A doctrinal model of state financial security management in the context of globalization changes has been developed. The model is formed at five levels (doctrinal, conceptual, strategic, programmatic, planned), contains a logical continuum of mission, priorities in the financial sector and the level of technological innovation, influencing factors and a system of actions aimed at achieving goals. This model accumulates a set of solutions aimed at adapting to transformational processes in the economy associated with new needs of states, globalization processes in the world financial space, technology development, new challenges and threats.

As a result of the study, forecasting is carried out and the effectiveness of the results of modifying approaches to managing the financial security of the state using a polynomial algorithm for extrapolating the parameters of stochastic systems is proved. A polynomial correlation-regression model is presented, the input data of which were specific indicators of the effectiveness of innovative development of the state, perception of corruption and debt dependence. In fact, this is a set of those indicators at which the strategic directions of strengthening the financial security of the state are directed in the context of globalization changes.

The generalized values of the state of financial security of the state, determined on the basis of the developed polynomial correlation-regression model, are obtained, as well as the absolute and relative amounts of error indicate the accuracy of the forecasts obtained. So, the mean level of error is 0.005 %, which means that the totality of these indicators can characterize the state of financial security of the state. Accordingly, this model is useful in the process of predicting the results of modifying approaches to the formation of the financial security of the state

Keywords: *financial security management, financial security, financial security forecasting*

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DEVELOPMENT OF DOCTRINAL MODEL FOR STATE FINANCIAL SECURITY MANAGEMENT AND FORECASTING ITS LEVEL

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1. Introduction

The financial security of the state is the conditions in which its financial system functions. The state of financial security is quantified by summarizing indicators of monetary, foreign exchange, banking, budget, tax, debt security, security of the non-banking financial sector, and technological innovation. A satisfactory level of financial security indicates that the action of internal and external threats does not cause negative processes in this complex system and does not interfere with the creation of favorable conditions for its sustainable development. An important task in modern transformational conditions in the economy is the management of ensuring the financial security of the state, its strengthening and forecasting its level.

Forecasting the results of changing the management paradigm of the financial security of the state can be carried out using methods of economic forecasting. These methods allow, on the basis of monitoring indicators of the retrospective period and factors of influence, to make reliable and convincing predictions regarding future changes in the state of financial security of the state and its components. For forecasting, it is advisable to use various statistical information that signals the intensity of the introduction of technological innovations, the peculiarities of the financial processes of past periods. It is important to take into account data on individual regions of the state, the dynamics of indicators of the financial security of the state proposed in the legislative and regulatory acts of the state, and other indicators that affect the change in the state of financial security. After a comprehensive analysis of these indicators, an expert assessment of the identified trends in their changes is carried out.

The relevance of scientific problems is justified by the need to form a system of actions aimed at weakening the negative factors of influence on the state of financial security of the state in the modern globalized world, the development of financial securitology as a scientific system.

2. Literature review and problem statement

Many authors made a substantial contribution to the structural formation of the scientific paradigm of state finan-

cial security management. The problem is considered by the scientific community at different levels: enterprise, household, region, industry and the state as a whole. This is due to the fact that the financial security of the state is a complex concept that unites various levels of government.

The first part of scientific works is devoted to the management, assessment and forecasting of the financial security of enterprises, which is the basis for the formation of the financial security of the state. Thus, in [1], a methodological approach to assessing the financial security of agricultural enterprises was developed, based on the use of the criterion "minimum total damage caused to security". The article [2] substantiates the need to manage the financial security of agro-industrial enterprises, and [3] summarizes the main forms of manifestation of tax risks of an enterprise in the system of economic security. The results of the analysis of the dependence of the level of financial security of an enterprise on incidents related to information security are presented in [4].

Financial security of households was considered in the article [5], which examines how financial incentives affect compliance with security policies. In addition, work [6] analyzes the problem of population aging and its impact on the financial security of households. However, there are still unresolved issues of how to strengthen the level of financial security of households in these conditions. The authors of [7] proposed a system of tips for ensuring the financial security of a person, which is an important practical component of this work.

Various scientific and methodological approaches are proposed for assessing the financial security of the state as a whole, and its individual components. Thus, the article [8] analyzes methods for assessing the effectiveness of the use of financial resources and the creation of the safest environment at the local level. The work [9] thoroughly examines the features of ensuring the financial security of banking institutions and the protection of financial private information.

It is convinced that all the components of financial security are the basis for the formation of financial security at the state level. The article [10] systematizes the trends in the field of financial technologies that create opportunities for strengthening the financial security of the state. The work [11] is devoted to the influence of the euro on debt securities and the provision of financial security of states, and work [12] analyzes the system of self-regulation in the field of finance, evaluates the possibilities of technological advances as the basis of financial security. Thus, in [13], a polynomial algorithm for extrapolating the parameters of stochastic systems is presented. In [14], this algorithm was applied to predict certain indicators of the activities of business entities, and in [15], the state of food security of the state in the system of its economic security was assessed.

