

## Modeling of the comprehensive assessment of the effectiveness of economic entities: Management aspect



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### ABSTRACT

The COVID-19 pandemic has caused an unprecedented structural change in the current evolutionary development of the national economy of Ukraine. Situational trends that arise in the open economy of the country require reactive changes in the conditions for doing business and force public authorities to update strategies or mechanisms to support it. At the same time, a number of explicit factors, including unemployment and inflation, further exacerbate the problems in business activities. This makes it necessary to search for relevant methods that would allow interested stakeholders to carry out uninterrupted diagnostics of the state of entrepreneurship development and, on this basis, determine effective government policy tools to support this sector of the economy. Important management measures are the current assessment of the business sector, determination of its future development, and forecasting the consequences of the impact of the external environment on the activities of enterprises. At the same time, the updated methods should take into account the evolution of the development of the national economy and the specifics of the modern activities of large, medium, and small enterprises in Ukraine. The purpose of the article is to develop a relevant methodology for assessing the current activities of business entities in the managerial aspect, as well as modeling the forecast for the development of this sector of the economy, taking into account the specifics of the functioning of the national economy of Ukraine. The use of the methodology proposed by the authors will make it possible to systematically assess the current state of entrepreneurship development and respond in advance to negative factors that cause its inert development.

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### 1. Introduction

Methods for assessing the current state and forecasting the business activities of economic entities have always been under close scrutiny by scientists. Savitri et al. (2021) investigated the analysis of the impact of innovation on the activities of small and medium-sized businesses using interviews and questionnaires. The authors gave a special role to the search for reserves of capital accumulation by micro-enterprises and the importance of the Indonesian government in this

process. Coles et al. (2021), Risi (2020), Kuratko et al. (2014), and Thong (2001) modeled the impact of the external environment and mediation on further business management strategy. Pavlova et al. (2021) proposed a method of integral assessment of the level of competitiveness on the example of Western Ukrainian gas distribution companies and noted the critical state of competitiveness of these enterprises. Anwar et al. (2021) based on a survey of 316 business entities noted the institutional conditions that hinder the creation of enterprises and proposed a method for recognizing promising opportunities for the initial growth of newly created enterprises. The authors note that effective business activity is achieved only by enterprises that are willing to take risks, and their owners take full responsibility for the results of risky activities. In addition, scientists emphasize the need to involve a mediator to ensure the sustainable operation of the enterprise. Krulicky et al. (2021) emphasized the attention of the

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scientific community to the fact that the assessment of entrepreneurial activity is especially important during periods of crisis. To determine the value of an enterprise, the authors propose a methodology for assessing the internal environment using the method of discounting cash flow. The authors pay special attention to the impact of COVID-19 on reducing business value. Bogatyrev (2021) analyzed the state of entrepreneurship development in the context of the COVID-19 pandemic in his study and, using the classical elements of the theory of comparative analysis and offered an assessment of the efficiency of an enterprise based on updated software. Zhuravka et al. (2020) in the periods 1987-2019 assessed the impact of wage growth, investment, and entrepreneurship on the macroeconomic development of Nigeria. The study showed a statistically significant effect of business development and wage growth for the long-term development of Nigeria in the short and long term. Zhang et al. (2021) proposed a methodology for achieving sustainable production by small and medium manufacturing enterprises in the process of making systemic management decisions. Using the technical, environmental, social, and economic indicators of the operating activities of enterprises, the authors assessed the dynamics of the life cycle of enterprises and proposed business cases that help make important management decisions in an unstable environment. Sarshar et al. (2006) developed an integrated business process model in the construction industry as part of the ArKoS project. Using various tools for modeling business processes, the authors noted the need for strategic distribution of management flows within the enterprise. Alekseenko et al. (2019) noted that globalization, digitalization, and cyclical production necessitate the implementation of the process of strategic management in integrated business organizations. On this basis, the authors proposed a method of integral assessment of resource support of business entities, which is determined using theories of synergy and systems genetics. The proposed methodology will ensure the strategic stability of enterprises in a high-risk external environment. The studies by Oh et al. (2018) should be considered important scientific achievements. The authors developed indicators to assess business models in response to climate change. They propose nine hierarchical indicators for assessing climate change and noted the financial instruments for adapting public policy to climate change. Brotons and Sansalvador (2018), when assessing entrepreneurial activity, suggested using fuzzy systems that were able to integrate input information in the best ways. Using triangular fuzzy numbers, scientists assessed the results of the enterprise and focused on its adaptability to the specific conditions of business. Oliveira and Zotes (2018) proposed a methodology for evaluating business startups for the Brazilian market. Moreover, to determine their own methodology, the authors used the extensive Scopus and Web of

