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INNOVATIVE, ECONOMIC AND MARKETING DETERMINANTS OF FINANCIAL SECURITY AND SUSTAINABILITY OF BUSINESS

Abstract. *The article aims to summarize the main determinants that affect the business's level of financial security and financial stability. Based on the bibliometric analysis, the authors identified the main areas of research on financial security and the stability of the business. They conducted a comparative analysis of trends in the number of publications on these issues. With the help of VOSviewer tools, the main economic categories that are most closely related to financial security and sustainability of business were identified. The paper substantiates that economic, innovation, and marketing determinants in various combinations could significantly affect the financial security and sustainability of the business. Based on the systematization of existing scientific achievements, the authors proposed a methodological approach to assessing the business's financial security level. The authors hypothesized the statistically significant impact of economic, innovative, and marketing determinants on the level of financial security of the business. The information base of the study is the World Bank and the International Monetary Fund data. Dickey-Fuller test and Johansen test were used to test the hypothesis. The validity of the results and the nature of the relationship between the indicators were tested by constructing the equation of end-to-end regression (Wald test), regression with fixed individual effects (Brush-Pegan test), and regression with random individual effects (Hausman test). According to the study results, measures to increase the level of financial security of business and minimize the negative impact of certain determinants were proposed.*

Keywords: financial security, innovative development, marketing determinants, sustainability of the business, economic development.

Introduction. Permanent economic transformations and aggravation of the crisis in the economy raise the issue of ensuring the stable functioning of the business. At the same time, a significant number of companies face financial problems and the inability to finance their current needs and programs of simple and extended reproduction. According to the Bank of International Settlements, the level of bankruptcy of enterprises in developed economies increased by 19-55% in 2020, by 20% – in 2021. The need to create conditions for sustainable business development and financial conditions for its operation leads to increasing the role of financial, innovation, and marketing components of financial security and studying their relationship in the systems of financial and economic relations in the country.

Literature Review. According to the analysis of publications on business financial security, 2294 publications were selected in the Scopus database and in 2004 in the Web of Science (WoS) database. The dynamic of publishing activity (Fig. 1) shows a gradual increase in the interest of scientists in these issues. Even though the first article was published in 1933 (in the Scopus database) and 1990 (in the WoS database), their number has increased significantly over the last 10 and 6 years, respectively. From 2015 to 2021, 67% of all papers were published in the WoS database and 68% – in the Scopus database. These

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tendencies are partly related to the aggravation of global financial problems, the growth of the number of bankrupt enterprises, the growth of financial crime globally, etc. These studies were conducted in more than 100 areas of research. More than 70% of publications belong to one of the research areas: business economics, social sciences, geography, environmental sciences ecology, urban studies, and public administration. The authors of 82 countries researched the marketing of territories. Scientists from the USA and England have published most studies. Also, more than 50 studies have been published by scientists from Italy, Canada, the Netherlands, Germany, Australia, and France.

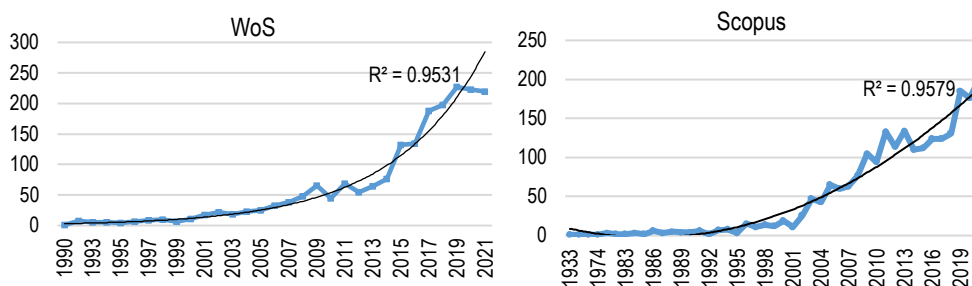


Figure 1. Dynamics of publications on financial security by years

Sources: developed by the authors.

