Challenging issues of performing forensic economic examinations of reports on independent expert valuation of asset value

Yuri Pozdnyakov * [a], Igor Bratishko ** [b]

* Ukrainian Society of Appraisers, Lviv, Ukraine, ORCID: https://orcid.org/0000-0001-5849-7345, ResearcherID: ABE-9851-2020, e-mail: jerzy.pozdniakow@gmail.com
* *Apex* Appraisal Company, Lviv, Ukraine, e-mail: apeks-ok@ukr.net
[a] Project management, Methodology.
[b] Conceptualization, Writing — original draft.

DOI: 10.32353/khrife.1.2022.07 UDC 343.98:33
Submitted: 10 Feb 2022 / Reviewed: 17 Feb 2022 / Approved for Print: 10 Mar 2022 /
Avialable online: 31 Mar 2022

The article is dedicated to methodological principles of conducting forensic economic examinations of reports on economic measurements that are performed through methods of assets independent valuation. The Article Purpose is to stress challenging issues arising while forensic economic examinations to identify indicators of assets value obtained as a result of economic measurements through methods of assets independent valuation. The problematic issues of substantiation of the method of quantitative measurement of the degree of uncertainty concerning valuation results based on the probabilistic metrological approach that is rooted in application of the interval form of valuation results presentation are outlined. A comparative analysis of the requirements of national and international valuation standards for description of valuation results uncertainty is carried out. It has been demonstrated that when applying comparative and income approaches, indicators of uncertainty for requested confidence levels in the form of numerical values of the confidence interval limits can be established on the grounds of statistical processing of multiple data of market information series (in particular, adjusted single indicators of offers for sale or rental rate of such property).

This article is translation of the original Ukrainian content, which source is available at the link: *https://khrife-journal.org/index.php/journal* (translation by Daryna Dukhnenko). The author acknowledges translation as corresponding to the original.

Peculiarities are presented and conditions of correctness for performing these economic measurements are formulated.

Keywords: *independent expert valuation, forensic economic examination of report, economic measurements, error, accuracy, reliability, uncertainty of valuation result.*

Research Problem Formulation

While forensic economic examination of reports on independent expert valuation of property value, the forensic expert is frequently asked about the reliability of valuation results; correctness of performance and completeness of disclosed information in the report on valuation procedures; compliance with requirements of the current regulatory framework (in particular, National Standards (hereinafter referred to as NVS) [1] of independent valuation); market value of valuation object at a specified valuation date. The answer to the last question presupposes conducting a re-valuation by a forensic expert based on which judgments are formulated regarding the accuracy of valuation in a report under study and reliability of its results.

Such issues demand not only a comprehensive research and analysis of the report but also a full-fledged valuation by a forensic expert. According to paragraph 1.4 of Scientific and methodological recommendations on preparation and appointment of forensic examinations and expert research [2], "during forensic examinations corresponding research methods, methods of forensic examinations as well as legal regulations and regulatory documents (international, national and industry standards) are used". That is, examination of independent valuation reports should be grounded on the same valuation standards that guide independent appraisers. But the problem of interpreting results of such work and, in particular, their correlation with results of a studied report is insufficiently outlined in the professional literature.

Unfortunately, currently there are no tested, approved and entered in the Register methods of forensic examinations to determine quantitative indicators of reliability of independent expert valuation results. Thus, judgments on results reliability of the analyzed report are obtained on the basis of creative heuristic approaches to the development of research methods that obviously necessitates application of scientifically sound principles. This sometimes exceeds capacities of an average forensic expert and goes well beyond the issues addressed to him. Most often, an expert research of

1 Про затвердження Національного стандарту № 1 «Загальні засади оцінки майна і майнових прав» : Постанова КМУ від 10.09.2003 р. № 1440 (зі змін. та допов.). URL: https://zakon2.rada.gov.ua/laws/show/1440-2003-п (date accessed: 17.12.2021) ; Про затвердження Національного стандарту № 2 «Оцінка нерухомого майна» : Постанова КМУ від 28.10.2004 р. № 1442 (зі змін. та допов.). URL: https://zakon5.rada.gov.ua/laws/show/1442-2004-п (date accessed: 17.12.2021).

2 Інструкція про призначення та проведення судових експертиз та експертних досліджень : затв. наказом Мін'юсту України від 08.10.1998 р. № 53/5 (у ред. наказу від 26.12.2012 р. № 1950/5). *Офіційний вісник України.* 2013. № 3. ст. 91.

a valuation report is limited to a fairly formal analysis of compliance with the requirements of the current regulatory framework. Though it is necessary, still insufficient for obtaining a reasonable unbiased judgment about the quality of performed economic measurements in a forensic report. As a consequence, while forensic economic examination and review of reports, fundamental issues of methodology for developing indicators of reliability and accuracy for results valuation are frequently overlooked. This situation urgently requires the development of unified, scientifically sound methods of adopting these indicators. They must be objective and quantitative, that is be independent from the subjective viewpoint of the forensic expert or reviewer.

Given the above, the issue of studying theoretical foundations of methods for establishing quantitative indicators of reliability and accuracy of results of economic measurements performed through methods of independent expert valuation is highly relevant. It is of great practical importance for the creation of a reliable evidence base in both civil and criminal proceedings. Occasionally, appraisers are accused of failing to cover (as well as commodity, land appraisal, construction appraisal and construction-technical examinations to determine the value) problematic issues of establishing indicators of reliability and accuracy of conducted independent valuation in conclusions of forensic economic examinations. This is the result of the lack of methodology and incompleteness of expert conclusions required to create a reliable evidence base. Concentrating on the research on reliability and accuracy of valuation results would enhance efficiency and ensure the quality of forensic economic examination, would help to separate professional judgments of the appraiser for which he is responsible from possible expanded interpretation of obtained valuation result the appraiser is not responsible for.

Article Purpose

The Article Purpose is to stress challenging issues arising while forensic economic examinations to determine indicators of assets value obtained through economic measurements by methods of independent expert valuation; research and interpretation of theoretical provisions and substantiation of practical guidelines for the development of heuristic methods for establishing objective quantitative indicators of the degree of uncertainty of valuation result; justification and selection of methodological approaches before determination of quantitative values of these indicators at the stage of valuation or at any date after their completion; interpretation of results acquired during valuation; analysis of possibilities to increase the objectivity of results of expert research of independent expert valuation reports and formulation of practical guidelines regarding priority areas of their analysis.