Science database, as well as the results of interviews with professional experts to assess the effectiveness of companies. The originality of this study was based on the direct relationship and deepening of the startup appraisal theory proposed by Blank, Dorf, and Ries. Qi (2010) noted that any methodology for assessing entrepreneurship performance should be based on a study of capital structure and debt obligations. King and Teo (1996) and Zos-Kior et al. (2021) proved that a key element of strategic business planning is the active use of information systems, in the process of which the necessary task is to determine the methodology for evaluating the effectiveness of the organization. Analyzing the scientific research of scholars and the methodological results obtained by them, it is necessary to determine their ambiguity, contradiction, obsolescence, and impossibility of use in the functioning of the modern economy of Ukraine. Therefore, there is a need to develop their own methodology for assessing the activities of business entities, which would best allow not only to assess the current state of business development but also to determine the prospects for its further operation. This will make it possible to adjust the existing state strategies for the development of this sector of the economy and will provide an improvement in the socio-economic development of the national economy by reducing unemployment, increasing tax revenues, and revitalizing the industrial sector of the economy.

## 2. Methods

Assessment and forecasting of entrepreneurship activities are important conditions for the implementation of strategic planning of adaptive state policy and the effectiveness of managerial decision-making in the process of creating a state. The authors of the article suggest using a variety of indicators (the number of business entities, employment of workers, the volume of products sold, the level of cost-effectiveness, profitability, investment, and personnel costs) to conduct an ongoing assessment of the management component of modern entrepreneurship development. The proposed author's methodology provides a linear combination of the activities assessments of large, medium, and small enterprises using the method of the modified first principal component. In the context of the method proposed by the authors, the method of dynamic regression is used, which belongs to the group of adaptive forecasting methods. This allowed developing business forecasting models taking into account the turbulence of the external environment, which is inherent in the national economy of Ukraine. On the basis of the obtained integral assessments of the activities of business entities, the definitions of the correlation coefficients, Student's and Fisher's criteria, using the least-squares methods, the influence of unemployment and inflation on the

activities of large, medium, and small enterprises was analyzed.

### 3. Results and discussion

To assess the activities of business entities, we select a set of indicators P, which includes the following indicators:

1. p<sub>1</sub>–number of business entities
2. p<sub>2</sub>–the average number of employed workers per enterprise
3. p<sub>3</sub>–average volume of products sold per employee (in USD)
4. p<sub>4</sub>–the level of profitability (unprofitability) of enterprises

5. p<sub>5</sub>–the percentage of enterprises that made a profit
6. p<sub>6</sub>–capital investments per enterprise (in thousands of US dollars)
7. p<sub>7</sub>–personnel costs per employee (in USD)

All enterprises are divided into 3 groups–large, medium, and small, and we evaluate the activities of enterprises of each group separately on the basis of the above set of indicators  $P = \{p_i\}_{i=1}^7$ . The period from 2010 to 2019 was chosen for the study. We denote by  $p_{it}^k$  the value of the indicator  $p_i$  in the  $t$ -th year of this period for the enterprises of the  $k$ -th group, where the group of large enterprises corresponds to the value  $k=1$ , medium ones–to the value  $k=2$ , small ones–to the value  $k=3$ . The value of  $p_{it}^k$  is given in Table 1.