Highly appreciating the fundamental research of scientists, let's note that among the unresolved local components of the problem is the absence of a doctrinal model for managing the financial security of the state and scientific and methodological tools for predicting its level. This requires further fundamental research in this area from the scientific community.

3. The aim and objectives of research

The aim of research is to systematically substantiate the theoretical and methodological foundations and practical approaches to the development of a doctrinal model for managing the financial security of the state and predicting its level. This will make it possible to highlight effective directions for managing the financial security of the state, which would take into account national values and interests in the financial sector, the approved mission and the vision of the future state of the financial security of the state.

To achieve the aim, the following objectives were set:

– to substantiate the structure and system of parameters included in the doctrinal model of state financial security management;

– to forecast the level of financial security of the state by means of a polynomial algorithm for extrapolating the parameters of stochastic systems;

– to develop an econometric model of paired regression for assessing and predicting the financial security of the state.

4. Materials and methods of research

In the process of carrying out this research, an analytical method was used, with the help of which the problems in their unity and development were examined in the article. Taking into account the goals and objectives of the study, correlation and regression analysis was also used. This made it possible to substantiate the polynomial correlation-regression model. Its input data were specific indicators of the effectiveness of the innovative development of the state, the perception of corruption and debt dependence, that is, the totality of those indicators at which the strategic directions of strengthening the financial security of the state in the context of globalization changes are directed.

5. Results of the development of a doctrinal model for the state financial security management and forecasting its level

5. 1. Results of substantiating the structure and system of parameters included in the doctrinal model of state financial security management

A SWOT analysis of the financial security management of Ukraine in the context of globalization was carried out and the TOWS matrix and the vector of the development direction of this system [10] were formed using expert methods and assessments, which are the integral sum of forecasts.

Among the strengths of the financial security management system of Ukraine in the context of globalization, the intellectual and educational potential is singled out separately (S_1). The shadow economy (W_1), the corruption component (W_2), debt dependence (W_3) and low-tech, raw materials, weak economy (W_5) are the weaknesses of the system. The capabilities of this system are the development of Fintech, the innovative potential of the state (O_1) and small and medium-sized businesses (O_5).

The results of this analysis made it possible to summarize the directions of improving the management of the financial security of the state, which in the future will form the basis of the measures of the doctrinal model of the management of the financial security of the state. Let's present the author's vision of the doctrinal model of state financial security management in the context of globalization changes (Fig. 1).

At the strategic level of this model, a project path is formed that combines the present position of the state financial security with the planned position defined in the doctrine and concept in the existing mission and vision. Also, an algorithm of actions for adjusting the state financial security management strategy, taking into account changes in influencing factors, is necessarily formed.

