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Abstract. The article summarizes the arguments and counterarguments within the scientific discussion on the relationship between shadow economic processes and corruption schemes in the country. The main purpose of the study is a retrospective and current analysis of the scientific publications on anti-corruption and the shadow economy at the international level based on the SciVal and VOSViewerv. The urgency of solving this scientific problem is to move from the traditional review of scientific publications to the innovative approach, which involves establishing cross-cutting issues, interdisciplinary and interethnic relations in the study of the scientific problems. The relationship between the corruption level in the country and the scale of the shadow economy is studied in the following logical sequence: determining the dynamics of scientific articles on anti-corruption issues and shadow processes; establishment of the most cited scientific papers and publications on certain issues; analysis of research areas in SciVal, identification of promising areas of research on selected topics. Data from the Scopus scientometric database for the period 1996—2021 were used to monitor scientific publications covering the interaction of corruption with shadow economic processes. 4696 scientific publications on certain issues were selected for bibliometric analysis. On average, about 40% of publications on corruption and the shadow economy are published by European scholars. The article finds that 15% of publications devoted to corruption and shadow activities belong to the cluster «Monetary policy; economic growth; export», the radiance level of 94,448. Between 2011 and 2020, researchers at the University of Sheffield (UK), Oxford University (UK), and the Australian National University (Australia) published the largest number of scientific papers studying the relationship between corruption and the shadow economy. Based on the analysis of metadata of scientific publications via VOSViewerv, four content clusters were identified. The study theoretically proves that corruption and shadow economy are complex and multifaceted phenomena that can both complement and condition each other and have a systemically important impact on the pace of the country's socio-economic development.

Keywords: shadow economy, corruption, bibliometric analysis, illegal activity, cluster.

JEL Classification D73, O17, P43

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ЗВ'ЯЗОК МІЖ ТІНЬОВОЮ ЕКОНОМІКОЮ І КОРУПЦІЄЮ: БІБЛІОМЕТРИЧНИЙ АНАЛІЗ

Анотація. Узагальнено аргументи і контраргументи в межах наукової дискусії з питання взаємозв'язку між тіншовими економічними процесами і корупційними схемами в країні. Основною метою проведеного дослідження є ретроспективний і поточний аналіз стану наукових публікацій, присвячених проблемам протидії корупції та тіншової економіки, на міжнародному рівні на основі використання сервісу SciVal та VOSViewerv. Актуальність розв'язання наукової проблеми полягає в необхідності переходу від традиційного огляду наукових публікацій до новітнього підходу, що передбачає встановлення крос-тематик, а також міждисциплінарних та міжнаціональних зв'язків при дослідженні обраної наукової проблематики. Дослідження питання взаємозв'язку між рівнем корупції у країні та масштабами тіншової економіки здійснено в такій логічній послідовності: визначення динаміки наукових статей, присвячених проблемам протидії корупції та тіншових процесам; установа найбільш цитованих наукових статей і видань з визначеної проблематики; проведення аналізу дослідницьких областей у SciVal, установа перспективних напрямів дослідження обраної проблематики. Для моніторингу наукових публікацій, у яких висвітлюється питання взаємодії корупції з тіншовими економічними процесами, використано дані наукометричної бази Scopus за період 1996—2021 рр. Для проведення бібліометричного аналізу відібрано 4 696 наукових публікацій з визначеної проблематики. У середньому близько 40 % публікацій, присвячених дослідженню корупції та тіншової економіки, опубліковано вченими з країн Європи. Установлено, що 15 % публікацій, які присвячені питанням корупції та тіншової діяльності, належать до кластера «Грошово-кредитна політика; економічне зростання; експорт», рівень промінентності якого становить 94,448. За період 2011—2020 рр. науковці Шеффілдського університету (Великобританія), Оксфордського університету (Великобританія), Австралійського національного університету (Австралія) опублікували найбільшу кількість наукових праць, присвячених дослідженню зв'язку між корупцією і тіншовою економікою. На основі аналізу метаданих наукових публікацій виокремлено чотири змістовні кластери з використанням інструментарію VOSViewerv. Дослідження теоретично доводить, що корупція та тінзація економіки є складними та багатоаспектними явищами, які можуть як взаємодоповнювати, так і взаємообумовлювати один одного, а також мають системно важливий вплив на темпи соціально-економічного розвитку країни.

Ключові слова: тіншова економіка, корупція, бібліометричний аналіз, кластер, нелегальна діяльність.

Формул: 0; рис.: 4; табл.: 2; бібл.: 21.