**Table 1:** Activity indicators of enterprises of large, medium, and small enterprises in Ukraine during 2010–2019 (SSSU, 2021)

№	Years										
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	
Large enterprises (k=1)											
p <sub>1</sub>	586	659	698	659	497	423	383	399	446	518	
p <sub>2</sub>	4096	3716	3559	3617	3853	4039	4143	3912	3530	3105	
p <sub>3</sub>	73583	91009	88714	90138	76546	55010	58990	70566	82104	87362	
p <sub>4</sub>	0.2	3.3	0.9	0.6	-11.1	-7.0	2.4	5.2	5.2	6.8	
p <sub>5</sub>	65.0	68.1	68.7	67.7	49.4	56.2	65.8	72.8	76.7	78.0	
p <sub>6</sub>	12718	14847	20584	19762	14767	10732	11107	13126	17910	17923	
p <sub>7</sub>	6275.1	7397.0	8561.4	9220.5	6794.0	4336.3	4261.6	5128.3	6549.5	8223.0	
Medium enterprises (k=2)											
p <sub>1</sub>	20983	20753	20189	18859	15906	15203	14832	14937	16057	17751	
p <sub>2</sub>	162	157	156	160	170	171	177	174	171	172	
p <sub>3</sub>	51856	62034	70424	69056	53760	38116	39822	47797	52571	52834	
p <sub>4</sub>	2.3	1.2	2.2	-0.1	-12.5	-5.0	0.7	3.1	4.6	8.6	
p <sub>5</sub>	61.6	64.1	64.3	63.7	61.4	70.6	75.5	76.1	77.7	77.6	
p <sub>6</sub>	302.9	488.4	482.6	491.7	334.3	236.1	298.3	350.8	388.9	436.1	
p <sub>7</sub>	3982.0	4690.5	5791.3	5909.6	4532.3	2943.1	2862.4	3707.5	4314.2	5209.8	
Small enterprises (k=3)											
p <sub>1</sub>	357241	354283	344048	373809	324598	327814	291154	322920	339374	362328	
p <sub>2</sub>	6.1	5.9	6.0	5.4	5.2	4.8	5.5	5.1	4.8	4.8	
p <sub>3</sub>	33082	36472	41036	41705	35159	27213	28950	33589	39568	40758	
p <sub>4</sub>	-5.7	-2.5	-3.3	-6.2	-26.5	-13.6	-3.6	-2.0	2.7	7.0	
p <sub>5</sub>	57.0	63.5	63.0	65.0	65.7	73.5	72.8	72.3	73.7	73.3	
p <sub>6</sub>	7.5	12.2	13.4	13.0	7.2	5.0	8.1	9.4	9.1	9.0	
p <sub>7</sub>	2156.9	2969.9	3577.7	3749.9	2717.7	1836.8	1726.0	2297.0	2791.9	3287.5	

To obtain integral assessments of the activities of large, medium, and small enterprises, it is necessary to transform these indicators p<sub>i</sub> in such a way that the summary indicators q<sub>i</sub> obtained on their basis are dimensionless and vary in the interval from 0 to 1, and the value of 1 should correspond the best one, and the value 0–the worst value of the initial indicator. For such a transformation, we use the equality:

$$q_{it}^k = \frac{p_{it}^k - m_i^k}{M_i^k - m_i^k} \quad (1)$$

where  $q_{it}^k$  is the value of the consolidated indicator q<sub>i</sub> in the  $t$ -th year for the  $k$ -th group of enterprises,  $p_{it}^k$ –the corresponding value of the initial indicator p<sub>i</sub>,  $M_i^k = \max_t p_{it}^k$ ,  $m_i^k = \min_t p_{it}^k$ .