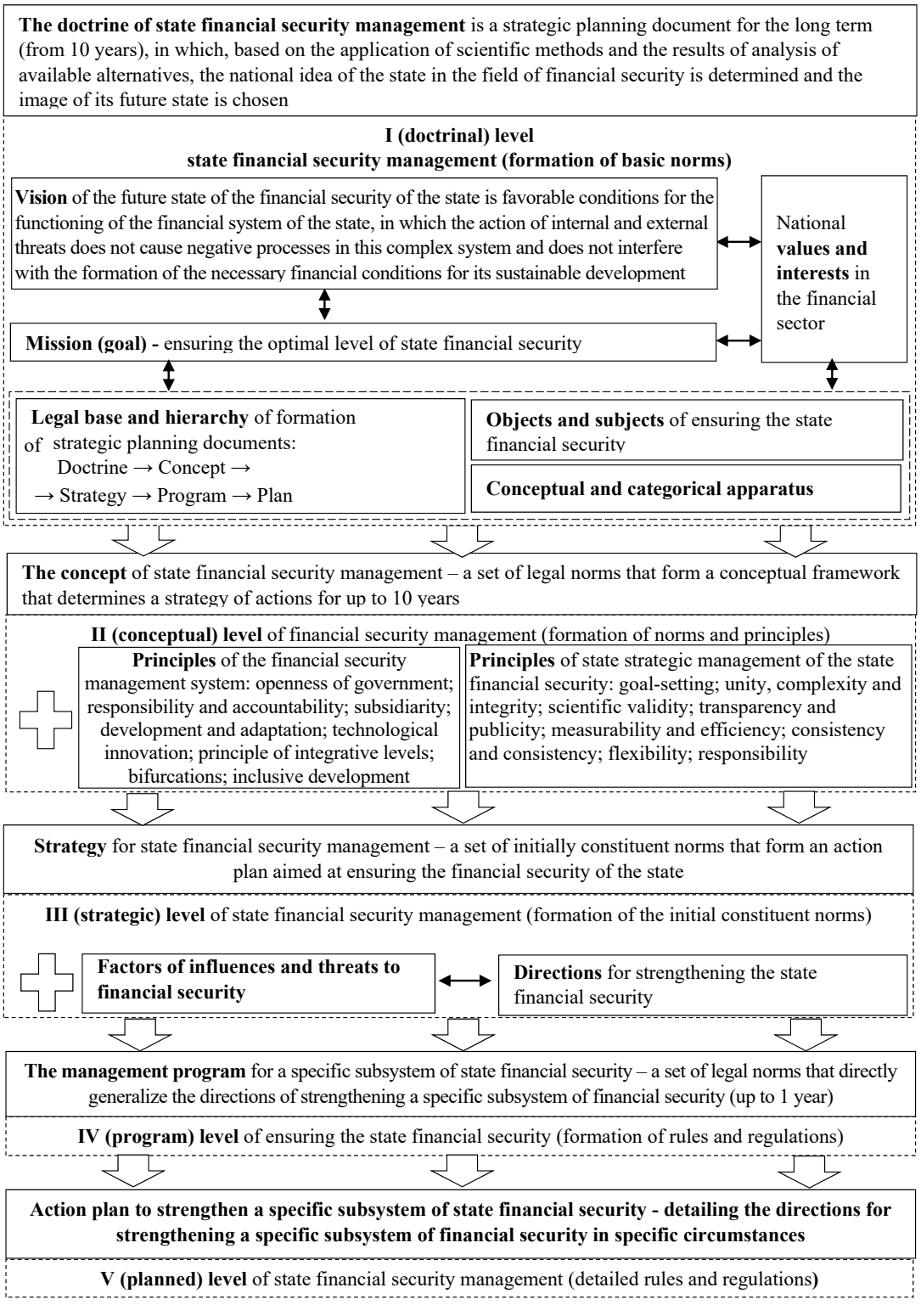

Fig. 1. Doctrinal model of state financial security management

5. 2. Results of forecasting the state of financial security of the state

The object of forecasting is a quantitative assessment of the state of financial security of the state and its subsystems. Choosing methods and initial data for predicting the state of financial security of the state, it is necessary to determine its purpose, as well as the period of formation, take into account the specifics of the selected object, the completeness of input information and other factors.

The main formalized methods for predicting the state of financial security of the state include methods of extrapolation and modeling. The extrapolation method actually provides that the analysis of available statistical data allows to investigate certain patterns in the formation of the financial security of the state and highlight the trends of economic phenomena in this area. Accordingly, the method is based on the assumption that certain unchanging factors in the formation of the financial security

of the state in the past will act similarly in the future. So, the forecast is formed taking into account the trends of changes in certain indicators that affect the level of financial security of the state, using extrapolation.

To construct a polynomial power-law correlation-regression model for an express assessment of the state of financial security of the state, the idea of a polynomial algorithm for extrapolating the parameters of stochastic systems was applied [13, 14]. The input data were 6 indicators of the security of the state in the financial system of Ukraine, they are not in direct functional dependence on each other. Among them:

– the ratio of loans and deposits in foreign currency;

– the share of government and government-guaranteed debt in GDP;

– the share of debt payments from state budget revenues;

– the share of loans in foreign currency from the total volume;

– the level of dollarization of the money supply;

– the share of long-term loans in the total volume.

Applying the basic ideas of the polynomial algorithm for extrapolating the parameters of stochastic systems [13, 14], a polynomial power-law correlation-regression model for assessing the state of the financial security of the state has been developed (1).

$$m_x^{(k,N)}(1,i)=M\left[X(i)\right]+ +\sum_{j=1}^{k}\sum_{v=1}^{N}\left(x^v(j)-M\left[X^v(j)\right]\right)S^{(kN)}_{((j-1)N+v)}\left((i-)\right)N+1\right), \quad (1)$$

$S^{(kN)}_{((j-1)N+v)}\left((i-)\right)N+1\right)$ – individual weight gain coefficients.

where $m_x^{(k,N)}(1,i)$ – quantitative assessment of the state of financial security of the state (implementation at a point and a random sequence when using k elements with the highest order of stochastic connections *N*);

$M[X(i)]$ – mean value of the state of financial security of the state;

$x^v(j)$ – empirical values of the selected indicators;

$M[X(j)]$ – mean value of the selected indicators for the analysis period;

$S^{(kN)}_{((j-1)N+v)}\left((i-)\right)N+1\right)$ – individual weighting factors.

The weighting factors used in (1) are defined as follows:

$$S_\lambda^{(\alpha)}(\xi)=\begin{cases}S_\lambda^{(\alpha-1)}(\xi)-S_\lambda^{(\alpha-1)}(\alpha)\gamma_k(i),\lambda\le\alpha-1;\\ \gamma_\alpha(\xi),\lambda=\alpha;\end{cases} \quad (2)$$

$$\gamma_\alpha(\xi)=\begin{cases}\beta^{(\mathrm{mod}_N(\alpha))}_{1[\alpha/N]+1}\left([\alpha/N]+1\right),\xi\le kN;\\ \beta^{(\mathrm{mod}_N(\alpha))}_{1[\alpha/N]+1}(i),\xi=(i-1)N+1;\end{cases} \quad (3)$$

