Oleh V. Hlushko[1], **Inna Yu. Gryshova**[2], **Nataliia V. Lagodiienko**[3]

EFFECTIVE METHODOLOGICAL TOOLS FOR FORECASTING FINANCIAL AND ECONOMIC STABILITY

The key principles of system indicators of enterprises' economic stability assessment are outlined. The calculation methodology for an integral indicator of economic stability is presented in detail. The analytical results concerning the prediction of enterprise economic stability level on the basis of models predicting the probability of bankruptcy are obtained. Effectiveness of the proposed evaluative and predictive tools and correlation between them is determined.
Keywords: *efficiency; economic stability; integral index; prediction models.*
Peer-reviewed, approved and placed: *10.05.2016.*

Олег В. Глушко, Інна Ю. Гришова, Наталія В. Лагодієнко

ЕФЕКТИВНИЙ МЕТОДИЧНИЙ ІНСТРУМЕНТАРІЙ ПРОГНОЗУВАННЯ ФІНАНСОВО-ЕКОНОМІЧНОЇ СТІЙКОСТІ

У статті сформовано базові засади побудови системи показників для оцінювання економічної стійкості підприємств. Деталізовано методику розрахунку інтегрального показника економічної стійкості. Наведено аналітичні результати прогнозування рівня економічної стійкості підприємств на базі моделей прогнозування ймовірності банкрутства. Визначено ефективність запропонованого оціночного та прогнозного інструментарію, а також кореляцію між ними.
Ключові слова: *ефективність; економічна стійкість; інтегральний показник; моделі прогнозування.*
Рис. 2. Табл. 1. Літ. 15.

Олег В. Глушко, Инна Ю. Гришова, Наталья В. Лагодиенко

ЭФФЕКТИВНЫЙ МЕТОДИЧЕСКИЙ ИНСТРУМЕНТАРИЙ ПРОГНОЗИРОВАНИЯ ФИНАНСОВО-ЭКОНОМИЧЕСКОЙ УСТОЙЧИВОСТИ

В статье сформированы базовые принципы построения системы показателей для оценки экономической устойчивости предприятий. Детализирована методика расчета интегрального показателя экономической устойчивости. Приведены аналитические результаты прогнозирования уровня экономической устойчивости предприятий на основе моделей прогнозирования вероятности банкротства. Определена эффективность предложенного оценочного и прогнозного инструментария, а также корреляция между ними.
Ключевые слова: *эффективность; экономическая устойчивость; интегральный показатель; модели прогнозирования.*

Problem setting. Analytical studies on sustainability of economic entities become actual in response to current political, legal, financial and economic instability or social rejection of the existing dysfunctions of government and its institutions. The methodological basis for enterprise economic stability assessment requires objectified improvement to ensure its compliance with contemporary assessment models.

Today most of methodologies for prediction of economic phenomena such as economic stability fail to provide high-probability results. A range of problems relat-

[1] National University "Lviv Polytechnics", Ukraine.
[2] Odesa National Academy of Food Technologies, Ukraine.
[3] Mykolayiv National Agrarian University, Ukraine.

ed to prediction procedures can be traced in hard-to-be-adapted foreign tools along with the lack of other options.

Recent studies and publications analysis. Ukrainian scientists L.I. Galyuk (2012), O.M. Goncharenko (2011), T.F. Kosyanchuk and N.L. Liubchenko (2011) studied the problems of enterprises' economic stability assessment giving the advantage to the integral assessment based on additive approach and taking into account the need to use integrated analytical tools for monitoring and diagnostics. Issues related to economic stability analysis have been also researched by foreign scientists, namely, S. Fujisaki (2012) in the context of stability indices as indicators for economic models, and also S.-Z. Li and K.G. Lofgren (2000) concerning correlation between updatable resources and enterprise economic stability level.