Analysis of Essential Researches and Publications

During forensic economic examinations of independent expert valuation reports, it is crucial to take into account the effect of uncertainty on economic measurements result. V. V. Lukianova's [3] research paper addresses peculiarities of

3 Лук'янова В. Дуалізм невизначеності та ризику в економічних явищах. *Вісник Хмельницького національного університету*. 2017. № 2 (2). С. 216—220. URL: https://nbuv.gov.ua/UJRN/Vchnu_ekon_2017_2%282%29__46 (date accessed: 17.12.2021).

causes of uncertainty and risk, provides a hierarchy of types of uncertainty in economic measurements and suggests a systematization for types of economic uncertainty. Having analyzed problems of uncertainty in economy, the author distinguished between four main classification features of economic uncertainty: 1) the level of information awareness in a person making a decision; 2) the probability level of events occurrence; 3) the nature of uncertainty (in particular, time uncertainty associated with forecasting; metric uncertainty related to inaccuracy of valuation or measurement of variables; structural uncertainty); 4) measurability indicator that is determined by existing methodology capabilities, computing base and peculiarities of random market processes.

One of the most powerful sources of uncertainty while performing economic measurements is market uncertainty conditioned by informational nature of the market and probabilistic nature of market mechanisms [4] functioning. It is impossible to imagine a situation in which the impact of uncertainty in the external marketing environment [5] can be fully localized, since in practice it is impossible to take into account and reasonably assess levels of all market risks affecting valuation results [6]. Credible measurement of risks during economic measurements is not always possible, as the researcher may not be aware of all sources of uncertainty as well as quantitative estimates of their weighting coefficients [7]. For economic measurements performed by methods of independent expert valuation, the statements from paragraphs 3.1—3.3 of this document [8] are valid. As with measurement of any other quantities, in this case the purpose of measurement is to provide information about the measured quantity (the value of valuation object). No measurement is infallible, that's why when measuring the value quantity, the value obtained depends on used source data, measurement methods, qualification and skills of the performer, current market conditions, etc. Even if this quantity is measured several times in the same way and under the same conditions, in most cases each time the result will vary. Such values of results of valuation performed by different performers are viewed as options for random implementation of estimates of the measured quantity. The values span of estimates depends on how

4 Поздняков Ю. В. Невизначеність результату незалежної експертної оцінки : монографія. LAP Lambert Academic Publishing, 2021. 472 с.

5 Литвиненко Т. М. Невизначеність ринкового середовища та шляхи її локалізації. Теоретичні та прикладні питання економіки : зб. наук. пр. КНУ ім. Т. Г. Шевченка. 2009. Т. 19. С. 46—55. URL: https://tppe.econom.univ.kiev.ua/data/2009_19/zb19_07.pdf (date accessed: 17.12.2021).

6 Жадан Т. А., Жадан Ю. В. Сучасні наукові підходи до розуміння економічного змісту поняття «ризик». Причорноморські економічні студії. 2018. Вип. 33. С. 74—78. URL: https://nbuv.gov.ua/UJRN/bses_2018_33_17 (date accessed: 17.12.2021) ; Вітлінський В. В., Великоіваненко Г. І. Ризикологія в економіці та підприємництві : монографія. Київ, 2004. 480 с.

7 Балджи М. Д. Економічний ризик та методи його вимірювання : навч. посіб. Харьків, 2015. 300 с. ; Вітлінський В. В., Наконечний С. І., Шарапов О. Д. Економічний ризик і методи його вимірювання : підручник. Київ, 1996. 336 с.

8 Введение к «Руководству по выражению неопределенности измерения» и сопутствующим документам. [Introduction to "The guidelines for the expression of measurement uncertainty" and relevant documents.] Оценивание данных измерений / пер. с англ. ; под науч. ред. проф. В. А. Слаева, А. Г. Чуновкиной. Санкт-Петербург, 2011. 58 с.

well measurement is performed. Their average value should ensure an estimate of the true value of a quantity that is generally more reliable comparing to the individual result of a single measurement. Variance and number of results of valuation provide information regarding the average value as an estimate of the true value of the measured quantity, but this information is mostly insufficient. International Valuation Standards (IVS) devote substantial attention to the disclosure of uncertainty while valuation [9].

In the modern metrological concept of uncertainty, it is generally accepted that after performing any measurements, there is always uncertainty about the truth of a delivered result; doubts as to how accurately the measurement result reflects the value of the measured quanity. For example, in case of a single measurement, the result may coincide with the conditionally true value of the measured quantity, i.e. there may be zero errors. But it is impossible to prove, that's why uncertainty as a measure of lack of confidence in the obtained result may be essential, since it reflects the possible scattering of a series of measurement results. In the approach from the standpoint of uncertainty, the true value concept is now abandoned, because it not only can not be known but does not exist at all in the probabilistic approach. The conventional true value in the concept of uncertainty can be expressed only in a certain range (for example, the confidence interval), since as we approach conventional true value (with a decrease in uncertainty), it is essential to take into account more factors that influence [10].

The efficiency of forensic economic examination and effectiveness of its interaction with forensic investigators depend in particular on the development of the applied theoretical and methodological framework. The latter is impossible without the use of scientifically sound approaches, as this examination applies specific expertise regarding economic area of human activity [11]. Specific expertise required to perform a forensic examination is the result of professional training and professional education of certain persons who are holders of this knowledge. Its use is stipulated only by certain subjects and in particular procedures. In each case it requires the existence of one of the subjects provided by law, certification of his / her professional competence and the use of legal ways to obtain research results. A forensic report as an independent forensic evidence in a case can only be the result of a forensic examination appointed and conducted in strict compliance with the requirements of procedural law. The forensic report obtained outside the process or in violation of requirements for the form, content, status of a forensic

9 Гаража О. П. Стандартизація оцінки майна у світі. *Науковий вісник Міжнародного гуманітарного університету. Серія «Економіка і менеджмент»*. 2016. Вип. 17. С. 36–42. URL: https://nbuv.gov.ua/UJRN/Nvmgu_eim_2016_17_10 (date accessed: 17.12.2021).

10 Василенко І. Ф. Вплив концепції невизначеності вимірювань на метрологічну діяльність. *Наукові записки*. 2016. Вип. 19. С. 58—68. URL: https://dspace.kntu.kr.ua/jspui/bitstream/123456789/4329/1/5__19_2016-59-69.pdf (date accessed: 17.12.2021) ; Чалый В. П. Неопределенность и погрешность, их сходство, различие и употребление в разных метрологических процедурах. *Системи обробки інформації.* 2006. Вип. 7 (56). С. 82—85. URL: https://nbuv.gov.ua/UJRN/soi_2006_7_27 (date accessed: 17.12.2021).