$$\beta^{(\lambda)}_{hv}(i)=\frac{1}{D_\lambda(v)}\times \times\begin{pmatrix}M\left[X^\lambda(v)X^h(i)\right]-\\ -M\left[X^\lambda(v)\right]M\left[x^h(i)\right]-\\ -\sum_{\mu=1}^{v-1}\sum_{j=1}^{N-1}D_j(\mu)\beta^{(j)}_{\lambda\mu}(v)\beta^{(j)}_{h\mu}(i)-\\ -\sum_{j=1}^{\lambda-1}D_j(\mu)\beta^{(j)}_{h\mu}(v)\beta^{(j)}_{hv}(i)\end{pmatrix},\ \lambda=\overline{1,h},\ v=\overline{1,i} \quad (4)$$

$$D_\lambda(v)=M\left[X^{2\lambda}(v)\right]- -M^2\left[X^\lambda(v)\right]- -\sum_{\mu=1}^{v-1}\sum_{j=1}^{N-1}D_j(\mu)\left\{\beta^{(j)}_{\lambda\mu}(v)\right\}^2- -\sum_{j=1}^{\lambda-1}D_j(v)\left\{\beta^{(j)}_{\lambda v}(v)\right\}^2,\qquad v=\overline{1,I} \quad (5)$$

where $\beta^{(\lambda)}_{hv}(i)$ – coordinate functions of the polynomial power-law canonical expansion of a random sequence;

$\gamma_a(\xi)$ – intermediate function for calculating individual weight coefficients [13, 14].

The input information for calculating the polynomial correlation-regression model is highlighted in Table 1.

Table 1

Input data for building a polynomial correlation-regression model

Years	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	Y
2012	2.62	10.20	0.75	13.8	0.75	11.5	24	39.9	3.8	47.350
2013	2.56	10.16	0.65	16.2	1.10	12.8	23	35.9	3.8	50.304
2014	2.46	9.25	0.67	17.4	0.82	13.6	26	36.6	3.3	50.138
2015	2.46	9.08	0.70	16.8	0.65	13.6	25	40.1	3.3	51.193
2016	2.21	8.20	0.60	16.1	0.48	12.1	26	70.2	2.5	42.074
2017	2.24	7.68	0.55	17.3	0.69	15.2	27	79.4	1.4	38.211
2018	1.66	4.74	0.48	18.9	0.97	16.6	29	81	0.2	43.120
2019	1.64	4.53	0.45	16.2	0.31	14.3	30	71.8	0.7	46.336
2020	1.67	4.45	0.47	16.4	0.34	15.6	32	60.9	0.8	48.691
$M[X^v(j)]$ mean value	2.17	7.59	0.59	16.57	0.68	13.92	26.89	57.31	2.20	46.38
$S^{(kN)}_{((j-1)N+v)}\left((i-1)N+1\right)$ individual performance ratios	–0.6793	–3.9087	0.4363	0.2714	–0.2490	0.81057	–0.977	–0.2324	4.6224	X

Source: calculated and summarized by the authors based on data [16–20]

To predict the results of modification of approaches to the formation of financial security of the state in the process of developing a polynomial correlation-regression model, 9 indicators were used (Table 1), namely:

*X*1 – the number of doctors of sciences involved in the implementation of scientific developments and research, people/10,000 people;

*X*2 – the number of candidates of sciences involved in the processes of scientific development and research, people/10,000 people;

*X*3 –the science intensity of GDP (the share of expenditures on scientific research and development in the country's GDP), **%**;

*X*4 – the proportion of the number of innovatively active economic entities that introduce technological innovations in the total number of industrial enterprises, **%**;

*X*5 – the share of expenditures on technological innovations of industrial enterprises in the state GDP, **%**;

*X*6 – the share of the number of enterprises that have introduced innovations (products and/or technological processes) in the total number of industrial enterprises, **%**;

*X*7 – corruption perceptions index.

*X*8 – the share of government and government-guaranteed debt in the government's GDP, **%**;

*X*9 – the share of the volume of sold innovative products in the total volume of sales of industrial enterprises, **%**.

Intermediate calculations of the existing polynomial correlation-regression model are shown in Table 2.

Calculated values of the state of financial security of the state according to statistical data of 9 indicators for 2012–2020 differ from the empirical values of the state of financial security of the state insignificantly (the mean level of error is 0.005 %). This substantiates the statement about the accuracy of the forecasts generated using this model, and proves the hypothesis put forward that the totality of these particular indicators can characterize the state of the financial security of the state. Accordingly, this model can be used in the process of predicting the results of modifying approaches to the formation of the financial security of the state.

So, let's highlight the results of calculations of the state of financial security of the state, performed using the developed polynomial correlation-regression model in Fig. 2. Also Fig. 2 presents the quantitative data of forecasting the results of modification of approaches to the formation of the financial security of the state (taking into account the planned indicators of the innovative development of the state until 2030 [19]).

Thus, the forecast results indicate that according to the results of 2030, the level of financial security of the state will increase to 69.6 percent, which can be considered a positive trend.

