due to coronavirus, shows what the possible consequences of this short-term deterioration in Lithuania would be for the FinTech sector. Initially, with a 4 percent decline in values of model factors, 35 FinTech

companies are forecasted to close, and if the situation improves next year, business growth of 201 companies is projected. After that, with the slow improvement of the situation, the number of 220 FinTech companies in Lithuania is forecasted at the end of 2024.

The fourth scenario shows a slightly longer-lasting downturn in the country. In this case, the factors of the model would reduce by 8 percent in the first year and by another 2 percent in the second, this would result in a reduction in the number of companies in the country to 149. However, with the slow start to recover in the third year, 207 companies could operate in the country by the end of 2024. Thus, in 5 years almost the same result in FinTech development as before the recession would be achieved.

The fifth scenario is designed to assess the fate of FinTech companies in Lithuania in the event of a major, prolonged downturn – a possible crisis. In this case, a sudden deterioration of the situation would lead to the closure of as many as 125 companies. Slow recovery after the recession would lead to a halving of the number of FinTech companies compared to 2019, with only 111 companies operating in the country by the end of 2024, according to the forecast scenario.

Forecasting the number of FinTech companies using 5 scenarios allowed us to assess the possible future development of this sector. According to the optimistic forecast, if Lithuania continues to put efforts to the improvement of the FinTech ecosystem, the creation of an innovation-friendly environment, and the legal framework for resolving various disputes will continue to improve, the number of FinTech companies can continue to grow rapidly. In the case of the neutral scenario forecast, a slight slowdown in the number of FinTech companies can be expected. Meanwhile, the remaining three forecasts, which assess the possible worst-case scenarios for Lithuania after the consequences of the coronavirus, suggest that we may also have to deal with the declining FinTech sector in Lithuania. These projections would require significant effort and time to revive the previous upward trend in FinTech development.

Discussion

In this research, an attempt was made to identify and analyse the main factors that influence the growth of FinTech companies' segment in Lithuania. The main factors identified were: gross national income GNI, GDP per capita, foreign direct investment, general government expenditure, central government debt, soundness of banks, efficiency of legal framework, venture capital availability, trade freedom and business freedom.

The results show that Government's role is very important. This correlates with the insights from other scientists. Lee and Shin (2018) claim that: "the government is important as a legislator that regulates the activities of the financial sector". Demirguc-Kunt et al. (2017) have proved that the growth of FinTech business sector has been driven by digital payments, government policies, and a new generation of financial services accessed through mobile phones and the internet. Among others, these researchers especially point to the Government's policy as one of the major factors.

According to Guild (2017), there are more important factors that influence the FinTech sector's growth. These are: "digital cash transfer services, peer-to-peer lending platforms, complementary government policies, and regulatory frameworks". Comparing the results of

this research, it can be seen that the factors identified, such as central Government decisions and the regulation of the legal system, coincide.

Zarrouk et al. (2021) have proved that "venture capital is vital to the success of FinTech start-ups". However, financial barriers, the regulatory environment, and legal issues have a detrimental impact on the creation and growth of FinTech companies. These results correlate with some of the factors identified in this investigation, such as efficiency of legal framework, venture capital availability, trade freedom and business freedom.

On the other hand, there are investigations that distinguish different factors that influence the growth of FinTech sector in the country. For example, Haddad and Hornuf (2019) claim that the main factors are: the number of secure Internet servers, mobile telephone subscriptions, and the available labor force. Chong et. al. (2019) has highlighted that security of technologies are very important for the FinTech sector: "the security concern is significant and positively influences one's intention to adopt FinTech". Slazus and Bick (2022) claim that "utility, socio-economic influencers, mobile device trust, youth, perceived risks and associated costs" are the most important.

It is clear that the topic is quite new and the related researches are very important, because every researcher identifies different factors that can influence the changes of numbers of Fintech companies in the country. Some of them rely on country-specific factors, such as gross national income, gross domestic product per capita, government decisions, and some are closely related with technological advancements, such as secure Internet connections or mobile devices trust.

Conclusions

FinTech's breakthrough became explicitly visible internationally after the 2008 global financial crisis and it was observed that the impact of this industry on the country's economy can be quite beneficial.

Listing of FinTech companies in Lithuania started in 2013 and since then the number of the companies grew rapidly demonstrating a 5 times rise during the period 2013–2020. These companies are becoming a significant country's economic driver, therefore both the Government and the Bank of Lithuania are interested in the promotion of this segment through the creation of a favorable business environment, including legislation and infrastructure.

Efficiency of promotion is first of all subject to the identification of factors that stimulate the development of this segment, therefore this issue became the main focus in this study. These aspects so far were out of the scope of both analysts and researchers in Lithuania.

A special four-stage approach was applied in this study and data from several different databases selected to examine the factors that could potentially determine the change in the number of FinTech companies settling in the country. A total of 40 factors, presented in three groups, were chosen to be examined as a first step. Performed correlation analysis made it possible to identify19 of the factors, which had a significant relationship with the number of FinTech companies.

In a simple linear regression analysis by using the criteria for checking the assumptions of the regression model, 9 of the 19 factors were ruled out. The rest 10 were recognized as

significant and were afterward used in multiple linear regression models with 2 independent variables. From 45 such models, which were composed and analysed, one was recognised as most reliable, capable of justifying 96.8 percent of the change in the number of FinTech companies.