11 Горлачук О. А. Теоретико-методологічні засади судової економічної експертизи. *Теорія та практика судової експертизи і криміналістики*. 2021. Вип. 23. С. 300—310. DOI: 10.32353/khrife.1.2021.23 (date accessed: 17.12.2021).

expert, does not acquire the status of forensic evidence [12]. Therefore, it seems expedient to more clearly circle the range of persons: holders of specific expertise who have legal rights and grounds to be subject to procedural obligations for practical application of this knowledge in forensic economic examination of asset valuation reports in accordance with corresponding legal responsibility. Until 2020, the concept of specialist conclusion as a source of evidence in the current criminal procedural legislation of Ukraine was not provided. The Law No 2617-VIII [13] of 22.11.2018 introduced the concept of specialist conclusion in the criminal procedure in cases when at the stage of inquiry it is required to set actual data and circumstances of a criminal offense by applying specific expertise. This Law, Part 4 of Article 71 of the Criminal Procedural Code of Ukraine was supplemented by a Provision on the right of a specialist: "... 7) to provide conclusions on issues within the scope of his expertise while pre-trial investigation of criminal offenses" [14]. The introduction of the *specialist conclusion* concept in criminal proceedings helps to enhance efficiency of forensic science institutions. This enables them to involve forensic experts who do not work in forensic science institutions (hereinafter referred to as FSIs) and also can improve the quality of expert support of justice by conducting a forensic examination, which is issued as a forensic report or specialist conclusion. Thus, in civil and criminal proceedings, a specialist can be any person who possesses specific expertise and skills in the relevant field and can provide assistance and conclusions while pre-trial investigation or trial on issues requiring corresponding specific expertise and skills. In the unavailability of approved methods for determining quantitative characteristics of uncertainty of valuation results, specialists in relevant fields of knowledge (appraisers with corresponding expertise and work experience; members of expert councils; representatives of professional self-regulatory organizations of appraisers; scientists in metrology) may be involved in such forensic examinations. These people are holders of specific expertise, they have the right to provide a specialist conclusion and take part in a appropriate proceeding [15]. After all, the current legal framework enables to include the specialist's advisory conclusion in case materials in civil and criminal proceedings based on Article 103 of the Civil Procedural Code [16] and Article 71 of the Criminal

12 Васильєв В. М. Судова експертиза у цивільному та господарському провадженні як окрема форма застосування спеціальних знань. *Теорія та практика судової експертизи і криміналістики*. 2020. Вип. 21. С. 120—132. DOI: 10.32353/khrife.1.2020_08 (date accessed: 17.12.2021).

13 Про внесення змін до деяких законодавчих актів України щодо спрощення досудового розслідування окремих категорій кримінальних правопорушень : Закон України від 22.11.2018 р № № 2617-VIII (зі змін. та допов.). URL: https://zakon.rada.gov.ua/laws/show/2617-19 (date accessed: 17.12.2021).

14 Сімакова-Єфремян Е. Б. До питання про введення у кримінальне процесуальне законодавство поняття «висновок спеціаліста». *Теорія та практика судової експертизи і криміналістики.* 2020. Вип. 20. С. 110—120. DOI: 10.32353/khrife.2.2019.07 (date accessed: 17.12.2021).

15 Ріпенко А. Правові засади проведення судової експертизи / Ліга. Блоги. URL: https://blog.liga.net/user/aripenko/article/25443 (date accessed: 17.12.2021).

16 Цивільний процесуальний кодекс України від 18.03.2004 р. № 1618-IV (зі змін. та допов.). Відомості Верховної Ради України (ВВР). 2004. № 40—41, 42. Ст. 492. URL: https://zakon.rada.gov.ua/laws/show/1618-15 (date accessed: 17.12.2021).

Procedural Code of Ukraine [17]. This direction of combining efforts of forensic experts and specialists can enhance the quality of examination and contribute to the establishment of cooperation between specialists in the development and improvement of the methodological base of expert researches.

Traditional metrological approaches can be used to determine quantitative characteristics of uncertainty of results of economic measurements, and error [18] estimation can be used to quantify the degree of uncertainty. Depending on the sources of uncertainty and a relevant component of an error of the valuation result, these errors can be divided into two groups: errors from uncertainty used to evaluate information and errors from imperfection of valuation methodology. Errors of the first group are manifested in the fact that source data of market information are probabilistic in nature and characterized by variation in certain intervals. The errors of the second group are caused by imperfections and incomplete adequacy of estimation methods, accepted assumptions and limitations, as well as simplified mathematical formulas, results of calculations based on them are approximate and often do not give a sufficiently accurate description of real economic phenomena and processes. Examples of the impact of limited assumptions are, for example, assumptions about the stability of dollar asset prices; about the proportional relationship between their value and a certain pricing factor; about the possibility of determining overhead costs as a percentage of wages, etc. This group of errors also contains possible calculation errors (including rounding). Estimates of random and systematic errors always contain an element of subjectivity. The appraiser makes subjective errors involuntarily (due to limited qualifications, inattention, haste) or intentionally (due to interest, bias or external pressure of a customer). Only an appraiser's adherence to professional ethics can tell him how far he can go in his compromises with his conscience, influencing the final result of valuation. In the literature, one can find quite contradictory information about the achieved accuracy of results of economic measurements, errors in which, according to S. V. Hrybovskyi, range from 5 to 25 %, and sometimes even more. Thus, cost of products sold is measured to an error of 3—5 %, and source data — 10—20 %. Errors in integrated calculations of feasibility studies sometimes reach 30% [19]. According to the results of research on the value of the most expensive brands in the world performed by well-known companies at one single date, numerical indicators of the relative error of valuation results range from 22 to 50% [20].

17 Кримінальний процесуальний кодекс України від 13.04.2012 р. № 4651-VI (зі змін. та допов.). *Відомості Верховної Ради України (ВВР)*. 2013. № 9—10, 11—12, 13. Ст. 88. URL: https://zakon.rada.gov.ua/laws/show/4651-17 (date accessed: 17.12.2021).

18 Керівництво з вираження невизначеності у вимірюваннях. Харків, 2000 ; Тарасова В. В., Малиновський А. С., Рибак М. Ф. Метрологія, стандартизація і сертифікація : підручник. Київ, 2006. 264 с. URL: https://www.kspu.edu/FileDownload.ashx/Tarasova.pdf?id=cf16947b-5c04-42ae-b29f-c3ac6ad40f3e (date accessed: 17.12.2021) ; Кнорринг В. Г., Марамзина М. Г. Метрология, стандартизация, сертификация : учеб. пособ. Санкт-Петербург, 2006. 240 с.

19 Грибовский С. В. Оценка доходной недвижимости : учеб. пособ. для вузов. Санкт-Петербург, 2001. 334 с.