Table 2

Intermediate calculations of the polynomial correlation-regression model

Years	$\left(x^v(j)-M\left[X^v(j)\right]\right)S^{(kN)}_{((j-1)N+v)}\left((i-1)N+1\right)$									
	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9	$m_x^{(k,N)}(1,i)$
2012	–0.304258	–10.19666943	0.069312299	–0.751006807	–0.147282940	–1.963391179	2.822331858	4.045492584	7.395768943	47.360
2013	–0.267200	–10.04583065	0.027322029	–0.099531023	–0.950665168	–0.909644537	3.799292886	4.974897389	7.395768943	50.310
2014	–0.197277	–6.499608043	0.034186702	0.226206870	–0.309016368	–0.261185065	0.868409803	4.812251548	5.084591148	50.140
2015	–0.197698	–5.828150258	0.046774636	0.063337924	0.061329776	–0.261185065	1.84537083	3.999022343	5.084591148	51.200
2016	–0.026431	–2.377053265	0.002439912	–0.126675847	0.438470445	–1.477046575	0.868409803	–2.994748817	1.386706677	42.062
2017	–0.048123	–0.366763377	–0.016981365	0.199062045	–0.033163983	1.035733879	–0.108551225	–5.13237987	–3.697884471	38.210
2018	0.3413720	11.11530004	–0.047506842	0.633379235	–0.661028651	2.170537954	–2.062473281	–5.504141792	–9.244711178	43.121
2019	0.3605411	11.94975035	–0.062782321	–0.099531023	0.841952617	0.306216973	–3.039434309	–3.36651074	–6.933533384	46.340
2020	0.3390737	12.24902464	–0.052765051	–0.045241374	0.759404271	1.359963614	–4.993356365	–0.833882645	–6.471297825	48.700

Source: calculated and summarized by the authors

Table 3

Results of assessing the state of financial security of the state using a polynomial correlation-regression model

Years	State of the financial security of the state (according to the Methodology), %	State of the financial security of the state (calculated by the model), %	Absolute error	Relative error, %
	Y	$m_x^{(k,N)}(1,i)$		
2012	47.350	47.360	0.010	0.020
2013	50.304	50.310	0.006	0.011
2014	50.138	50.140	0.001	0.003
2015	51.193	51.200	0.007	0.013
2016	42.074	42.062	–0.012	–0.029
2017	38.211	38.210	–0.001	–0.002
2018	43.120	43.121	0.000	0.001
2019	46.336	46.340	0.003	0.007
2020	48.691	48.700	0.009	0.019
Mean error value				0.005 %

Source: calculated by the authors

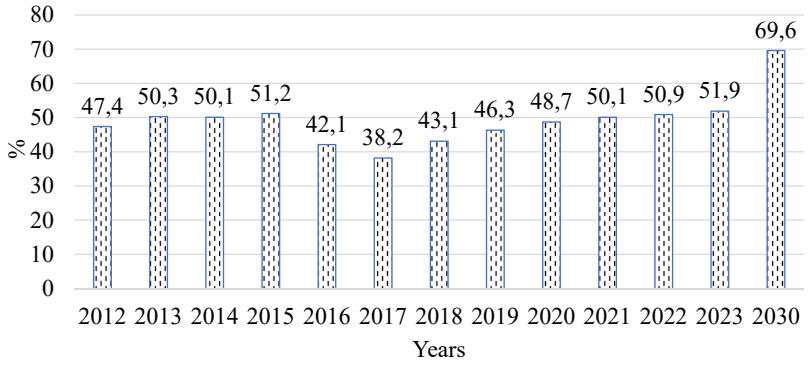

Fig. 2. The level and forecast of the state of financial security of the state, %

Mean values and standard deviations of Y, X_1 and X_2 are summarized in Table 4.

Table 4

Mean values and standard deviation of indicators

Indicators	Y	X_1	X_2
Mean value: $\overline{Y}$, $\overline{x_1}$, $\overline{x_2}$	45,86	26,40	55,07
Variance: σ_Y^2, $\sigma_{X_1}^2$, $\sigma_{X_2}^2$	17,90	9,04	338,32
Mean deviation: σ_Y, σ_{X_1}, σ_{X_2}	4,23	3,01	18,39

5. 3. Results of the development of an econometric model of paired regression for assessing and predicting the state financial security

Let's believe that the debt dependence of the state and the ineffectiveness of the use of borrowed funds lead to the emergence of a debt spiral and is one of the factors of a negative impact on the process of managing the financial security of the state. Corruption, the fight against which often turns into a permanent process, is also an important factor influencing this process.

Corruption not only causes ineffective use of budget funds, but also forms the general image of the state, in which investors do not want to invest financial resources. Debt dependence of the state on the financial resources of international financial organizations and other countries of the world significantly reduces the financial independence of the state, in fact, it cannot carry out the chosen financial policy without the approval of creditors of the main directions of such a policy.