The integral assessment of the enterprises' activity of the  $k$ -th group in the  $t$ -th year is determined by a linear combination of values of the corresponding summary indicators:

$$I_t^k = \sum_{i=1}^7 a_i^k q_{it}^k \quad (2)$$

where  $a_i^k, i = \overline{1,7}$ –summary weights  $q_i^k$  in integral assessment  $I_t^k$ . To determine these weights, we use the method of the modified first principal component. We define the matrix N<sub>k</sub>, whose elements are coefficients of the covariance n<sub>ij</sub> between summary indicators  $q_i^k$  and  $q_j^k$ . For this matrix, we determine the largest eigenvalue λ<sub>k</sub> and the eigenvector Λ<sub>k</sub> corresponding to this value. The coefficients  $a_i^k, i = \overline{1,7}$  are chosen proportional to the squares of the vector components Λ<sub>k</sub>.

For large enterprises λ<sub>1</sub> = 0.4804 and weights in the integral assessment are as follows:

$$a_1^1 = 0.153, a_2^1 = 0.121, a_3^1 = 0.224, a_4^1 = 0.036, a_5^1 = 0.050, a_6^1 = 0.209, a_7^1 = 0.207$$

An integral assessment of the activities of large enterprises is determined by the equality:

$$I_t^1 = 0.153q_{1t}^1 + 0.121q_{2t}^1 + 0.224q_{3t}^1 + 0.036q_{4t}^1 + 0.050q_{5t}^1 + 0.209q_{6t}^1 + 0.207q_{7t}^1$$

For medium enterprises  $\lambda_2 = 0.5459$  and weights in the integral assessment are as follows:

$$a_1^2 = 0.214, a_2^2 = 0.194, a_3^2 = 0.166, a_4^2 = 0.001, a_5^2 = 0.148, a_6^2 = 0.132, a_7^2 = 0.145$$

An integral assessment of the activities of medium enterprises is determined by the equality:

$$I_t^2 = 0.214q_{1t}^2 + 0.194q_{2t}^2 + 0.166q_{3t}^2 + 0.001q_{4t}^2 + 0.148q_{5t}^2 + 0.132q_{6t}^2 + 0.145q_{7t}^2$$

For small enterprises  $\lambda_3=0.3736$  and weights in the integral assessment are as follows:

$$a_1^3 = 0.122, a_2^3 = 0.106, a_3^3 = 0.218, a_4^3 = 0.016, a_5^3 = 0.116, a_6^3 = 0.195, a_7^3 = 0.227$$

An integral assessment of the activities of small enterprises is determined by the equality:

$$I_t^3 = 0.122q_{1t}^3 + 0.106q_{2t}^3 + 0.218q_{3t}^3 + 0.016q_{4t}^3 + 0.116q_{5t}^3 + 0.195q_{6t}^3 + 0.227q_{7t}^3$$

We define a general integral assessment of the activities of business entities in Ukraine. This assessment is a linear combination of assessments of the activities of large, medium, and small enterprises, that is, it has the following form:

$$J_t = \sum_{k=1}^3 b_k I_t^k = \sum_{k=1}^3 b_k \sum_{i=1}^7 a_i^k q_{it}^k \tag{3}$$

We define weights  $b_k$  by the method of the modified first principal component. They are equal:

$$b_1 = 0.45536, b_2 = 0.1444, b_3 = 0.4003$$

Thus, the integral assessment of the activities of business entities in Ukraine is determined by the equality:

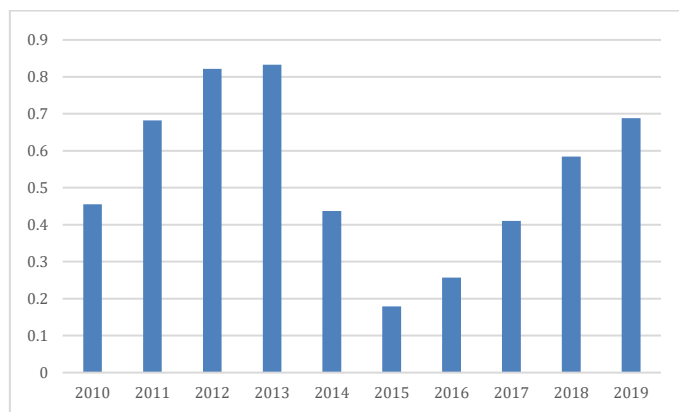
$$J_t = 0.45536I_t^1 + 0.1444I_t^2 + 0.4003I_t^3$$

The values of the obtained integral assessments of the activities of business entities in Ukraine are given in [Table 2](#).