Introduction. Shadow economic processes and corruption schemes in the country hinder the expanded reproduction, increase the differentiation of incomes and social tensions, weaken the levers of public administration and restrain economic development. Despite the long history of corruption and the shadow economy in various countries worldwide, no effective mechanism has yet been found to combat these destructive processes since, in practice, methods and tools for committing these illegal acts are constantly being improved. It necessitates the study of current trends in the implementation of illegal economic transactions and mechanisms to combat them.

Corruption and the shadow economy are complex and multifaceted processes that can complement each other and be interdependent. In particular, Cockcroft and Tauris [1] substantiate in their study that the shadow economy is one of the most important obstacles to any effective anti-corruption measures in the country.

The purpose of this article is a retrospective and current analysis of the scientific publications on anti-corruption and the shadow economy at the international level based on the use of SciVal and VOSViewerv. 1.6.10 [2].

Literature review and the problem statement. Problems of shadow economy development, its place in the national economic system, and the constructive and destructive potential ratio do not lose relevance and still cause active scientific discussions.

The imperfection and «manageability» of state control and supervision bodies and bureaucratization, create favorable conditions for the import and export of smuggled goods, trade in prohibited goods across the state border, encouraging the illegal movement of capital and withdrawal of financial assets abroad [3; 4]. Based on data from 47 countries, it is empirically proven that the higher the regulation level of the goods market, the lower the level of corruption perception in the studied countries [5].

The investigation of Kaya et al. [6] compares the crisis with the post-crisis period and finds that informal payments have decreased significantly since the end of the global economic crisis.

Corruption is a destabilizing factor in developing economic relations, contributing to the unfair competitive conditions for businesses, increasing the unequal distribution of income among the population, etc. In particular, the author proved that a high level of corruption perception in the country leads to a decrease in foreign investment [7]. Furthermore, numerous works have empirically proven the destructive impact of shadow economic processes on the pace of innovative development of the country and access to free financial resources [8; 9].

One of the determinants of the corruption development in the state is the availability of unique natural resources. Thus, the paper emphasizes that in countries with an «autocratic regime» to obtain a license for international mining companies, it is necessary to provide illegal benefits to government officials, which stimulates the development of the illegal sector of the country's economy [10].

One of the main tools for shadowing the economy is taxes. So, the work devoted to the assessment of the volume of tax gaps in terms of export-import activities and their impact on the country's economic development deserves special attention. According to the results of calculations, it is established that Ukraine has the highest index of asynchrony of export-import activity with Cyprus and the Solomon Islands [11].

The paper empirically confirms the hypothesis that the lower the corruption perception in the public sector, the higher the tax morale of its citizens. In particular, the average European citizen's tax morale is 12 % lower than in the Member States with the lowest corruption perceptions in the public sector, but 11 % higher than in the EU countries with the highest corruption perceptions [12].

Juarez-Garcia [13] argues that there is a dual nature of the corruption implementation schemes: the first level — corruption among government officials, the second level — the legal framework imperfection, which allows for illegal activities and lack of proper punishment for it. In order to monitor the effectiveness of public policy to combat shadow processes in the country, the methodological approach to assessing the level of effectiveness of tax instruments of state regulation of the economy based on the use of fuzzy logic [14].

Special attention should be paid to research on the psychological aspects regarding the perception of illegal actions by country's citizens. Scientists Williams and Onoshchenko [15] conducted a study that included a survey of medical service consumers in public utilities in Mykolayiv and found that 88% of respondents positively perceive the use of interpersonal relationships to bypass formal procedures only 12 percent — have a negative attitude to such practices. According to the authors of the article, this positive perception leads to a deterioration in the quality features of social capital. The paper also confirms the relationship between corruption and shadow schemes in the country and social capital development. It is proved that strong social capital in the country contributes to strengthening control over corruption and shadow economic activity, and this effect is more typical for developed countries.

Guerrero and Urbano [16] proved that formal (state programs) and informal institutions (corruption, extortion and illegal trade) have a statistically significant impact on the development of technological initiatives of enterprises to protect victimization.

A variety of practical tools, namely VOSviewer [17—19] and SciVal [20; 21] are used for bibliometric analysis.

Research results. Bibliometric analysis of scientific publications was carried out in the following logical sequence: determining the dynamics of scientific articles on the problems of combating corruption and shadow processes; establishment of the most cited scientific papers and

publications on certain issues; analysis of research areas in SciVal; establishment of perspective directions of research on the chosen problem; trends' identification of research on anti-corruption and shadow economy using the tools VOSViewerv.1.6.10.

In the framework of this study, it is assumed that corruption and shadow economy are interdependent and complementary processes in many countries' economy. This assumption necessitated a comprehensive and comprehensive analysis of this interaction in the scientific literature.