Thus, it is necessary to investigate the tightness of the relationship between the state of financial security of the state (Y), the Corruption Perceptions Index [16] (X_1) and the share of government and government-guaranteed debt in the structure of the country's GDP (X_2). The hypothesis about the existence of a relationship between these indicators will be accounted for using the method of correlation-regression analysis and the formation of an appropriate econometric model [3, 10]. The initial data that became the basis for the current model, presented in Fig. 3.

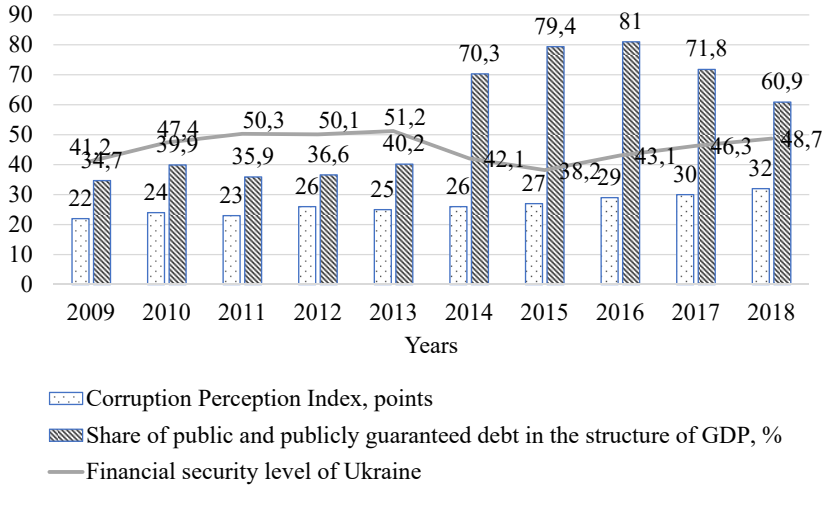

Fig. 3. Initial data for constructing an econometric model of paired regressio

The estimation of the parameters of the econometric model of paired regression is calculated: $(\hat{a}_0, \hat{a}_1, \hat{a}_2)$, accordingly, the model of the state of the financial security of the state has the following form:

$$Y = 30.240882 + 1.152671 \cdot X_1 - 0.268965 \cdot X_2. \quad (6)$$

Intermediate calculations are presented in Table 5.

Table 5

Results of variance analysis

Source of variation	Degrees of freedom	Sum of squares	Variances (mean squares)
regressions	$k_1=m-1=$ $=3-1=2$	SSR=124.0821646	MSR=62.0410823
remainders	$k_2=n-m=$ $=10-3=7$	SSE=54.9018354	MSE=7.8431193
common variable	$n-1=$ $=10-1=9$	SST=178.984	MST=19.8871111

The coefficient of determination (R^2) is a universal characteristic of the density of the statistical relationship between the indicators being analyzed. The indicator R^2=0.6933 means that the variation in the quantitative assessment of the state of financial security by almost 70 % is determined by the variation in the corruption index and the share of the volume of public and publicly guaranteed debt in the structure of GDP. The calculated indicator R=0.8326 (multiple correlation coefficient) characterizes a strong relationship between the indicators that are considered.

Partial coefficients of elasticity (E_1=0.6636; E_2=–0.3230) signal a quantitative relationship between changes in the indicators studied with the level of financial security. So, with an increase in the corruption perception index in the state by 1 %, the level of financial security will increase by 0.66 %, while other factors of influence remain unchanged. With an increase in the share of debt to GDP by 1 %, the quantitative assessment of the financial security of the state decreases by 0.32 %.

So, based on the planned indicators of the Medium-Term Public Debt Management Strategy [20] and the developed econometric model of paired regression, it was found that the share of public debt in GDP in 2022 will be 51.1 %. This is

16.09 % less than in 2018. Such a decrease in the state's debt dependence (according to the calculations performed) will contribute to an increase in the level of financial security by 10.68 %. If the corruption perception index improves by 1.5 points annually (which the state has been demonstrating on average since 2013), then at the end of 2022 this indicator will be 38 points. This dynamics corresponds to an increase of 18.75 %. So, strengthening the level of financial security in this case will be 6.06 %.

Using Fisher's F-criterion, the adequacy of the presented econometric model to the actual data was checked (the hypothesis about the significance of the relationship between the variables is tested). It was found that since $F_{act}>F_{tabl}$ (7.91>4.74), the econometric model is adequate, and the hypothesis about the significance of the relationship between the variables is confirmed.

So, as a result of calculations, it was proved that there is a strong relationship between the level of financial security of the state and the corruption perception index and the share of government and government-guaranteed debt in the structure of GDP. It has been substantiated that an increase in the corruption perception index leads to an increase in the dependent variable Y, confirms this assumption. And vice versa, the share of government and government-guaranteed debt in the structure of GDP is characterized by an inverse effect; accordingly, with its increase, the dependent variable decreases.