**Table 2:** Integral assessments of the activities of business entities in Ukraine

Years	Large	Medium	Small	All enterprises
2010	0.5057	0.4300	0.4076	0.4555
2011	0.7090	0.5810	0.6878	0.6821
2012	0.8621	0.6460	0.8392	0.8218
2013	0.8663	0.6339	0.8662	0.8328
2014	0.4679	0.3748	0.4251	0.4373
2015	0.1516	0.2444	0.1864	0.1789
2016	0.2096	0.3639	0.2732	0.2573
2017	0.3596	0.4518	0.4533	0.4104
2018	0.5772	0.5531	0.6031	0.5842
2019	0.6711	0.6896	0.7068	0.6881

The dynamics of the integral assessment of the activities of business entities in Ukraine during 2010–2019 are shown in [Fig. 1](#).



**Fig. 1:** Dynamics of integral assessment of business entities in Ukraine

To effectively manage the development of entrepreneurship in the country, an objective forecast of the dynamics of indicators included in the integral assessment of the activities of business entities is required. To obtain such forecasts, we use the dynamic regression method, which refers to adaptive forecasting methods. Adaptive methods differ in that the forecasting models on which they are based change their parameters during operation, thus adapting to changes in external conditions. Such models are especially effective in the study of processes whose dynamics are characterized by abrupt changes. Such processes include the development of entrepreneurship in Ukraine. When applying the dynamic regression model, the forecast

values of the indicator for the years included in the retrospective period are determined. These values are compared with the known real values of this indicator and depending on the error allowed in forecasting the model parameter is modified. This ensures the adjustment of the model in accordance with the dynamics of the studied indicator. The final value of the parameter obtained as a result of such adjustment is used for forecasting for future periods. We will denote the forecast value of the indicator  $p_t^k$  with  $x_{it}^k$  the  $t$ -th year of the studied retrospective period. For  $t=1$ , we take  $x_{i1}^k = p_{i1}^k$ , and for other values of  $t$ , the forecast values are determined from the equality:

$$x_{it}^k = \beta p_{it}^k + (1 - \beta)x_{i(t-1)}^k \quad (4)$$

$$\beta_t = \frac{\sum_{t=1}^T \Delta_{t+2} \Delta_{t+1}}{\sum_{t=1}^T \Delta_{t+1}^2} \quad (5)$$

The parameter  $\beta$  changes dynamically depending on the magnitude of forecasting errors for previous periods. At the beginning we take  $\beta=0$  and the following values of this parameter are determined by the following formula:

where  $\Delta_{e+1}$  and  $\Delta_{e+1}$  are the forecasting errors for one and two periods, respectively,  $T$  is the period at which the modeling stage is completed.

The results of forecasting the performance of business entities in Ukraine for 2021 are shown in [Table 3](#).