During the accumulation of large data arrays on the scientific publications, it becomes possible to analyze current scientific activities using many modern information resources and tools, comprehensively exploring various aspects and comparing them with similar indicators of individual scientists, organizations, benchmarks, countries, and regions in the world. The peculiarity of this study is the transition from the traditional review of scientific publications to the innovative approach, which involves the establishment of cross-cutting issues, interdisciplinary and interethnic relations in the study of certain scientific issues.

One of the tools for monitoring scientific publications included in the scientometric database Scopus is SciVal, which enables to analyze research on more than 20 different metrics and assess the prominence level of the chosen scientific field.

Within the framework of this work, the scientific direction is analyzed, which includes the study of the corruption interaction and the shadow economy (in 4 versions of the translation). According to the results of the search queries, it was established that during 1996—2021 in the scientometric database, Scopus published 4 696 publications on this issue (Fig. 1).

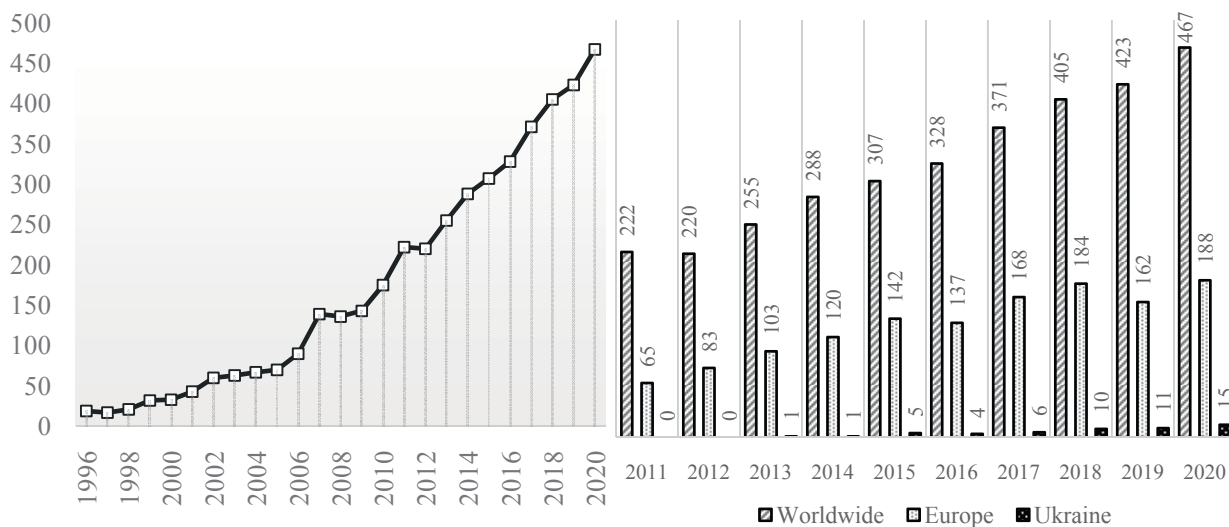


Fig 1. Dynamics of the scientific publications in the scientometric database Scopus on «shadow economy & corruption»: a) the number of publications; b) geographical distribution of publications.

Source: systematized by the authors based on SciVal data.

The data in Fig. 1 visually show a steady increase in the relevance of the chosen area in the research, namely during 1996—2020, on average, the number of publications in the Scopus database on this issue increased by 11 % annually.

During the last 25 years, there have been some peak periods of scientists' growing interest in the study of this issue: 2007 (growth rate compared to the previous period — 54.4 %), 1999 (52,4 %), and 2002 (39,5 %). On average, about 40 % of publications on corruption and the shadow economy are published by European scholars. The share of scientists from Ukraine who deal with this issue is only 3.2 %.

The interdisciplinary articles, included in our sample, confirm the chosen scientific direction relevance. During 2011—2020, the largest number of publications on this issue (39 % of the total)

refers to the field of «social sciences», while 27 % — to «economics and business», while about a third of publications have related fields (Fig. 2). Thus, the chosen scientific issues are still most intensively intertwined with the humanities.