6. Discussion of the results of the development of a doctrinal model for state financial security management and forecasting its level

The results of the study on the development of a doctrinal model for managing the state financial security management and forecasting its level indicate the importance of continuing scientific research in this direction. An important result of this study is the developed doctrinal model of state financial security management, which hierarchically combines 5 levels of management, solves the problem of fuzzy hierarchy in the formation of strategic planning documents (Fig. 1). In addition, the application of the developed model will contribute to the formation of a continuum of directions for strengthening the financial security of the state, national values and interests in the financial sphere, an approved mission and a vision of the future state of the financial security of the state.

A scientific and methodological approach to predicting the state of financial security of the state by means of a polynomial algorithm for extrapolating the parameters of stochastic systems will be undeniably useful in the process of managing the financial security of the state (1). The input data of this model are different indicators of the security of the state in the financial system of the state, which are not in direct functional dependence on each other. The obtained generalized calculated values of the state of financial security of the state are determined on the basis of the existing polynomial correlation-regression model (Table 3), as well as the absolute and relative amounts of error indicate the accuracy of the forecasts obtained. So, the mean level of error is 0.005 **%**, which proves the hypothesis put forward that the totality of these indicators can characterize the state of the financial security of the state. Accordingly, this model is useful in the process of predicting the results of modifying approaches to the formation of the financial security of the state.

Interesting and useful are the results of calculations of the state of financial security of the state and quantitative data for predicting the results of modification of approaches to the formation of financial security, obtained using the developed polynomial correlation-regression model (Fig. 2). These data were obtained taking into account the planned indicators of innovative development of the state, established in the Strategy for the development of the sphere of innovative activity for the period until 2030.

Let's note that the developed scientific and methodological approach to forecasting the state of financial security of the state is characterized by the possibility of operational analysis, qualitative forecasting based on a reduced number of indicators. In contrast to those currently used [18], it is based on the basic ideas of the polynomial algorithm for extrapolating the parameters of stochastic systems and the developed polynomial model of express analysis, the use of which will contribute to obtaining objective forecasts.

At the same time, this study has certain limitations. In particular, in the process of predicting the level of financial security of the state, the input data were specific indicators of the effectiveness of the introduction of technological innovations in the country, the level of perception of corruption and debt dependence. This is a set of indicators that were identified in the process of SWOT-analysis of the financial security management system of the state in the context of globalization. However, in a situation of critical changes in the world and in the financial security management system of the state, situations are possible when the factors of influence on the research system will radically change. In this situation, the list of incoming indicators should be adjusted.

Factors of influence on the state of financial security change over time, innovative technologies are actively developed and introduced, therefore, the assessment of their impact on the state of financial security should be systematically carried out and taken into account in analytical work. It is a research area that has powerful potential for future analytic action. The proposed scientific and methodological approach to forecasting the state of financial security of the state is available to a certain extent for practical use by all interested parties.

7. Conclusions

1. The doctrinal model of ensuring the financial security of the state in the context of globalization changes has been substantiated, which is structurally formed at five levels, at each of which the continuity of the provisions of the highest-level documents is determined, namely:

– doctrinal (basic norms are formed for the long term, based on the application of scientific methods and the results of the analysis of available alternatives, the national idea of the state in the field of ensuring financial security is determined and the image of its future state is chosen);

– conceptual (a set of legal norms is determined that form a conceptual basis for actions for a period of up to 10 years, a model of target aspirations is clarified, a vision of the future state of financial security of the state, a concept is substantiated);

– strategic (a set of initially constituent and legal norms is highlighted, which form the order of ensuring the financial security of the state);

– software (generalizes the directions of strengthening a certain subsystem of financial security);

– planned (there is a detailing of the directions for strengthening a certain subsystem of financial security in specific circumstances).

2. The forecasting of the level of financial security of the state was carried out by means of a polynomial algorithm for extrapolating the parameters of stochastic systems. The input data were specific indicators of the effectiveness of the implementation of technological innovations in the country, the level of perception of corruption and debt dependence. This is a set of those indicators that were identified in the process of SWOT analysis of the state financial security management system in the context of globalization, the formation of the TOWS matrix and the vector of the direction of development of this system.

3. An econometric model of paired regression has been developed for assessing and predicting the financial security of the state. Based on the results obtained and the targets of the mid-term strategy for public debt management for 2019–2022, the level of financial security of the state was predicted. It has been proved that with a decrease in the level of public debt to 42.4 % of GDP and an increase in the corruption perception index to 38 points, the level of financial security will increase to 56.85–60.3 percent. Forecasting is carried out using methods that allow, on the basis of monitoring indicators of the retrospective period, external and internal factors of influence, to make reliable predictions regarding the future changes in the state of financial security and its components.