The study of these issues took place within 147 areas of research based on WOS and 22 based on Scopus. A significant number of publications were made in high-ranking journals included in Q1-Q4.

Table 1. TOP-10 journals in which papers on the financial security of business are published

Source	Number of articles		Quartile
	Scopus	WoS	
Network Security	22		Q4
Computers Security	21	11	Q1
Sustainability Switzerland	21	22	Q1
Economic Annals XXI	18		Q3
Computer Fraud and Security	16		Q2
Review of Pacific Basin Financial Markets and Policies	14		Q3
Journal of Advanced Research in Dynamical and Control Systems	12		-
Espacios	11		-
IEEE Access	11	10	Q1
Journal of Financial and Quantitative Analysis	11		Q1
Financial and Credit Activity Problems of Theory and Practice		34	-
Baltic Journal of Economic Studies		20	-
Journal of Business Ethics		13	Q1
Marketing and Management of Innovations		13	-
Entrepreneurship and Sustainability Issues		12	-
International Journal of Computer Science and Network Security		11	-
Decision Support Systems			Q1

Sources: developed by the authors based on the Scopus and Web of Science database.

The bibliometric analysis results conducted by VOSviewer tools show the connection between business financial security with a significant number of economic categories (Fig. 2). Thus, based on the results of bibliometric analysis, it could be concluded that scientists from different countries widely study

The basis for the formalization of the components of the business financial security level is its integrated assessment by the formulas:

$$FBS_A = \sum_{i=1}^n a_i FBS_i^A, FBS_M = \sum_{i=1}^n (FBS_i^M)^{a_i} \quad (2)$$

where FBS_A and FBS_M – partial indicators (for additive and multiplicative form) of the i -th component of financial security of business; n - the number of components; a_i – weights for which the following condition is met:

$$\sum_{i=1}^n a_i = 1, a_i \geq 0, i = \overline{1, n} \quad (3)$$

Assessment of the level of financial security of business will be carried out in the context of the following indicators:

- 1) Economic component:
 - Business Sophistication;
 - Business extent of disclosure index;
 - Total business densityl.
- 2) Innovative component:
 - CT services imports, % total trade;
 - ICT access;
 - ICT use;
 - Software spending, % GDP;
 - High-tech manufacturing, %;
 - High-tech exports, % total trade;
 - ICT services exports, % total trade;
 - Online creativity;
 - Firms that spend on R&D, % of firms.
- 3) Marketing component:
 - Market capitalization of listed domestic companies (% of GDP);
 - S&P Global Equity Indices (annual % change).

The study of the impact of the whole set of factors on the level of financial security of business would be conducted using VAR modeling using the following equation:

$$\begin{pmatrix} D(FBS_t) \\ D(inf_t) \\ D(TB_t) \\ D(SE_t) \\ D(GII_t) \end{pmatrix} = \begin{pmatrix} CointEq^{FBS} \\ CointEq^{inf} \\ CointEq^{TB} \\ CointEq^{SE} \\ CointEq^{GII} \end{pmatrix} \begin{pmatrix} a_0^{FBS} \\ a_0^{inf} \\ a_0^{TB} \\ a_0^{SE} \\ a_0^{GII} \end{pmatrix} + \begin{pmatrix} a_p^{FBS}(L) \\ a_p^{inf}(L) \\ a_p^{TB}(L) \\ a_p^{SE}(L) \\ a_p^{GII}(L) \end{pmatrix} \cdot \begin{pmatrix} D(FBS_{t-p}) \\ D(inf_{t-p}) \\ D(TB_{t-p}) \\ D(SE_{t-p}) \\ D(GII_{t-p}) \end{pmatrix} + \begin{pmatrix} \varepsilon_t^{FBS} \\ \varepsilon_t^{inf} \\ \varepsilon_t^{TB} \\ \varepsilon_t^{SE} \\ \varepsilon_t^{GII} \end{pmatrix} \quad (4)$$

where $D(FBS_t)$ – the first differences in the level of financial security of business; $D(inf_t)$ – the first differences in inflation; $D(TB_t)$ – the first differences in tax burden; $D(SE_t)$ – the first differences in the level of shadow economy; $D(GII_t)$ – the first differences in the Global Innovation Index; $CointEq^i$ – a member of regression residue correction; a_0^i – zero coefficient; $a_p^i(L)$ – a polynomial of the lag operator; p – the order of the model; ε_t^i – vector of random variables.