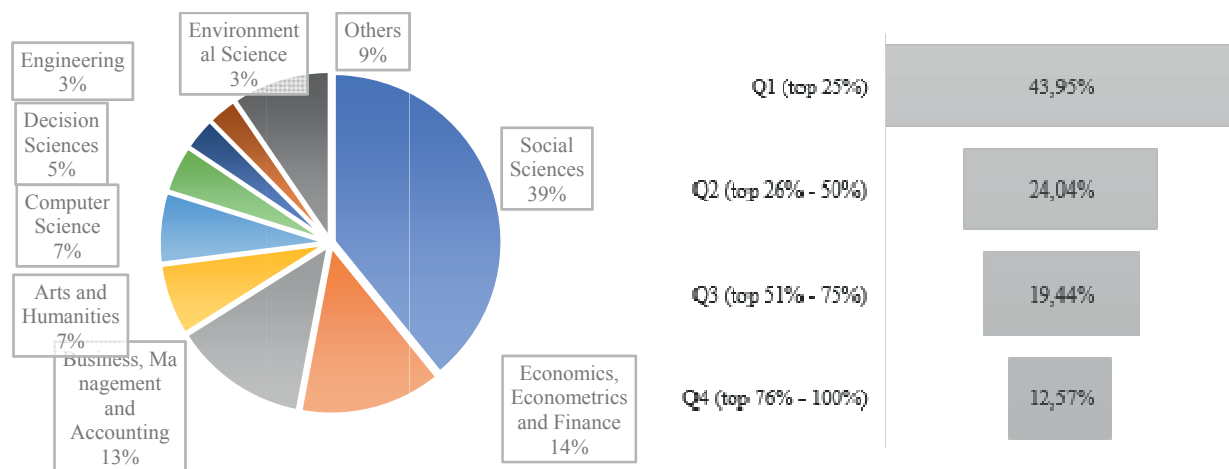


Fig. 2. The structure of the topics of the articles

Source: systematized by the authors based on SciVal data.

The data in Fig. 2 clearly show that 43.95 % of publications on the studied issues were published in scientific journals of Q1 rating, while 24.04 % — in Q2.

SciVal service determines the number of publications on this issue and their geography and assesses the chosen scientific field relevance based on the radiance indicator (Topics Prominence). «Prominence» in SciVal is an algorithm that analyzes an array of publications from the Scopus database, combines them into thematic clusters/topics and assigns a numerical index to each topic (maximum value — 100). The higher the radiance index, the greater the importance of this area in the world scientific community. The Table 1 shows the main thematic clusters, in the context of which works on corruption and the shadow economy are published.

Table 1

The top five thematic clusters in SciVal in terms of which most articles on the researched issues for the period 2011—2020 are published

Cluster		Prominence percentile	Scholarly Output	Publication Share	Share in the sample section, %	Growth rate, %
ID	Name					
TC.21	Monetary Policy; Economic Growth; Exports	94,448	519	0,55	15,79	+207,6
TC.920	Taxes; Tax Evasion; Tax Compliance	42,876	129	1,21	3,93	+521,2
TC.56	Corporate Social Responsibility; Corporate Governance; Firms	97,458	124	0,17	3,77	+365,7
TC.172	Party; Election; Voter	88,027	119	0,23	3,62	+12,4
TC.637	Research; Technology; Industry	80,268	107	0,47	3,26	+76,9

Source: systematized by the authors based on SciVal data.

According to the study, it was found that 15% of publications on corruption and shadow activities belong to the cluster «Monetary policy; economic growth; export». It is worth noting that the radiance level of this cluster is 94,448, which indicates the study relevance on corruption and shadow economic activity in the context of the monetary policy and economic growth strategy implementation. The study of corruption and illegal activities in the context of tax policy (cluster

TC.920) has the lowest level of radiance (42,876) among the top five thematic clusters in SciVal, while the number of publications in this thematic cluster during 2011—2020 increased by 521,2 %.

A decrease in the scientists' publishing activity by 49,2 %, 56,6 % and 72,5 %, respectively, proves the loss of relevance of the study on corruption and illegal activities in the context of such clusters as «Media. News. Journalism (TS.279)», «Conflict, Peace, War (TS.489)», «Terrorism, Organized Crime, Radicalism».

Within the framework of this research, the study of the scientists' works who observe the corruption and shadow activity, their synergy attracts special attention. According to the analysis of the scientometric database Scopus, it was established that during 2011—2020 the largest number of works on this topic (22 works) was published by the American scientist K. Williams (*Table 2*).

Table 2

**Top scientists on the researched problems in the world
for the period 2011—2020**

Name	Country	Quality		Name	Country	Quality	
		publications	citations			publications	citations
Williams C. C.	United Kindom	22	405	Goel R. K.	USA	8	135
Urbano D.	Spain	4	283	Polese A.	Ireland	6	130
Winters M. S.	USA	8	226	Schneider F.G.	Austria	7	128
Weitz-Shapiro R.	USA	5	185	Chan A.P.C.	Hong Kong	8	121
Puffer S.M.	USA	3	179	Zhu J.	Hong Kong	4	111
Pande R.P.	USA	3	158	Beaulieu E.	USA	3	106
Villoria M.	Spain	4	157	Barnes T.D.	USA	3	106
Jiménez F.	Spain	4	157	Saunoris J.W.	USA	9	103

Source: systematized by the authors based on SciVal data.