References

1. Davydenko, N. M. (2015). Modern paradigm of agrarian units' financial security assessment. Economic Annals-XXI, 5-6, 90–93 Available at: http://soskin.info/userfiles/file/2015/Davydenko.pdf
2. Davydenko, N., Bilyak, Yu., Nehoda, Yu., Shevchenko, N. (2020). Financial security for the agrarian sector of the economy of Ukraine. Economic Science for Rural Development Conference Proceedings. doi: http://doi.org/10.22616/esrd.2020.53.007
3. Poltorak, A., Volosyuk, Y. (2016). Tax risks estimation in the system of enterprises economic security. Economic Annals-XXI, 158 (3-4 (2)), 35–38. doi: http://doi.org/10.21003/ea.v158-08
4. Otero, A. R. (2015). An information security control assessment methodology for organizations' financial information. International Journal of Accounting Information Systems, 18, 26–45. doi: http://doi.org/10.1016/j.accinf.2015.06.001
5. Goel, S., Williams, K. J., Huang, J., Warkentin, M. (2021). Can financial incentives help with the struggle for security policy compliance? Information & Management, 58 (4), 103447. doi: http://doi.org/10.1016/j.im.2021.103447
6. Lyons, A. C., Grable, J. E., Joo, S.-H. (2018). A cross-country analysis of population aging and financial security. The Journal of the Economics of Ageing, 12, 96–117. doi: http://doi.org/10.1016/j.jeoa.2018.03.001
7. Doroghazi, R. M. (2019). Investing 101: How to Achieve Financial Security. The American Journal of Cardiology, 124 (2), 312. doi: http://doi.org/10.1016/j.amjcard.2019.04.033
8. Kubás, J., Šoltés, V., Mišík, J., Štofková, Z. (2017). Efficiency of Using Financial Resources and Their Impact on Security in a Local Context. Procedia Engineering, 192, 498–503. doi: http://doi.org/10.1016/j.proeng.2017.06.086
9. Lee, J. H., Lim, W. G., Lim, J. I. (2013). A study of the security of Internet banking and financial private information in South Korea. Mathematical and Computer Modelling, 58 (1-2), 117–131. doi: http://doi.org/10.1016/j.mcm.2012.07.019
10. Sirenko, N., Atamanyuk, I., Volosyuk, Y., Poltorak, A., Melnyk, O., Fenenko, P. (2020). Paradigm Changes that Strengthen the Financial Security of the State through FINTECH Development. 2020 IEEE 11th International Conference on Dependable Systems, Services and Technologies (DESSERT). doi: http://doi.org/10.1109/dessert50317.2020.9125026
11. Engert, A., Hornuf, L. (2018). Market standards in financial contracting: The Euro's effect on debt securities. Journal of International Money and Finance, 85, 145–162. doi: http://doi.org/10.1016/j.jimonfin.2018.03.017
12. Hemphill, T. A., Longstreet, P. (2016). Financial data breaches in the U.S. retail economy: Restoring confidence in information technology security standards. Technology in Society, 44, 30–38. doi: http://doi.org/10.1016/j.techsoc.2015.11.007
13. Atamanuyk, I. P. (2002). Polynomial algorithm of optimal extrapolation of stochastic system parameters. International Journal, 16–19.
14. Atamanyuk, I., Kondratenko, Y., Shebanin, V., Sirenko, N., Poltorak, A., Baryshevska, I., Atamaniuk, V. (2019). Forecasting of Cereal Crop Harvest on the Basis of an Extrapolation Canonical Model of a Vector Random Sequence. CEUR Workshop Proceedings, II, 02–315. Available at: https://dspace.mnau.edu.ua/jspui/bitstream/123456789/7721/1/paper_276.pdf
15. Poltorak, A. S. (2015). Assessment of Ukrainian food security state within the system of its economic security. Actual Problems of Economics, 173 (11), 120–126. Available at: https://cutt.ly/xEYNFcW
16. Corruption Perceptions Index. Available at: https://www.transparency.org/en/cpi/2020/index/nzl Last accessed: 24.09.2021
17. Statystychna informatsiia: ofitsiinyi veb-sait Derzhavnoi sluzhby statystyky Ukrainy. Available at: http://www.ukrstat.gov.ua/ Last accessed: 24.09.2021
18. Pro zatverdzhennia Metodychnykh rekomendatsii shchodo rozrakhunku rivnia ekonomichnoi bezpeky Ukrainy (2013). Nakaz Ministerstva ekonomichnoho rozvytku i torhivli Ukrainy No. 1277. 29.10.2013. Available at: https://zakon.rada.gov.ua/rada/show/v1277731-13#Text Last accessed: 24.09.2021
19. Pro skhvalennia Stratehii rozvytku sfery innovatsiinoi diialnosti na period do 2030 roku (2019). Rozporiadzhennia Kabinetu Ministriv Ukrainy No. 526-r. 10.07.2019. Available at: https://zakon.rada.gov.ua/laws/show/526-2019-%D1%80 Last accessed: 24.09.2021
20. Pro zatverdzhennia Serednostrokovoi stratehii upravlinnia derzhavnym borhom na 2019-2022 roky (2019). Postanova Kabinetu Ministriv Ukrainy No. 473 05.06.2019. Available at: https://www.kmu.gov.ua/ua/npas/pro-zatverdzhennya-serednostrokovoyi-strategiyi-upravlinnya-derzhavnim-borgom-na-20192022-roki Last accessed: 24.09.2021