T. Bodnar and A. Bodnar (2011) suggest carrying out forecasts based on financial indicators, which are presented in the most of economic and mathematical models. O.M. Goncharenko (2010) considers it efficient to predict economic stability using the system of functional equations provided that the integral curve attains the predetermined surface area. A number of national and foreign researchers of enterprises economic stability, including I. Gryshova et al. (2015), E. Smith et al. (2013) and M. Wagner (2010), used advanced economic and mathematical tools, in particular, during the analysis they pay attention to corporate stability and its efficiency, to statistical indicators and practical aspects of social and economic development of the enterprise.

Being under the influence of international factors, national economy is significantly deformed and it is clear that improvement of available tools for assessment and interpretation of the applied effect of prediction models of engineering enterprises economic stability is required.

The article aims to update the available assessment tools for enterprise economic stability and to illustrate the applied effect of prediction models.

Key research findings. There are certain specific features in assessment of enterprise economic stability. They are to be taken into account to ensure objectivity and completeness of disclosure of economic stability level of an economic entity. Proper base should be provided for formation of effective tools for enterprise economic stability assessment. Thus it is required to determine the positioning principles of currently available analytical tools.

The key components of economic stability assessment tools are single indicators, but efficiency of the integral index can be provided only with their well-grounded synthesis. Figure 1 represents the formation principles of assessment tools of enterprise economic stability.

There are two main systems of indicators, which are based on schematic presentation of enterprise economic stability indicators formation: a non-formalized and a formalized system. Non-formalized system of indicators has the followings features:

- indicators are integrated on the basis of theoretical and practical knowledge about the features of determination of enterprise economic stability level;
- indicators assess all relevant aspects of economic stability to disclose the actual level of enterprise economic stability;
- use of indicators, which are difficult to convert into a quantity index due to lack of required informative data (statistical data, accounting analytical data etc.) or

due to insufficient development of the procedure on interpretation of attributive features of economic stability of an economic entity.

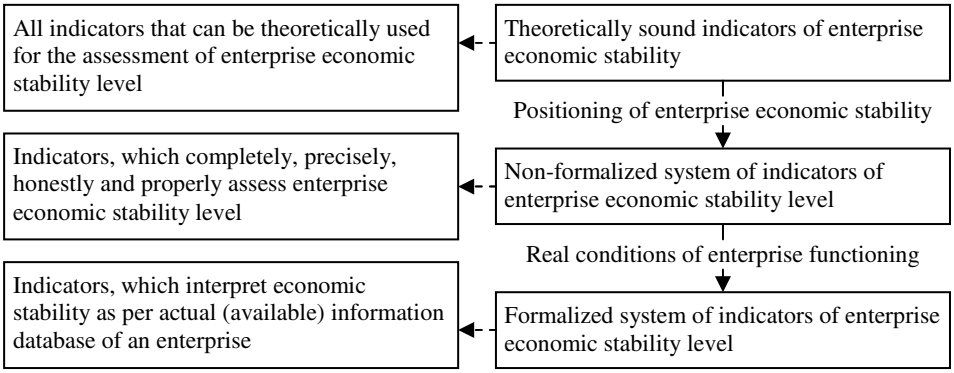

Figure 1. **Selection and formation principles of the indicators system of enterprise financial and economic stability,** *authors'*

Indicators of the formalized system are formed within the paradigm of enterprises economic stability, but unlike the non-formalized system, availability of information is taken into account. Thus some indicators are re-formatted, which makes it possible to reach a conclusion about financial indicators (output data, financial reporting) and indicators obtained through expertise. This brings down the objectiveness of assessment results, but increases truthfulness of output data.

Receiving the maximum possible objective assessment results on the enterprise economic stability level using available economic information is the priority for the abovementioned assessment analytical approach. The resulting indicator of enterprise economic stability is determined to define further the destabilizing factors in economic entity functioning. The integral index ensures a high level of assessment results' efficiency.

Clear detalization of stages is required while applying the tools of this integral approach. Features of economic stability integral assessment implementation providing a reasonable level of efficiency is presented in Figure 2.