20 Поздняков Ю. В., Садовенко Ю. П. Кількісна оцінка точності визначення вартості об'єктів інтелектуальної власності. *Економіка та суспільство*. 2018. № 19. С. 216. DOI: 10.32782/2524-0072/2018-19-216 (date accessed: 17.12.2021).

In accordance with the current requirements of IVS, the valuation report should include as complete disclosure of the degree of uncertainty of the obtained result as possible. It can be expressed in several ways: verbal description of the appraiser's judgment on the accuracy of this result; justification of the degree of its rounding; submission of a numerical estimate of the error; indicating the confidence level and confidence interval, as well as in any other ways. The appraiser's judgment as a detailed verbal commentary on the degree of uncertainty is the easiest way, but it only shows a subjective qualitative characteristic. Qualitative verbal description is the least comprehensive way to express a judgment on the accuracy of valuation result, but it is better when it is than the total lack of comments in the report on the uncertainty and accuracy of a result. A verbal description provides only an approximate qualitative idea of accuracy, its indicators remain non-quantified, but this formally satisfies the requirements of IVS on description of the result uncertainty.

A fuller description of uncertainty is indication of confidence level and interval (when this data is supported by accuracy analysis calculations), which provides an objective quantitative characteristic. Rounding the calculated value is the most common method used by experienced appraisers to express the degree of uncertainty in a result. The form of result presentation (the degree of its rounding) includes an indication of achieved accuracy. The number of significant figures left after rounding shows the lines of the appraiser's responsibility for the valuation result. According to the rules, the rounding error must not exceed half a unit of the decimal point which is determined by the last non-zero significant figure remaining in the final rounded value of the result. Therefore, erroneous presentation of valuation result in a report without rounding and further use of the unrounded value constitute an interpretive error (accordingly, of an appraiser or a user), which consists in arbitrary expansion of the content of the appraiser's judgment in the sense of misunderstanding attained accuracy. When the appraiser hastily formulates the final result of implemented economic measurements in the same way as the calculated one (with segregated capability of up to UAH 1, and sometimes up to 1 kop.), it is usually mistakenly seen as an indication that the result is accurate to UAH 1 or 1. kop. That's why, such a non-rounded form of presenting the valuation result is not entirely accurate, but the current regulatory framework does not provide grounds for making claims to the appraiser, as IVS does not address the issue of uncertainty, accuracy and rounding of received results.

On the grounds of application of this format of valuation results presentation, sometimes quite fictitious indicators of losses are being formed by the simplest mathematical manipulations, the responsibility for which is unreasonably placed on an appraiser. In fact, this is the result of an elementary misunderstanding while interpretation of the valuation result, which accuracy can never reach the segrerated capability of the calculated result. Technically, it is several orders lower, usually remaining uncertain in neither a report nor an expert conclusion.

For cases where evaluative methodological approaches based on processing of multiple observations (comparative, income) are used in a studied report, objective quantitative characteristics of the degree of uncertainty of the obtained result can be determined ex post facto, in the course of forensic economic examination or review

of a report. The principal task of analyzing uncertainty and accuracy of a result is to determine values of confidence levels and intervals or estimates of result errors on the basis of market data used by an appraiser and their further processing in accordance with the applied mathematical and logical models. The comparison of these quantitative characteristics of uncertainty is a ground for objectively assessing the quality of economic measurements.

Due to the influence of multiple sources of uncertainty, the low level of accuracy of valuation results is the reason for their rather large variance in case of valuation of one valuation object at one valuation date. According to A. Kinh, a recognized worldwide authority in the valuation field, users of valuation reports understand intuitively that each valuation result is a personalized professional judgment that can not be absolutely accurate. The value of a valuation object as a measured parameter of probabilistic nature is characterized by a considerable degree of uncertainty, therefore accurate execution of valuation should include expression of professional opinion by an appraiser both on the result and the degree of uncertainty. If two appraisers receive the same valuation task and work independently, their results may be comparable, but they will never be the same. Such variability is more an advantage than a disadvantage of the valuation procedure [21].

While reviewing reports on valuation, it is expedient to analyze the degree of heterogeneity of the series of observational data of market information and their further processing, which quantitative characteristic is the variation coefficient. In mathematical statistics, there are certain criteria for determining the upper limit of the coefficient of series variation at which it is considered acceptable to use these data for accurate calculation of average estimates. If the coefficient of variation exceeds 33%, it demonstrates a critically high heterogeneity of data and impossibility to use them to determine the value of valuation [22] object. In economic measurements, requirements for homogeneity of series of researched indicators may be less sharp due to availability of a number of uncertainty sources and high volatility of market data. A similar statement about acceptable upper limit of the variation coefficient is outlined by M. L. Lapishko [23], who states that in order to solve tasks of economic analysis, the set is considered to be homogeneous, and evaluation of its average value is reliable if the variation coefficient does not exceed 33 %. A similar limitation is found in the valuation professional literature [24], which states that while valuation based on comparative approach, it can be suggested not to use a model which variation coefficient of series exceeds 33 %. Since in this case we can not assume that these parts are subordinated to the normal distribution law or the one close to it. If the calculated value of the coefficient is about 33 % smaller than the threshold value, then the average value of series is recognized as reliable, and the quality of results of determining the

21 Кинг А. Оценка справедливой стоимости для финансовой отчетности. Новые требования FASB / пер. с англ. Москва, 2011. С. 269.

22 Китаев Н. Н. Групповые экспертные оценки. Москва, 1975. 64 с. ; Соколов Г. А. Математическая статистика : учебник. Москва, 2007. 432 с.

23 Лапішко М. Л. Основи фінансово-статистичного аналізу економічних процесів. Львів, 1995. С. 72.

24 Грибовский С. В. Оценка стоимости недвижимости. Москва, 2009. С. 89.

average single indicator is quite high. Current IVS do not require to provide this indicator in a report, but it is advisable to check its value while forensic examination and review of reports. In particular, for a number of adjusted single indicators of comparison objects while valuation with the help of a comparative approach, since exceeding this indicator is often a sign of incorrect performance of valuation procedures of selecting comparison or adjustment objects. To validate the first one you can use certain techniques [25], for the second one: the following developments [26].

Conclusions

A principal issue while forensic economic examination of independent asset valuation of reports is the degree of uncertainty in received results. To obtain scientifically sound expert conclusions required to create a reliable evidence base, objective quantitative characteristics of the degree of uncertainty (e.g., values of confidence level and intervals or estimates of result errors, and / or indicators associated with them, including coefficient of data series variation) should be defined in a research. Verification of a report under study for compliance with the requirements of current IVS is a necessary but insufficient condition for developing a reasoned judgment on reliability of valuation result.