**Table 3:** Forecast of performance indicators of business entities in Ukraine

Indicator	Forecast for 2021	Growth rate compared to 2019
Large enterprises		
The number of business entities	600	1.1
Average number of employed workers per enterprise	2668	0.9
Average volume of products sold per employee (in USD)	90357.64	1.03
The level of profitability (unprofitability) of enterprises	8.66	1.19
The percentage of enterprises that made a profit	78.76	1.01
Capital investments per enterprise (in thousands of US dollars)	16612.7	0.94
Personnel costs per employee (in USD)	9668.81	1.12
Medium enterprises		
Number of business entities	18303	1.01
Average number of employed workers per enterprise	172.47	1.00
Average volume of products sold per employee (in USD)	52015.86	1.00
The level of profitability (unprofitability) of enterprises	11.73	1.08
The percentage of enterprises that made a profit	77.1	1.00
Capital investments per enterprise (in thousands of US dollars)	457.93	1.01
Personnel costs per employee (in USD)	5761.22	1.03
Small enterprises		
Number of business entities	349412	0.99
Average number of employed workers per enterprise	4.87	1.00
Average volume of products sold per employee (in USD)	39478.5	0.99
The level of profitability (unprofitability) of enterprises	4.5	0.83
The percentage of enterprises that made a profit	73.35	1.00
Capital investments per enterprise (in thousands of US dollars)	9.028	1.00
Personnel costs per employee (in USD)	3012	0.97

Thus, for large enterprises, a significant increase in the level of profitability (by 19%) and personnel costs per employee (by 12%) is forecasted. At the same time, a slight decrease in capital investments per enterprise is expected (by 6%). For medium enterprises, an increase in the level of profitability (by 8%) and personnel costs per employee (by 3%) is also forecasted. Other performance indicators of medium enterprises are not expected to change significantly. For small enterprises, a 17% decrease in profitability and a decrease in personnel costs per

employee (by 3%) are forecasted, other indicators remain practically unchanged.

The rates of unemployment and inflation have a significant impact on the performance of business entities in Ukraine. The rates of these indicators for the period from 2010 to 2019 are shown in [Table 4](#).

To assess the magnitude of the impact of these factors, we will determine the correlation coefficients between these indicators and integral performance indicators of business entities ([Table 5](#)).

**Table 4:** Unemployment rate and inflation rate in Ukraine

Indicator	Years									
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Unemployment rate, %	8.8	8.6	8.1	7.7	9.7	9.5	9.7	9.9	9.1	8.6
Inflation rate,%	9.1	4.6	-0.2	0.5	24.9	43.3	12.4	13.7	9.8	4.1

**Table 5:** Correlation coefficients between integral assessments of the activities of business entities and indicators of unemployment and inflation rates

Groups of enterprises	Integral assessment	Influencing factor	Correlation coefficient
Large	$I_t^1$	Unemployment rate	-0.8857
Large	$I_t^1$	Inflation rate	-0.7968
Medium	$I_t^2$	Unemployment rate	-0.7741
Medium	$I_t^2$	Inflation rate	-0.8729
Small	$I_t^3$	Unemployment rate	-0.8488
Small	$I_t^3$	Inflation rate	-0.8147
All enterprises	$J_t$	Unemployment rate	-0.8701
All enterprises	$J_t$	Inflation rate	-0.8204

The significance of all the correlation coefficients given in [Table 5](#) is confirmed by the Student's criterion. The results show that unemployment and inflation have a significant negative impact on the

activities of business entities. The unemployment rate has the greatest impact on the activities of large and small enterprises, and the inflation rate – on the activities of medium enterprises.

We denote the unemployment rate (in percent) with  $v$ , and the inflation rate (in percent)–with  $w$ . To display the dependences of the integral assessments of the activities of large, medium, and small enterprises on the unemployment rate, we write the equation of paired linear regression  $I^k = \eta_k v + \theta_k$ , the coefficients of which are determined by the method of least squares. To check the adequacy of these equations with statistical data, we use Fisher’s criterion. To do this, we determine the coefficients of determination:

$$R_k^2 = 1 - \frac{\sum_{t=1}^{10} (I_t^k - \eta_k v(t) - \theta_k)^2}{\sum_{t=1}^{10} (I_t^k - I^k)^2} \tag{6}$$

We calculate the value of Fisher’s criterion:

$$F_k = \frac{R_k^2}{1 - R_k^2} \sqrt{T - 2} \tag{7}$$

where  $T$  is the duration of the retrospective period ( $T=10$ ).