The essence of integral index application for determination of enterprise economic stability is to consider all essential indicators for a certain enterprise. The presented methodology takes into account both theoretical and practical aspects of this analytical procedure. The methodology aims at evaluating enterprise economic stability and ambiguity minimization that may occur during calculations.

The methodology for prediction of enterprise economic stability level should be based on an assessment methodology. It would be therefore useful to consider these processes as a totality. For this reason, the indicators of integral assessment of economic stability must correlate with the single indicators of prediction models, thus, we believe it is appropriate to consider several such models.

To define an enterprise economic stability level we focus on the models of bankruptcy prediction, as they are obviously related to stability of any business entity.

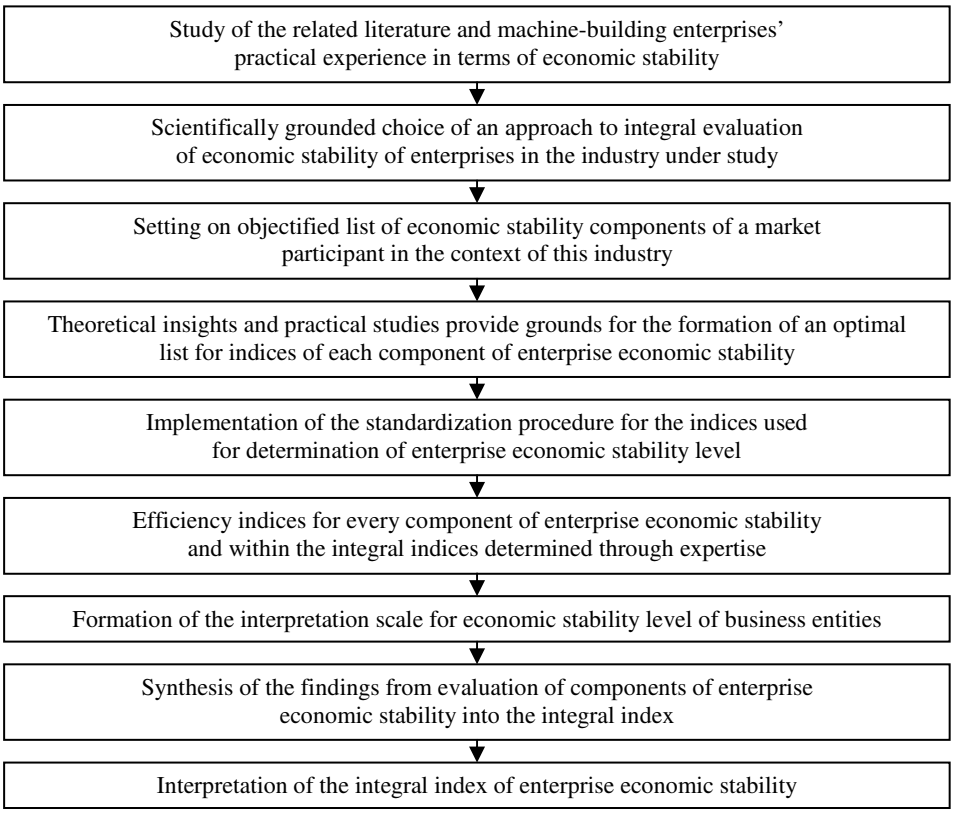

Figure 2. **Methodology for formation of the integral index of enterprise financial and economic stability,** *authors'*

With due regard to a considerable number of bankruptcy models (Altman, 1968; Lisa et al., 1990; Taffler and Tisshaw, 1977; Springate, 1978; Beaver, 1968) the ones most often used and adapted to current business in the engineering industry were described in this article. In particular, adaptation of models was oriented on selecting indices as set forth by the methodology for their integral assessment. The results of bankruptcy prediction were systemized and standardized under preliminary analytical calculation and are shown in Table 1. In the machine-building industry that was chosen for our investigation it is difficult to find enterprises for such forecasting models. In this case we were looking for useful empirical information on the enterprises located in the West part of Ukraine. Most of the analyzed enterprises (more than 20) were unprofitable and only a few of them as shown in Table 1 meet the criteria for our forecasting models.