Guerrero and Urbano (2020) believe that companies are more likely to work in the informal economy sector due to the country's imperfect institutional environment. The paper evaluates the integrated indicator of business entities' informalization using logistic regression. It considers the individual features of the head and the institutional and structural conditions of their operation within the country. Accordingly, one of the institutional environment indicators is the corruption level in the public sector of the economy.

Research centers and universities from around the world deal with the fight against corruption and the shadow economy. During the period 2011—2020, scientists from the University of Sheffield (UK), Oxford University (UK), the Australian National University (Australia) published 28 papers each (*Fig. 3*). Although representatives from the University College London have published 20 scientific publications on this issue, citations are the highest (4.08) among the analyzed higher education institutions. It is also worth noting that the list of leading universities, the scientists of which deal with this issue, includes two Russian institutions — the Russian Academy of Sciences and the Higher School of Economics. Despite the significant number of works on this issue (about 20), the citation of these works is quite low (about 0.4). For comparison, the level of citations is quite high at Sumy State University, having only ten scientific papers in the field of corruption and the shadow economy (1.52).

At the next stage of bibliometric analysis — investigate content-contextual dimension of the study, which involves the establishment of relationships between «shadow economy» and «corruption», clustering and visualization of scientometric data using the VOSViewerv.1.6.10.

The words «shadow», «illegal», «underground», «informal» with reference to the concept of «corruption» and its varieties (bridery, theft, empezzlement, nepotism), which were connected by the logical operator AND.

The object of bibliometric analysis is selected 2378 scientific articles for the period 1996—2021 in publications indexed by the Scopus scientometric database.

The first and largest cluster combined articles that address issues of imperfect institutional environment in starting your own business, running a business, receiving administrative services, investing money, and more. Note that among the scientific works from the scientometric database Scopus included in the attached cluster, the most frequent mention is the concept of «corruption» (because it has the largest diameter of the circle), which is closely intertwined with various types of illegal activities, motives, causes and consequences of these processes. society. The first cluster brought together 129 keywords from the annotations of scientific articles, the main ones being bribes, business ethics, employment, privatization, taxes, rents, transparency, regulation, social capital, education, investment, income, and more.

The second largest cluster of research (120 concepts) specializes in the study of computer and information technology in illegal operations as a tool for their implementation (cyberattacks, imperfections of the data protection system, etc.) and the mechanism for combating them (machine learning, big data, authentication, etc.). The most common keywords in this cluster include: algorithms, codes, information system, bitcoin, data protection, cryptography, neural networks, machine learning, malware, cyber threat, networks, technology, crime and others. It is worth noting that in recent years the number of scientific publications devoted to the study of protection against cyber threats of energy infrastructure and the search for ways to combat such illegal activities has increased.

Research on illegal activities in the field of environmental protection and forestry is concentrated in the scientific works of the third cluster, which brought together 80 similar concepts on this issue. The main keywords within the third cluster are: deforestation, illegal logging, environmental protection, illegal wildlife trade, natural resources, pollution, timber, rights protection, rural areas, climate change, etc.

A separate part of scientific research (fourth cluster) specializes in covering the problem of perception of corruption and criminal activity by people and members of society. This cluster contains 51 concepts, among which the following should be singled out: crime, behavior, psychology, ideology, gender, age, risk, local population, etc.

The fifth cluster includes scientific publications that cover the problem of officials using their official powers for profit and illegal activities in the health care system. Of the 42 keywords in the fifth cluster, the main ones are: health care, health insurance, morality, informal payments, social responsibility, public health care, trust, health services, and more.

Conclusions. According to the trend and bibliometric analysis, one can note that de-shadowing of the economy and combating corruption in various spheres of public life form a popular area of research that has developed over the past 30 years. The study confirmed the hypothesis of a transmission effect between shadow schemes in the economy and corrupt practices in society. Clustering of scientific research with the help of VOSviewer tools allowed to identify areas of activity where the fight against shady operations and corruption schemes is particularly hotly debated among the scientific community (business, environment, health). A new area of research is the use of unstructured data sets and machine learning tools in the formation of information and analytical support of regulatory and regulatory authorities. Summing up, we note that corruption and shadow economy are complex and multifaceted phenomena caused by the complex action of various factors that are constantly transforming and have a significant impact on the socio-economic development and attractiveness to foreign investors.

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