It should be taken into account that in certain cases, during review and forensic economic examination, it is possible to identify formal violations by the appraiser of the requirements of legal and regulatory framework, but at the same time to obtain a conditionally accurate valuation result. In contrast, there may be situations when there are no direct violations of such requirements in a report, but the valuation

25 Поздняков Ю. В., Лапішко М. Л. Критерій відбору та верифікації вихідних даних при оцінці нерухомості. *Magyar Tudományos Journal*. 2018. № 19. Pp. 5—10 ; Лапішко М. Л., Поздняков Ю. В. Інформаційний критерій максимальної частоти для відбору, верифікації та систематизації ринкової інформації. *Економіка та суспільство*. 2018. № 17. С. 114—119. DOI: 10.32782/2524-0072/2018-17-16 (date accessed: 17.12.2021) ; Поздняков Ю. В., Лапішко М. Л. Використання критерію максимальної вірогідності продажу при відборі даних ринкової інформації. *Економічні науки. Серія «Облік і фінанси»*. 2018. Вип. 15 (57). С. 172—182. DOI: 10.36910/6775-2707-8701-2018-15/57-21 (date accessed: 17.12.2021).

26 Поздняков Ю. В., Лапішко М. Л. Багаторазові непрямі економічні вимірювання як методологічна основа для встановлення невизначеності результату оцінювання вартості. *Приазовський економічний вісник*. 2019. № 5 (16). С. 415—421. DOI: 10.32840/2522-4263/2019-5-71 (date accessed: 17.12.2021) ; Їх же. Коригування на масштаб об'єкта оцінки з застосуванням нелінійного кореляційно-регресійного аналізу даних дослідження ринку. *Економічні студії*. 2019. № 4 (26). С. 141—148 ; Їх же. Абсолютная методическая погрешность метода дисконтированных денежных потоков в контексте информационного подхода. *Экономика и банки*. 2017. № 2. С. 23—31 ; Pozdnyakov Yu. V., Sadovenko Yu. P. (2020). Adjustment coefficients methodical error at economic measurements implementation with the use of comparative sales approach. The role of science in society sustainable development. *Monograph 34*. Katowice, 2020. Pp. 51—61. URL: https://www.wydawnictwo.wst.pl/uploads/files/20ad278a7f-9cbf86ed31d75bdc0730dd.pdf (date accessed: 17.12.2021) ; Поздняков Ю. В., Садовенко Ю. П. Зв'язок коефіцієнта гальмування під час коригування на масштаб зі ступенем невизначеності результату оцінки вартості активів. *Науковий вісник Міжнародного гуманітарного університету. Серія: Економіка і менеджмент*. 2019. Вип. 41. Ч. 1. С. 104—113. DOI: 10.32841/2413-2675/2019-41-14 (date accessed: 17.12.2021).

result can not be viewed as valid [27]. When comparing two (or more) valuation works of one valuation object at one valuation date, it is obligatory to study fulfillment of conditions of comparability in relation to these valuation works and to establish quantitative characteristics of the degree of uncertainty of their results. In another case, results of estimates should be considered as independent implementation of estimates of a random measured quantity lying within the range of its likely values. If there are two valuation works of the same valuation object at the same date, their results should be compared and analyzed given the quantitative indicators of uncertainty and accuracy of independent valuation results while each valuation. The methodology for identifying indicators of the degree of results uncertainty in conditions of several independent valuations is outlined in such works [28]. Research results can be formulated in conclusions of a forensic expert or specialist in accordance with Article 103 of the Civil Procedural Code and Article 71 of the Criminal Procedural Code of Ukraine.

As of today, neither the community of forensic experts nor appraisers nor appraisal users are ready for a conscious perception of the concept of uncertainty in the result of economic measurements performed by independent valuation methods. Although IVS have long promoted the concept of uncertainty, IVS form of presenting valuation results provided so far does not require any quantitative data on the degree of uncertainty in a report. The consequence of this is an extremely paradoxical situation, when results were obtained with an undetermined degree of uncertainty and unknown indicators of accuracy in the course of valuation. To date, IVS apply only the notion of valuation reliability, in no way specifying methods of its objective definition and description. Due to the lack of corresponding methodology developments, the level of reliability of valuation results is predominantly determined on the basis of subjective judgments of reviewers and forensic experts who usually focus only on identifying violations in regulatory requirements but do not have effective tools to objectively evaluate uncertainty.

As practice shows, valuation customers are for the most part unable to assess the valuation result expressed in the form of a confidence interval and a confidence level where the measured quantity of the value is within this interval. An average customer usually wants to get the valuation conclusion only in the form of a point measurement result: one value not burdened with additional data about the assessment of the degree of uncertainty of this result. The same applies to forensic experts and employees of governing and

27 Максимов С. Й. Висновок про достовірність оцінки майна не є гарантією достовірності результату звіту / Асоціація фахівців оцінки (офіційний сайт). 09.03.2016 р. URL: https://afo.com.ua/uk/news/2-general-assessment/1055-opinion-on-the-reliability-of-property-valuation-is-not-a-guarantee-of-reliability-results-report (date accessed: 17.12.2021).

28 Поздняков Ю. В., Скибінська З. М., Гринів Т. Т. Аналітичне обґрунтування методики розрахунку показників невизначеності результату незалежної оцінки вартості активів. *Вісник Одеського національного університету. Економіка.* 2020. Т. 25. Вип. 1 (80). С. 229—235. DOI: 10.32782/2304-0920/1-80-39 (date accessed: 17.12.2021) ; Поздняков Ю. В., Лапішко М. Л. Методика вибору кількості економічних вимірювань вартості при встановленні ступеня невизначеності результатів незалежної експертної оцінки / *Сучасні підходи до соціально-економічного, інформаційного та науково-технічного розвитку суб'єктів національного господарства* : монографія / за ред. Л. М. Савчук, Л. М. Бандоріної. Дніпро, 2020. С. 394—415.

supervisory authorities who focus primarily on the requirements of somewhat outdated current national regulatory framework for valuation, where the concept of uncertainty of its outcome is not even mentioned. Also, the notion of the uncertainty interval of this result is frequently misunderstood by valuation users, as the majority of them are unfamiliar with the basic principles of the measurement theory. Interval form of presenting economic measurement results is unacceptable in particular for accounting and bank valuation purposes (where any uncertainty of received value of assets is not permissible at all and the appraiser is obliged to tackle the almost impossible task of obtaining absolutely accurate value to an error lower than ± 1 kop.) .