Results. In the first stage, this study assessed the financial security level of business in 10 countries from 2015 to 2020. The assessment results (Table 2) show significant differences in the level of financial security of businesses in some countries. Austria, Italy, Poland, Croatia, and Romania have the highest levels of financial security. At the same time, businesses in Ukraine, Azerbaijan, and Bulgaria have the lowest levels of financial security.

Table 2. The results of assessing the level of financial security of business

Country	2015	2016	2017	2018	2019	2020
Austria	0.84	0.86	0.83	0.85	0.85	0.84
Azerbaijan	0.66	0.65	0.66	0.67	0.69	0.68
Bulgaria	0.64	0.63	0.63	0.62	0.64	0.65
Georgia	0.71	0.70	0.71	0.72	0.73	0.72
Spain	0.68	0.69	0.69	0.68	0.70	0.70
Italy	0.74	0.76	0.76	0.79	0.80	0.83
Poland	0.71	0.73	0.74	0.74	0.76	0.75
Croatia	0.69	0.71	0.72	0.73	0.75	0.76
Romania	0.69	0.72	0.73	0.74	0.74	0.76
Ukraine	0.55	0.57	0.59	0.57	0.56	0.54

Sources: developed by authors based on World Data Bank data.

These features are due to several economic and political reasons that determine the nature of the business environment in the country and affect the performance of economic entities. To consider the impact of these factors on the level of financial security of business, we will conduct an econometric analysis of the relationship between these indicators. Among the economic drivers of the formation of the business's financial security, the level of the tax burden on business, the level of shadowing of the economy, and the level of inflation are considered. As part of the study of the impact of the innovation component on the business's financial security, its dependence on the level of innovative development of the country, on the example of the Global Innovation Index, is analyzed. This study tests the identified hypotheses by evaluating the parameters of the models of end-to-end regression, regression with fixed individual effects, and regression with random individual effects. The formalization of the established interdependencies was carried out with the help of one of the models. According to the model's pairwise comparison of the parameters, it most fully describes the relationships between indicators. In the first stage, using the Wald test, the regression model parameters with fixed individual effects with the model of end-to-end regression were compared (Table 3).

Table 3. The results of the Wald test

Country	F test	Prob > F	Country	F test	Prob > F
Austria	41.22	0.0000	Italy	44.26	0.0000
Azerbaijan	52.17	0.0000	Poland	43.29	0.0000
Bulgaria	59.15	0.0000	Croatia	51.36	0.0000
Georgia	49.74	0.0000	Romania	59.53	0.0000
Spain	25.26	0.0000	Ukraine	57.36	0.0000

Sources: developed by authors.

Critical values of less than 10% were obtained for all analyzed indicators. It suggests that the regression model with fixed effects better describes the relationship between indicators than a simple regression model. The results of calculating the relationship between the analyzed indicators using the Broych-Pagan test (Table 4) indicate the feasibility of using a model with combined regression to formalize the dependences we analyzed. For Australia, Georgia, Italy, and Poland, p-level values are less critical (10%), which indicates a lack of relationship between the analyzed indicators.