At the very beginning of our evaluation we used the last 5 financial years but due to destabilization of Ukrainian economy at the end of 2014 the results of 2015 were not included. Another argument not to use the data for 2015 is that most of financial reports of the chosen enterprises were unprofitable in that financial year.

Having determined the probability of bankruptcy of a machine-building enterprise, it is possible to interpolate these data more precisely to the level of enterprise

economic stability in the future accounting periods. Thus, if there is high probability of bankruptcy (the result is compared with a critical value), the enterprise is not under stability, neither middle level of stability. If the results are within the critical value frame, such an enterprise can be positioned as the one with proper economic stability.

Table 1. **Prediction of the enterprise financial and economic stability level based on the models of bankruptcy prediction, calculated by the authors using public financial statements of these enterprises**

Models of bankruptcy prediction (critical value)	2010	2011	2012	2013	2014
Lviv Locomotive Repair Plant					
Model of E. Altmans (> 3)	2.96	3.1	2.33	2.5	2.3
Model of R. Lisa (≤ 0.037)	0.02	0.03	0.04	0.04	0.04
Model of R. Taffler and H. Tisshaw (≤ 0.2)	0.77	0.78	0.84	0.6	0.55
Model of G. Springate (> 2.45)	0.65	1.2	1.3	0.78	1.14
W. Beaver's Ratio (> 0.4–0.45)	8.03	6.26	6.26	3.64	21.98
Return on Assets Net Profit Margin (> 6,0–8,0)	0.04	2.59	3.18	2.7	2.29
Financial Leverage (≤ 37)	0.22	0.27	0.25	0.36	0.4
Net Working Capital to Total Assets Ratio (> 0.4)	0.06	0.1	0.16	0.12	0.12
Current Ratio (≤ 3.2)	0.6	1.39	1.66	3.77	2.04
Ivano-Frankivsk Locomotive Repair Plant					
Model of E. Altmans (> 3)	2.94	2.56	3.15	2.9	2.86
Model of R. Lisa (≤ 0.037)	0.04	0.04	0.04	0.04	0.04
Model of G. Springate (> 2.45)	1.3	1.27	1.67	1.25	1.24
Model of R. Taffler and H. Tisshaw (≤ 0.2)	0.65	0.56	0.76	0.8	0.75
W. Beaver's Ratio (> 0.4–0.45)	2.19	1.83	2.28	2.69	2.51
Return on Assets Net Profit Margin (> 6.0–8.0)	0.59	0.57	6.76	2.98	2.89
Financial Leverage (≤ 37)	0.33	0.37	0.33	0.29	0.31
Net Working Capital to Total Assets Ratio (> 0.4)	0.21	0.2	0.23	0.26	0.26
Current Ratio (≤ 3.2)	1.05	1.05	1.19	1.42	1.11
Drogobych Machine-Building Plant					
Model of E. Altmans (> 3)	1.52	1.1	1.16	1.31	1.33
Model of R. Lisa (≤ 0.037)	0.05	0.05	0.05	0.06	0.05
Model of R. Taffler and H. Tisshaw (≤ 0.2)	0.58	0.43	0.48	0.58	0.51
Model of G. Springate (> 2.45)	0.81	0.68	0.82	1.14	0.75
W. Beaver's Ratio (> 0.4–0.45)	1.59	1.04	1.18	1.4	1.31
Return on Assets Net Profit Margin (> 6.0–8.0)	-1.51	-3.41	-1.45	3.26	-2.16
Financial Leverage (≤ 37)	0.37	0.47	0.46	0.43	0.42
Net Working Capital to Total Assets Ratio (> 0.4)	0.31	0.27	0.28	0.33	0.33
Current Ratio (≤ 3.2)	1.06	0.83	0.87	1.02	0.94
Drogobych Truck Crane Plant					
Model of E. Altmans (> 3)	1.48	0.25	-0.38	-0.94	-1.4
Model of R. Lisa (≤ 0.037)	0.07	0.06	0.04	0.03	0
Model of R. Taffler and H. Tisshaw (≤ 0.2)	1.18	0.37	0.22	0.2	0.01
Model of G. Springate (> 2.45)	1.44	0.1	0	-0.05	-0.61
W. Beaver's Ratio (> 0.4–0.45)	1.72	0.49	0.42	0.49	0.3
Return on Assets Net Profit Margin (> 6.0–8.0)	7.21	-15.63	-18.51	-19.59	-30.47
Financial Leverage (≤ 37)	0.24	0.41	0.54	0.65	0.93
Net Working Capital to Total Assets Ratio (> 0.4)	0.39	0.24	0.08	-0.09	-0.38
Current Ratio (≤ 3.2)	1.54	1.07	0.78	0.53	0.52