Therefore, we deem it expedient to focus on modern approaches of IVS while forensic economic examinations that enable to objectively quantify the degree of uncertainty in valuation results. Submission of quantitative characteristics of report result uncertainty in an expert conclusion allows to specify statements for which the appraiser is responsible. If it was not included in a report, it means that the appraiser neglected the opportunity to limit the possibility of arbitrary interpretation of his professional judgment, which content he can prove mathematically. IVS do not require to present uncertainty characteristics in a report, but in this way the appraiser can separate his / her own evidential statements from the misleading ones that are provided only under specific conditions. It also excludes the possibility of arbitrary expanded interpretation of the appraiser's statements by other persons and eliminates the possibility of possible attempts to hold the appraiser responsible for expanded interpretation of his conclusions.

Identification of uncertainty characteristics in an expert conclusion will help to increase the degree of objectivity in forensic economic examination. After all, there are many cases when the court may make an unjust decision based on results of submitting expert research with incomplete or biased conclusions to the court. As a judge does not posses specific expertise, he cannot always thoroughly study and analyze a provided expert conclusion. It is what necessitates verifying compliance with an accuracy of the research algorithm and using scientifically sound research methods. This can be ensured by involving a specialist in the relevant field and reviewing expert conclusion or expert research of a specialist. The forensic examination conclusion is an independent procedural document received while forensic examination, it must include information synthesized within the competence of the forensic expert that was obtained using special scientific methods specifically in the course of research. The forensic report must meet the main criteria for evidence evaluation: relevance, admissibility, reliability and sufficiency [29]. If questions addressed to the forensic expert are developed as above, sufficiency condition of the expert conclusion as valid evidence should be deemed quantification of the value of an object and characteristics of uncertainty of results submitted in a studied report and obtained by a forensic expert.

Gradual implementation of current IVS requirements in the practice of forensic examination and review of valuation works, which require greater specification of the degree of uncertainty in obtained results, will ensure application of uniform unified methodological approaches in forensic expert practice, improve the quality and

29 Жеребко О. І. Висновок експерта: актуальні питання / *Судова експертиза: проблеми сьогодення та перспективи розвитку* : кол. моногр. Дрогобич, 2020. С. 48—54.

objectivity of expert researches, reduce the complexity of forensic examinations and enhance efficiency of their conduct [30]. It can be practically implemented by identification of quantitative indicators of quality in results of economic measurements with the development of a reasoned judgment by the forensic expert on the degree of uncertainty based on information and metrological evaluation paradigm [31].

Проблемні питання виконання судово-економічних експертиз звітів із незалежної експертної оцінки вартості активів

Юрій Поздняков, Ігор Братішко

Досліджено методичні засади проведення судово-економічних експертиз звітів з економічних вимірювань, які виконують методами незалежної оцінки вартості активів. Метою статті є висвітлення проблемних питань судово-економічних експертиз зі встановлення показників вартості активів, отриманих у результаті виконання економічних вимірювань методами незалежної експертної оцінки. Розглянуто проблемні питання обґрунтування методики кількісного встановлення ступеня невизначеності результатів оцінки на основі ймовірнісно-метрологічного підходу, що базується на застосуванні інтервальної форми представлення результату оцінки. Виконано порівняльний аналіз вимог національних і міжнародних стандартів оцінки до опису невизначеності результатів оцінки. Продемонстровано, що застосування порівняльного та прибуткового підходів дає змогу встановити показники невизначеності для заданих рівнів довірчої імовірності у вигляді чисельних значень меж довірчого інтервалу на підставі статистичної обробки множинних даних рядів ринкової інформації (зокрема, скоригованих одиничних показників пропозицій продажу або орендних ставок подібного майна). Представлено ознаки та сформульовано умови коректності виконання цих економічних вимірювань.

Ключові слова: *незалежна експертна оцінка; судово-економічна експертиза звіту; економічні вимірювання; похибка; точність; достовірність; невизначеність результату оцінки.*

Проблемные вопросы выполнения судебно-экономических экспертиз отчётов о независимой экспертной оценке стоимости активов

Юрий Поздняков, Игорь Братишко

Исследованы методические основы проведения судебно-экономических экспертиз отчётов об экономических измерениях, выполняемых методами независимой оценки стоимости активов. Целью статьи является освещение проблемных вопросов судебно-экономических экспертиз по установлению показателей стоимости активов, полученных в результате выполнения экономических измерений методами независимой экспертной оценки. Рассмотрены проблемные вопросы обоснования методики количественного установления степени неопределённости результатов оценки на основе вероятностно-метрологического подхода, основанного на применении интервальной формы представления результата оценки. Выполнен сравнительный анализ требо-

30 Бондар В. М. Визначення вартості машин та обладнання, що не представлені на внутрішньому ринку України. *Криминалистика и судебная экспертиза*. 2015. Вип. 60. С. 449—460. URL: https://nbuv.gov.ua/UJRN/krise_2015_60_47 (date accessed: 17.12.2021).

31 Pozdnyakov Yu., Lapishko M. The use of informative-metrological paradigm in independent expert valuation theory. *Monograph 27*. Information and Innovation Technologies in Economics and Administration. Katowice, 2019. Pp. 80—88.

ваний национальных и международных стандартов оценки, предъявляемых к описанию неопределённости результатов оценки. Продемонстрировано, что применение сравнительного и доходного подходов позволяет установить показатели неопределённости для заданных уровней доверительной вероятности в виде числовых значений границ доверительного интервала на основании статистической обработки множественных данных рядов рыночной информации (в частности, скорректированных единичных показателей предложений продажи или ставок аренды подобного имущества). Представлены признаки и сформулированы условия корректности выполнения этих экономических измерений.

Ключевые слова: *независимая экспертная оценка; судебно-экономическая экспертиза отчёта; экономические измерения; погрешность; точность; достоверность; неопределённость результата оценки.*

Funding
This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Disclaimer
The funders had no role in the study design, data collection and analysis, decision to publish, or preparation of the manuscript.

Contributors
The authors contributed solely to the intellectual discussion underlying this paper, case-law exploration, writing and editing, and accept responsibility for the content and interpretation.

Declaration of Competing Interest
The authors declares that he has no conflict of interest.

References

Baldzhy, M. D. (2015). *Ekonomichnyi ryzyk ta metody yoho vymiriuvannia* [Economic risk and methods of its measurement] : navch. posib. Kharkiv [in Ukrainian].

Bondar, V. M. (2015). Vyznachennia vartosti mashyn ta obladnannia, shcho ne predstavleni na vnutrishnomu rynku Ukrainy [Valuation of machines and equipment, which are not represented in the Ukrainian domestic market]. *Krymynalystyka y sudebnaia ekspertyza.* Vyp. 60. URL: https://nbuv.gov.ua/UJRN/krise_2015_60_47 [in Ukrainian].