It can be assumed that efforts and investment from the Government side, creation of favorable legal environment and infrastructure, like specialised platforms, such as Sandbox and LBChain by the Bank of Lithuania, also the involvement of Agency Invest Lithuania into the activities were significant positive factors to stimulate the growth of the segment.

In forecasting the number of FinTech companies in Lithuania, 5 possible scenarios of the country's economic situation were used. The optimistic scenario is possible in the case if Lithuania continues to allocate funds for the improvement of the FinTech ecosystem, further puts efforts into the development of a favorable environment for innovation, and the country's legal system will further improve. The neutral scenario envisages a slight slowdown of the segment's growth. The last three represent a group of worst-case scenarios, which are mainly subject to the consequences of the coronavirus pandemic and predict a more or less declining FinTech sector. In this case, the revival of a previous upward trend in FinTech development would require a lot of effort and time.

This study represents one of the first attempts to link the development of FinTech sector in Lithuania with potential factors, capable of stimulating it. The factors analysed were mainly local, therefore extension of their scope, especially through adding information from other countries could verify the results in terms of their validity and applicability on broader scale.

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Appendix

Table A1. Research on the topic of FinTech (source: authors)

Year	Author	Topic (research)
2016	Jui-Long Hung, Binjie Luo	FinTech in Taiwan: a case study of a Bank's strategic planning for an investment in a FinTech company

Continue of Table A1

Year	Author	Topic (research)
2017	Yingiao Li, Renée Spigt, Laurens Swinkels	The impact of FinTech start-ups on incumbent retail banks share prices
	Stian Omreng, Ida Gjendem	FinTech in Norway. The effect of FinTech on the traditional Norwegian banking sector
	Diederick Van Thiel, Fred Van Raaij	Explaining customer experience of digital financial advice
2018	Ådne Karlsen Persmoen, Eian Sandvik	Collaboration between banks and FinTech companies
	Christian Haddad, Lars Hornuf	The emergence of the global FinTech market: economic and technological determinants
2019	Greta Keliuotytė-Staniulėnienė, Gintarė Smolskytė	Possibilities for financial technology sector development and its impact on banking sector profitability in Lithuania
	Christopher Svensson, Jakob Udesen, Jane Webb	Alliances in financial ecosystems: a source of organisational legitimacy for FinTech start-ups and incumbents
	David Laurent, Robin Sinz	FinTech: the role of perceived cybersecurity and organisational trust
	Xun Zhang, Jiajia Zhang, Zongyue He	Is FinTech inclusive? Evidence from China's household survey data
	Nofie Iman	Traditional banks against FinTech start-ups: a field investigation of a regional bank in Indonesia
	Greta Navickaitė, Grigorij Žilinskij	Crowdfunding – place in Fintech market and FinTech research
	PK Senyo, Ellis L.C. Osabutey	Unearthing antecedents to financial inclusion through FinTech innovations
2020	Moritz Jünger, Mark Mietzner	Banking goes digital: the adoption of FinTech services by German households
	Micheal R. King and Richard W. Nesbitt	The technological revolution in financial services
	Maoyong Cheng, YangQu	Does bank FinTech reduce credit risk? Evidence from China
	Isil Erel, Jack Liebersohn	Does FinTech substitute for banks? Evidence from the Paycheck Protection Program
	Shubhangi Singh, Marshal M. Sahni, Raj K. Kovid	What drives FinTech adoption? A multi-method evaluation using an adapted technology acceptance model
	Ayse Demira, Vanesa Pesqué-Cela	FinTech, financial inclusion and income inequality: a quantile regression approach
	Hyun-Sun Ryu,Kwang Sun Ko	Sustainable development of FinTech: focused on uncertainty and perceived quality issues
	A machine learning approach to predict the success of crowdfunding FinTech project Jen-Yin Yeh, Chi-Hua Chen	A machine learning approach to predict the success of crowdfunding FinTech project
	Yadong Liu, Sharjeel Saleem, Rizwan Shabbir, Malik Shahzad Shabbir, Adil Irshad, Shahbaz Khan	The relationship between corporate social responsibility and financial performance: a moderate role of FinTech technology

End of Table A1

Year	Author	Topic (research)
2021	Tadiwanashe Muganyiab, Linnan Yana Hua-ping Sunc	Green finance, FinTech and environmental protection: Evidence from China
	Yang Wanga, Sui Xiupingb, Qi Zhangc	Can FinTech improve the efficiency of commercial banks? An analysis based on big data
	Vasenska, Ivanka, Preslav Dimitrov, Blagovesta Koyundzhiyska-Davidkova, Vladislav Krastev, Pavol Durana, and Ioulia Poulaki	Financial transactions using FinTech during the Covid-19 Crisis in Bulgaria
	Najib, Mukhamad, Wita J. Ermawati, Farah Fahma, Endri Endri, and Dwi Suhartanto	FinTech in the small food business and its relation with open innovation
	Zarrouk, Hajer, Teheni El Ghak, and Abderazak Bakhouche	Exploring economic and technological determinants of FinTech startups' success and growth in the United Arab Emirates
	Tianxiang Sheng	The effect of FinTech on banks' credit provision to SMEs: evidence from China