Continuation of *Table 1*

Models of bankruptcy prediction (critical value)	2010	2011	2012	2013	2014
Conveyer					
Model of E. Altmans (> 3)	4.67	4.43	2.93	2.05	1.98
Model of R. Lisa (≤ 0.037)	0.02	0.01	0	-0.01	0
Model of R. Taffler and H. Tisshaw (≤ 0.2)	1.09	0.96	0.69	0.45	0.51
Model of G. Springate (> 2.45)	-0.35	-0.27	0.12	-0.08	0.2
W. Beaver's Ratio (> 0.4–0.45)	6.15	6.79	4.88	1.88	2.16
Return on Assets Net Profit Margin (> 6.0–8.0)	-10.07	-9.29	-5.38	-10.27	-4.63
Financial Leverage (≤ 37)	0.12	0.13	0.19	0.25	0.26
Net Working Capital to Total Assets Ratio (> 0.4)	0.2	0.13	0.09	0.01	0.01
Current Ratio (≤ 3.2)	1.08	0.78	0.58	0.27	0.27

With due regard to critical values, the proposed models calculated bankruptcy likelihood for the defined machine-building plants. In particular, Mukachivprylad is to go bankrupt soon according to 4 models results. Nevertheless, the enterprise shows similar results for the whole review period. The enterprise under study is not considered as a bankrupt one under the results of the majority of the bankruptcy prediction models. Such result is specified by a variety of indices used for calculation of the final result.

The results of bankruptcy prediction for Lviv Locomotive Repair Plant are not so decisive, as with the previously analyzed enterprise. Only 3 models predict no bankruptcy, whereas four models confirm it. Two models during the period to 2011 defined this enterprise as a potentially profitable company but further periods demonstrate negative results. As a whole, the results of this prediction may be considered as being more critical as compared to Mukachivprylad. The situation with bankruptcy prediction for Ivano-Frankivsk Locomotive Repair Plant is very similar to the results of Lviv Locomotive Repair Plant.

The models presented in Table 1 fail to correlate significantly with planned targets, which are to be reasonably used for integral assessment of the enterprises' economic stability level. This is the reason why the results differ significantly. These models fail to ensure high efficiency level of forecasting dand thus, they may be used as approximate indices of possible destabilizing factors and reveal only a potential for economic instability of an enterprise.

Findings of the study and prospects of further research. Having studied the results of various models of bankruptcy prediction and integral index of economic stability, we can state that the models, in their majority, are not sensitive to changes in non-formalized indices, and that additionally a number of indices fail to represent in full extent the features of the engineering industry. In this case, the assessment results of the integral index of economic stability of an enterprise are reasonably considered as more objective and better adapted to conditions of the sector under study. Such position can be explained by a number of indices, which are more appropriate for the industry requirements, and also by more effective results of the study.

References:

Боднар Т., Боднар А. Системи прогнозування економічних показників фінансового стану підприємства // Економічний аналіз: Збірник наук. праць Тернопільського національного економічного університету.– 2011. –Вип. 9, Ч. 1. – С. 40–43.