Chalyi, V. P. (2006). Neopredelennost i pogreshnost, ikh skhodstvo, razlichie i upotreblenie v raznykh metrologicheskikh protsedurakh [Uncertainty and error, their similarity, difference and use in different metrological procedures]. *Systemy obrobky informatsii.* Vyp. 7 (56). URL: https://nbuv.gov.ua/UJRN/soi_2006_7_27 [in Russian].

Gribovskii, S. V. (2001). *Otsenka dokhodnoi nedvizhimosti* [Valuation of profitable real estate] : ucheb. posob. dlia vuzov. Sankt-Peterburg [in Russian].

Gribovskii, S. V. (2009). *Otsenka stoimosti nedvizhimosti* [Real estate valuation]. Moskva [in Russian].

Harazha, O. P. (2016). Standartyzatsiia otsinky maina u sviti [Standardization of property valuation in the world]. *Naukovyi visnyk Mizhnarodnoho humanitarnoho universytetu. Seriia «Ekonomika i menedzhment»*. Vyp. 17. URL: https://nbuv.gov.ua/UJRN/Nvmgu_eim_2016_17_10 [in Ukrainian].

Horlachuk, O. A. (2021). Teoretyko-metodolohichni zasady sudovoi ekonomichnoi ekspertyzy [Theoretical and methodological foundations of forensic economics]. *Teoriia ta praktyka sudovoi ekspertyzy i kryminalistyky*. Vyp. 23. DOI: 10.32353/khrife.1.2021.23 [in Ukrainian].

Kerivnytstvo z vyrazhennia nevyznachenosti u vymiriuvanniakh [Guide to expressing uncertainty in measurements] (2000). Kharkiv [in Ukrainian].

King, A. (2011). *Otsenka spravedlivoi stoimosti dlia finansovoi otchetnosti. Novye trebovaniia*

FASB [Fair value estimation for financial reporting. FASB New requirements] / per. s angl. Moskva [in Russian].

Kitaev, N. N. (1975). *Gruppovye ehkspertnye otsenki* [Group expert valuations] : uchebnik. Moskva [in Russian].

Knorring, V. G., Maramzina, M. G. (2006). *Metrologiia, standartizatsiia, sertifikatsiia* [Metrology, standardization and certification] : ucheb. posob. Sankt-Peterburg [in Russian].

Lapishko, M. L. (1995). *Osnovy finansovo-statystychnoho analizu ekonomichnykh protsesiv* [Fundamentals of financial and statistical analysis of economic processes]. Lviv [in Ukrainian].

Lapishko, M. L., Pozdniakov, Yu. V. (2018). Informatsiinyi kryterii maksymalnoi chastoty dlia vidboru, veryfikatsii ta systematyzatsii rynkovoi informatsii [Maximal frequency information criterion for selection, verification and systematization of the market information data]. *Ekonomika ta suspilstvo*. № 17. DOI: 10.32782/2524-0072/2018-17-16 [in Ukrainian].

Lukianova, V. V. (2017). Dualizm nevyznachenosti ta ryzyku v ekonomichnykh yavyshchakh [Dualism of vagueness and risk is in the economic phenomena]. *Visnyk Khmelnytskoho natsionalnoho universytetu.* № 2 (2). URL: https://nbuv.gov.ua/UJRN/Vchnu_ekon_2017_2%282%29__46 [in Ukrainian].

Lytvynenko, T. M. (2009). Nevyznachenist rynkovoho seredovyshcha ta shliakhy yii lokalizatsii [Uncertainty of the market environment and ways of its localization.]. *Teoretychni ta prykladni pytannia ekonomiky* : zb. nauk. pr. KNU im. T. H. Shevchenka. T. 19. URL: https://tppe.econom.univ.kiev.ua/data/2009_19/zb19_07.pdf [in Ukrainian].

Maksymov, S. Y. (2016). *Vysnovok pro dostovirnist otsinky maina ne ye harantiieiu dostovirnosti rezultatu zvitu* [The conclusion on reliability of the property valuation is not a guarantee of report result reliability] / Asotsiatsiia fakhivtsiv otsinky (ofitsiinyi sait). URL: https://afo.com.ua/uk/news/2-general-assessment/1055-opinion-on-the-reliability-of-property-valuation-is-not-a-guarantee-of-reliability-results-report [in Ukrainian].

Pozdniakov, Iu. V., Lapishko, M. L. (2017). Absoliutnaia metodicheskaia pogreshnost metoda diskontirovannykh denezhnykh potokov v kontekste informatsionnogo podkhoda [Maximal sale probability criterion using for primary market information data selection]. *Ehkonomika i banki*. № 2 [in Russian].

Pozdniakov, Yu. V. (2021). *Nevyznachenist rezultatu nezalezhnoi ekspertnoi otsinky* [Uncertainty of the result of independent expert valuation] : monohrafiia. LAP Lambert Academic Publishing [in Ukrainian].

Pozdniakov, Yu. V., Lapishko, M. L. (2018). Kryterii vidboru ta veryfikatsii vykhidnykh danykh pry otsintsi nerukhomosti [Criteria for selection and verification of source data in real estate appraisal]. *Magyar Tudományos Journal*. № 19 [in Ukrainian].

Pozdniakov, Yu. V., Lapishko, M. L. (2018). Vykorystannia kryteriiu maksymalnoi virohidnosti prodazhu pry vidbori danykh rynkovoi informatsii [Maximal sale probability criterion using for primary market information data selection]. *Ekonomichni nauky. Seriia «Oblik i finansy»*. Vyp. 15 (57). DOI: 10.36910/6775-2707-8701-2018-15/57-21 [in Ukrainian].

Pozdniakov, Yu. V., Lapishko, M. L. (2019). Bahatorazovi nepriami ekonomichni vymiriuvannia yak metodolohichna osnova dlia vstanovlennia nevyznachenosti rezultatu otsiniuvannia vartosti [Multiple indirect economic measurements as methodological base for valuation results uncertainty degree determination]. *Pryazovskyi ekonomichnyi visnyk*. № 5 (16). DOI: 10.32840/2522-4263/2019-5-71 [in Ukrainian].

Pozdniakov, Yu. V., Lapishko, M. L. (2019). Koryhuvannia na masshtab obiekta otsinky z zastosuvanniam neliniinoho koreliatsiino-rehresiinoho analizu danykh doslidzhennia rynku [Valuation object size adjustment with the use of market data research nonlinear cross-correlation regressive analysis]. *Ekonomichni studii*. № 4 (26) [in Ukrainian].