Table 4. The results of the Brush-Pegan test

Country	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	Cons	
Austria	-0,5407	0,0005	1,11	0,0002	0,0015	0,0028	-2,0216
Azerbaijan	-0,1172	0,0187	-0,54	0,0816	-0,0922	0,0687	-6,4231
Bulgaria	-0,2705	0,0392	0,17	0,0731	-0,3665	0,4030	-3,6402
Georgia	-0,1834	0,0550	-0,68	0,0004	-0,2805	0,1932	-0,8750
Spain	-0,2122	0,0141	-0,57	0,4877	-0,6989	0,4778	-3,9027
Italy	-0,2784	0,0156	0,59	0,0005	0,0001	0,0001	-1,7374
Poland	-0,3526	1,1675	-0,74	0,0005	-0,9079	1,4609	-1,3033
Croatia	-0,0250	0,0663	-0,32	0,6347	-0,3103	0,2603	-3,6213
Romania	-0,0117	0,0001	0,10	0,7833	-0,0002	0,0002	-5,6230
Ukraine	-0,6907	0,6895	0,38	0,5970	1,6800	1,3518	-3,8289

Sources: developed by authors.

The formalization of the relationship between the level of financial security and business stability and the level of shadowing of the economy using the Hausman test (Table 5) allows concluding that the model with fixed individual effects best describes the relationship between these indicators. For all analyzed countries, the p-level value is less than 10%, and the coefficient of determination is quite high.

Table 5. The results of the Hausman test

Country	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
Austria	0,0006	0,0005	1,05	0,0026	0,0014	0,0027
Azerbaijan	-0,0111	0,0177	-0,51	0,0001	-0,0871	0,0649
Bulgaria	0,1331	0,0373	0,16	0,0001	-0,3464	0,3808
Georgia	-0,0412	0,0520	-0,64	0,0000	-0,2650	0,1826
Spain	-0,6280	0,0133	-0,54	0,0046	-0,6605	0,4515
Italy	0,0104	0,0151	0,56	0,0000	0,0001	0,0001
Poland	-0,9503	1,1049	-0,69	0,0000	-0,8580	1,3805
Croatia	-0,0236	0,0627	-0,31	0,0060	-0,2932	0,2460
Romania	0,6214	0,0001	0,10	0,0074	-0,0002	0,0002
Ukraine	0,6527	0,6516	0,36	0,0056	1,5876	1,2774

Source: developed by authors.

Thus, the obtained results allow building an equation of dependence of the level of financial security of business on the level of shadowing of the economy in the country. The obtained equations have the following form:

$$\begin{aligned}
 FBS_{AST} &= -2.0216 - 0.5407SE_{t-1} \\
 FBS_{AZB} &= -6.4231 - 0.1172SE_{t-2} \\
 FBS_{BUL} &= -3.6402 - 0.2705SE_{t-1} \\
 FBS_{GRG} &= -0.8750 - 0.1834SE_{t-1} \\
 FBS_{SPN} &= -3.9027 - 0.2122SE_{t-2} \\
 FBS_{ITL} &= -1.7374 - 0.2784SE_{t-1} \\
 FBS_{POL} &= -1.3033 - 0.3526SE_{t-1} \\
 FBS_{CRT} &= -3.621 - 0.0250SE_{t-1} \\
 FBS_{ROM} &= -5.6230 - 0.0117SE_{t-1} \\
 FBS_{UKR} &= -3.8289 - 0.6907SE_{t-1}
 \end{aligned}$$

Thus, the results show the impact of the shadow economy on the level of the business's financial security for all analyzed countries. In all the analyzed countries, the shadowing of the economy has a negative impact on the financial security of the business. In Ukraine, a shadowing economy rise of 1% led to the business's financial security decrease by 0.6907%, in Azerbaijan - by 0.5407%, in Bulgaria - by 2.705%. The study results of the impact of other drivers on the level of financial security of business showed a significant positive impact of the Global Innovation Index and the negative relationship of financial security of business with the levels of tax burden and inflation. One of the advantages of using this method is the ability to consider the dual nature of the relationship between the studied indicators. In the system of economic relations, each analyzed factor is both an object and a subject of influence. In addition, the use of some data for a certain time necessitates the need to consider both the natural nature of changes in the analyzed indicators and the leveling of the random component.

In the first stage, this study conducted a regression analysis of the relationship between the businesses' financial security and the country's economic and innovative development indicators. Table 6 shows the fragment of calculations. It confirms the close relationship between the indicators (the presence of a constant was rejected in the evaluation process).