Bodnar T., Bodnar A. Systemy prohnozuvannia ekonomichnykh pokaznykiv finansovoho stanu pidpryiemstva // Ekonomichnyi analiz: Zbirnyk nauk. prats Ternopilskoho natsionalnoho ekonomichnoho universytetu.– 2011. –Vyp. 9, Ch. l. – C. 40–43.

Галюк Л.І. Інтегрована оцінка економічної стійкості розвитку газорозподільних підприємств // Галицький економічний вісник.– 2012.– №2. – С. 145–154.

Haliuk L.I. Intehrovana otsinka ekonomichnoi stiikosti rozvytku hazorozpodilnykh pidpryiemstv // Halytskyi ekonomichnyi visnyk.– 2012.– №2. – S. 145–154.

Гончаренко О.М. Діагностика та інструментарій оцінки стійкого розвитку підприємства // Праці Одеського політехнічного університету.– 2011.– Вип. 2. – С. 312–319.

Honcharenko O.M. Diahnostyka ta instrumentarii otsinky stiikoho rozvytku pidpryiemstva // Pratsi Odeskoho politekhnichnoho universytetu.– 2011.– Vyp. 2. – S. 312–319.

Гончаренко О.М. Прогнозування стійкого розвитку підприємства // Менеджмент та підприємництво в Україні: етапи становлення і проблеми розвитку: Вісник Національного університету «Львівська політехніка».– 2010.– №691. – С. 130–135.

Honcharenko O.M. Prohnozuvannia stiikoho rozvytku pidpryiemstva // Menedzhment ta pidpryiemnytstvo v Ukraini: etapy stanovlennia i problemy rozvytku: Visnyk Natsionalnoho universytetu «Lvivska politekhnika».– 2010.– №691. – S. 130–135.

Косянчук Т.Ф., Любченко Н.Л. Комплексне оцінювання економічної стабільності промислових підприємств: Монографія. – Хмельницький: Хмельницький національний університет, 2011. – 218 с.

Kosianchuk T.F., Liubchenko N.L. Kompleksne otsiniuvannia ekonomichnoi stabilnosti promyslovykh pidpryiemstv: Monohrafiia. – Khmelnytskyi: Khmelnytskyi natsionalnyi universytet, 2011. – 218 s.

Altman, E.I. (1968). Financial Ratios, Discrimination Analysis and the Prediction of Corporate Bankruptcy. Journal of Finance, September: 589–609.

Beaver, W.H. (1968). Market Prices, Financial Ratios, and the Prediction of Failure. Journal of Accounting Research, 6(2): 179–192.

Fujisaki, S. (2012). Economic stability and interest-rate controls in an open-economy model with productive money. Economics Bulletin, 32(4): 3053–3060.

Gryshova, I., Kryukova, I., Mityay, O. (2015). Ukraine's positions in international ratings evaluation as a factor of its competitiveness. Economic Annals-XXI, 5–6: 24–27.

Li, C.-Z., Lofgren, K.-G. (2000). Renewable resources and economic sustainability: A dynamic analysis with heterogeneous time preferences. Journal of Environmental Economics and Management, 40(3): 236–250.

Lisa, R.G., Menon, K., Schwartz, K.B. (1990). Predicting Bankruptcy for Firms in Financial Distress. Journal of Business Finance & Accounting, 17(1): 161–171.

Smith, E., Foley, D.K., Good, B.H. (2013). Unchangeable shocks and statistical economic equilibrium. Economic Theory, 52(1): 187–235.

Springate, G.L.V. (1978). Predicting the Possibility of Failure in a Canadian Firm. Unpublished MBA Research Project, Simon Frazer University, January 1978. Insolvency Prediction, E. Sands &Associates Inc.

Tafler, R.J., Tisshaw, H. (1977). Going, Going, Gone – Four Factors Which Predict. Accountancy, 88: 50–54.

Wagner, M. (2010). The role of corporate sustainability performance for economic performance: A firm-level analysis of moderation effects. Ecological Economics, 69(7): 1553–1560.