Pozdniakov, Yu. V., Lapishko, M. L. (2020). Metodyka vyboru kilkosti ekonomichnykh vymiriuvan vartosti pry vstanovlenni stupenia nevyznachenosti rezultativ nezalezhnoi ekspertnoi otsinky [The method of choosing the number of economic measurements of value while establishing the degree of uncertainty of results independent expert valuation] / *Suchasni pidkhody do sotsialno-ekonomichnoho, informatsiinoho ta naukovo-tekhnichnoho rozvytku sub'iektiv natsionalnoho hospodarstva* : monohrafiia / za red. L. M. Savchuk, L. M. Bandorinoi. Dnipro [in Ukrainian].

Pozdniakov, Yu. V., Sadovenko, Yu. P. (2018). Kilkisna otsinka tochnosti vyznachennia vartosti obiektiv intelektualnoi vlasnosti [Quantitative estimation of intellectual property objects evaluation accuracy]. *Ekonomika ta suspilstvo*. № 19. DOI: 10.32782/2524-0072/2018-19-216 [in Ukrainian].

Pozdniakov, Yu. V., Sadovenko, Yu. P. (2019). Zviazok koefitsiienta halmuvannia pid chas koryhuvannia na masshtab zi stupenem nevyznachenosti rezultatu otsinky vartosti aktyviv [Scale factor relationship with assets valuation result uncertainty degree at object size adjustment]. *Naukovyi visnyk Mizhnarodnoho humanitarnoho universytetu. Seriia: Ekonomika i menedzhment.* Vyp. 41. Ch. 1. DOI: 10.32841/2413-2675/2019-41-14 [in Ukrainian].

Pozdniakov, Yu. V., Skybinska, Z. M., Hryniv, T. T. (2020). Analitychne obgruntuvannia metodyky rozrakhunku pokaznykiv nevyznachenosti rezultatu nezalezhnoi otsinky vartosti aktyviv [Mathematical principles analytical ground of assets independent valuation results uncertainty degree indexes calculation methodology]. *Visnyk Odeskoho natsionalnoho universytetu. Ekonomika*. T. 25. Vyp. 1 (80). DOI: 10.32782/2304-0920/1-80-39 [in Ukrainian].

Pozdnyakov, Yu. V., Sadovenko, Yu. P. (2020). Adjustment coefficients methodical error at economic measurements implementation with the use of comparative sales approach. The role of science in society sustainable development. *Monograph 34*. Katowice. URL: https://www.wydawnictwo.wst.pl/uploads/files/20ad278a7f9cbf86ed31d75bdc0730dd.pdf [in Ukrainian].

Pozdnyakov, Yu., Lapishko, M. (2019). The use of informative-metrological paradigm in independent expert valuation theory. *Monograph 27*. Information and Innovation Technologies in Economics and Administration. Katowice [in Ukrainian].

Ripenko, A. *Pravovi zasady provedennia sudovoi ekspertyzy* [Legal principles of conducting forensic examination] / Liha. Blohy. URL: https://blog.liga.net/user/aripenko/article/25443 [in Ukrainian].

Simakova-Yefremian, E. B. (2020). Do pytannia pro vvedennia u kryminalne protsesualne zakonodavstvo poniattia «vysnovok spetsialista» [On the issue of introduction of the concept of specialist's conclusion into criminal procedural legislation]. *Teoriia ta praktyka sudovoi ekspertyzy i kryminalistyky*. Vyp. 20. DOI: 10.32353/khrife.2.2019.07 [in Ukrainian].

Sokolov, G. A. (2007). *Matematicheskaia statistika* [Math Statistics] : uchebnik. Moskva [in Russian].

Tarasova, V. V., Malynovskyi, A. S., Rybak, M. F. (2006). *Metrolohiia, standartyzatsiia i sertyfikatsiia* [Metrology, standardization and certification] : pidruchnyk. Kyiv. URL: https://www.kspu.edu/FileDownload.ashx/Tarasova.pdf?id=cf16947b-5c04-42ae-b29f-c3ac6ad40f3e [in Ukrainian].

Vasylenko, I. F. (2016). Vplyv kontseptsii nevyznachenosti vymiriuvan na metrolohichnu diialnist [Influence of the concept of measurement uncertainty on metrological activity]. *Naukovi zapysky*. Vyp. 19. URL: https://dspace.kntu.kr.ua/jspui/bitstream/123456789/4329/1/5__19_2016-59-69.pdf [in Ukrainian].

Vasyliev, V. M. (2020). Sudova ekspertyza u tsyvilnomu ta hospodarskomu provadzhenni yak okrema forma zastosuvannia spetsialnykh znan [Forensic science in civil and commercial proceedings as a separate form of specific expertise application]. *Teoriia ta praktyka sudovoi ekspertyzy i kryminalistyky*. Vyp. 21. DOI: 10.32353/khrife.1.2020_08 [in Ukrainian].

Vitlinskyi, V. V., Nakonechnyi, S. I., Sharapov, O. D. (1996). *Ekonomichnyi ryzyk i metody yoho vymiriuvannia* [Economic risk and methods of its measurement] : pidruchnyk. Kyiv [in Ukrainian].

Vitlinskyi, V. V., Velykoivanenko, H. I. (2004). *Ryzykolohiia v ekonomitsi ta pidpryiemnytstvi* [Riskology in economics and business] : monohrafiia. Kyiv, 2004. [in Ukrainian].

Vvedenie k «Rukovodstvu po vyrazheniiu neopredelennosti izmereniia» i soputstvuiushchim dokumentam. Otsenivanie dannykh izmerenii [Introduction to "The guidelines for the expression of measurement uncertainty" and relevant documents. Estimation of measurement data] (2011) / per. s angl. ; pod nauch. red. prof. V. A. Slaeva, A. G. Chunovkinoi. Sankt-Peterburg [in Russian].

Zhadan, T. A., Zhadan, Yu. V. (2018). Suchasni naukovi pidkhody do rozuminnia ekonomichnoho zmistu poniattia «ryzyk» [Modern scientific approaches to understanding economic content concept "risk"]. *Prychornomorski ekonomichni studii.* Vyp. 33. URL: https://nbuv.gov.ua/UJRN/bses_2018_33_17 [in Ukrainian].

Zherebko, O. I. (2020). Vysnovok eksperta: aktualni pytannia [Expert's statement: actual aspects] / *Sudova ekspertyza: problemy sohodennia ta perspektyvy rozvytku* : kol. monohr. Drohobych [in Ukrainian].

Pozdnyakov, Yu., Bratishko, I. (2022). Challenging issues of performing forensic economic examinations of reports on independent expert valuation of asset value. *Theory and Practice of Forensic Science and Criminalistics.* Issue 1 (26). P. 108—124. DOI: 10.32353/khrife.1.2022.07.