We compare the obtained value with the critical value  $F_{kp}=5.3177$  of the Fisher’s criterion, which corresponds to the confidence level 0.95 and degrees of freedom  $k_1=1, k_2=8$ . If the calculated value of  $F_k$  exceeds the critical value, then the regression equation is considered adequate statistical data. If the regression equation is adequate, then we determine the coefficients of elasticity of integral assessments of the unemployment rate by the formula:

$$Kel_k = \frac{\eta_k v}{\eta_k v + \theta_k} \tag{8}$$

These coefficients are determined with the value of the unemployment rate  $v=8.6$ , which took place in 2019.

Similarly, we determine the regression equation  $J = \eta_0 v + \theta_0$  reflecting the dependence of the integral assessment of the activities of all enterprises on the unemployment rate; then we check its adequacy and calculate the coefficient of elasticity. The results of the study are shown in [Table 6](#).

**Table 6:** Dependence of the integral assessment of the activities of business entities on the unemployment rate

Group of enterprises	Regression equation	Coefficient of determination	Fisher’s criterion	Coefficient of elasticity
Large	$I^1 = -0.2984 v + 3.2149$	0.7845	29.1310	-3.9580
Medium	$I^2 = -0.1529 v + 1.8684$	0.5993	11.9652	-2.3762
Small	$I^3 = -0.2667 v + 2.9370$	0.7204	20.6110	-3.5639
All enterprises	$J = -0.2647 v + 2.9095$	0.7571	24.9326	-3.5978

Thus, the growth of unemployment by 1% leads to a decrease in the integral assessment of the activities of large enterprises by 3.96%, medium enterprises by 2.38%, small enterprises by 3.56%, all business entities by 3.60%.

Similarly, we investigate the dependence of integral assessments of the activities of large, medium, and small enterprises and all business entities on the inflation rate. The research results are shown in [Table 7](#).

**Table 7:** Dependence of the integral assessment of the activities of business entities on the inflation rate

Group of enterprises	Regression equation	Coefficient of determination	Fisher’s criterion	Coefficient of elasticity
Large	$I^1 = -0.0150 w + 0.7219$	0.6348	13.9069	-0.0934
Medium	$I^2 = -0.0097 w + 0.6149$	0.7619	25.6023	-0.0689
Small	$I^3 = -0.0143 w + 0.7202$	0.6637	15.7878	-0.0889
All enterprises	$J = -0.0140 w + 0.7058$	0.6730	16.4683	-0.0885

Thus, an increase in inflation by 1% leads to a decrease in the integral assessment of the activities of large enterprises by 0.09%, medium enterprises by 0.07%, small enterprises by 0.09%, all business entities by 0.09%.

#### 4. Conclusion

According to the results of the research, a method for assessing the current activities of business entities is proposed, as well as models for forecasting the development of this sector of the economy, taking into account the specifics of the national economy of Ukraine. The dynamics of the integral assessment of the business entities’ activities in Ukraine showed a significant decrease in entrepreneurial activity in 2015 and its revival in subsequent periods under study. The use of dynamic regression methods, which change their parameters during modeling, thus adapting to changes in the external conditions of the national economy allowed determining the prospects for the development of

entrepreneurship for future periods. The forecasting results showed an increase in profitability at large enterprises (by 19%) and personnel costs per employee (by 12%). At the same time, a decrease in capital investment per enterprise is forecasted (by 6%). These trends will also be typical for medium enterprises, which are forecasted to increase the level of profitability (by 8%) and personnel costs per employee (by 3%). It is estimated that the activities of small enterprises will be characterized by a decrease in profitability (by 17%) and a decrease in personnel costs per employee (by 3%). It is noted that the inertia of the development of large, medium, and small enterprises will lead to inflation and unemployment.

The proposed methodology should be used in the process of updating and revising management strategies to support this sector of the economy, which will respond in a timely manner to negative trends in the external or internal environment that cause inertia of entrepreneurship.

## Compliance with ethical standards

## Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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