Table 6. Parameters of the regression equation between drivers of the level of financial security of business on the example of Australia

FBS	Coef.	Std. Err.	T	p > t	[95% Conf. Interval]
<i>inf</i>	1.364589	0.007126	183.60	0	1.348469 1.380707
<i>TB</i>	1.274013	0.006428	190.01	0	1.259471 1.288553
<i>SE</i>	7.782006	0.214944	34.70	0	7.295769 8.268242
<i>GII</i>	3.016057	0.018	160.64	0	2.975338 3.056777

Sources: developed by authors.

Similar results were obtained for the other analyzed countries. At the same time, these results (despite the high level of statistical significance (0.99) do not consider the presence of indirect influence of factor characteristics on the resulting indicator and other factor characteristics in the middle of the system). To eliminate this shortcoming, we will analyze the presence of multiple influences between indicators using VAR modeling. In the first stage, this study used the Dickie-Fuller test to test the series of data analyzed by us for stationarity (Table 7). The calculations show the non-stationarity of the analyzed data series. In contrast, the analysis of the first differences in the logarithmic series allows assuming their possible cointegration.

Table 7. The results of the Dickie-Fuller test on the example of Australia

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-1.190	-3.750	-3.000	-2.630
D.FBS	Coef.	Std. Err.	t	p > t
FBS				[95% Conf. Interval]
L1.	-0,24467	0,20566	-1,02	0,27
LD	-0,04097	0,40662	-0,09	0,79
L2D	0,01846	0,68147	0,03	0,84
_cons	2,966929	0,681471	1,00	0,28

Sources: developed by authors.

The next stage determines the duration of the time lag due to which the impact of each indicator is the largest. Table 8 shows that for most indicators, the time lag is insignificant.

Table 8. The results of calculating the time lag of the impact of factor indicators on the resulting for the analyzed countries

Country	<i>inf</i>	<i>TB</i>	<i>SE</i>	<i>GII</i>
Austria	1	1	1	2
Azerbaijan	1	1	1	2
Bulgaria	2	1	1	1
Georgia	1	2	1	1
Spain	2	1	1	1
Italy	1	1	1	2
Poland	2	1	1	2
Croatia	1	2	1	1
Romania	1	1	1	1
Ukraine	2	1	1	2

Sources: developed by authors.

Confirmation of the non-stationary and cointegration of data series allows concluding that it is appropriate to formalize the relationship between the level of financial security of the business and the drivers of its formation using the VEC model. Table 9 shows the fragment of VEC modeling. It allows constructing the equation of the dependence of the business's financial security on inflation, shadowing of the economy, tax burden, and innovation development index.

Table 9. VEC model parameters on the example of Australia

<i>beta</i>	<i>Coef.</i>	<i>Std. Err.</i>	<i>t</i>	<i>p> t </i>	<i>[95% Conf. Interval]</i>	
<i>_ce1</i>						
<i>FBS</i>	1					
<i>inf</i>	-2.4835	0.2673	-8.89	0.0000	-3.0075	-1.9596
<i>TB</i>	-0.6032	0.2579	2.22	0.0182	0.0977	1.1087
<i>SE</i>	-7.1341	0.5654	-12.08	0.0000	-8.2423	-6.0260
<i>GII</i>	1.1582	0.5267	2.11	0.0268	0.1259	2.1905

Sources: developed by authors.

The co-integration VEC model of the dependence of financial security of business on economic and innovative determinants of the country's development for Australia will be as follows:

$$\begin{aligned}
 FBS_t^{AST} &= -2.4835 \ln inf_{t-1} - 0.6032 \ln TB_{t-1} - 7.1341 \ln SE_{t-1} + 1.1582 \ln GII_{t-2} \\
 FBS_t^{AZB} &= -2.1478 \ln inf_{t-1} - 0.7896 \ln TB_{t-1} - 5.5478 \ln SE_{t-1} + 1.2364 \ln GII_{t-2} \\
 FBS_t^{BUL} &= -2.0325 \ln inf_{t-2} - 0.8547 \ln TB_{t-1} - 4.6325 \ln SE_{t-1} + 1.1751 \ln GII_{t-1} \\
 FBS_t^{GRD} &= -1.9856 \ln inf_{t-1} - 0.7254 \ln TB_{t-2} - 5.2504 \ln SE_{t-1} + 1.3015 \ln GII_{t-1} \\
 FBS_t^{SPN} &= -2.3625 \ln inf_{t-2} - 0.5804 \ln TB_{t-1} - 4.2365 \ln SE_{t-1} + 1.2451 \ln GII_{t-1} \\
 FBS_t^{ITL} &= -2.2012 \ln inf_{t-1} - 0.6012 \ln TB_{t-1} - 3.2458 \ln SE_{t-1} + 1.1302 \ln GII_{t-1} \\
 FBS_t^{POL} &= -2.0124 \ln inf_{t-2} - 0.5470 \ln TB_{t-1} - 4.0324 \ln SE_{t-1} + 1.0364 \ln GII_{t-2} \\
 FBS_t^{CRT} &= -2.0365 \ln inf_{t-1} - 0.6125 \ln TB_{t-2} - 7.2452 \ln SE_{t-1} + 0.7245 \ln GII_{t-1} \\
 FBS_t^{ROM} &= -2.1023 \ln inf_{t-1} - 0.7165 \ln TB_{t-1} - 6.2356 \ln SE_{t-1} + 0.6045 \ln GII_{t-1} \\
 FBS_t^{UKR} &= -1.8065 \ln inf_{t-2} - 0.6852 \ln TB_{t-1} - 5.2415 \ln SE_{t-1} + 1.0312 \ln GII_{t-2}
 \end{aligned}$$

Conclusions. Thus, the analysis results conclude about the average level of business's financial security in most of the analyzed countries. These results confirm the need to implement measures to increase the financial potential of companies and increase their level of financial security. One of the most

effective tools in this area is the management of the main drivers of financial security. To this end, the impact of economic and innovative drivers on the level of financial security of business was formalized. The significant negative impact of inflation, tax burden, and shadow economy on a business's financial security has been proved. At the same time, the country's innovative development creates a favorable environment for the safe operation of the business.

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Фінансова безпека та стійкість бізнесу: економічні, інноваційні та маркетингові детермінанти

Метою статті є узагальнення основних детермінант, які впливають на рівень фінансової безпеки та фінансової стійкості бізнесу. У ході дослідження здійснено бібліометричний аналіз для визначення основних напрямів дослідження фінансової безпеки та фінансової стійкості бізнесу. Авторами проведено порівняльний аналіз тенденцій зміни кількості публікацій з означених питань. За допомогою інструментарію VOSViewer виділено основні економічні категорії, які найбільш тісно пов'язані з фінансовою безпекою та стійкістю бізнесу. У роботі обґрунтовано, що економічні, інноваційні та маркетингові детермінанти в різних комбінаціях можуть суттєво впливати на фінансову безпеку та стійкість бізнесу. На основі систематизації наявного наукового доробку, авторами запропоновано методичний підхід до оцінювання рівня фінансової безпеки бізнесу. Інформаційною базою дослідження слугують дані Світового банку та Міжнародного валютного фонду. У

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роботі висунуто гіпотезу про наявність статистично значущого впливу економічних, інноваційних та маркетингових детермінант на рівень фінансової безпеки бізнесу. Для перевірки гіпотези використано тести Діккі-Фулера та Йохансена. Достовірність отриманих результатів та характер взаємозв'язку між показниками перевірено шляхом побудови рівняння наскрізної регресії (тест Вальда), регресії з фіксованими індивідуальними ефектами (тест Бруша-Пегана) та регресії з випадковими індивідуальними ефектами (тест Хаусмана). За результатами дослідження запропоновані заходи підвищення рівня фінансової безпеки бізнесу та мінімізації негативного впливу окремих детермінант.

Ключові слова: фінансова безпека, маркетингові детермінанти, стабільність бізнесу, економічний розвиток.