

# USING ARTIFICIAL INTELLIGENCE TO IMPROVE TAX SECURITY AND CONTROL OVER TAX AVOIDANCE SCHEMES

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## ABSTRACT

Tax security is a critical area in modern states in view of its importance for ensuring the state budgets' replenishment and reducing the shadow economy size. At the same time, a serious obstacle to tax security is the development of tax evasion schemes using modern technologies. The aim of the research is to analyse the impact of artificial intelligence (AI) on the volume of losses from tax abuse in European countries. The work uses the methods of statistical analysis, case study, regression and correlation analysis. The conducted research confirmed the initial assumption about the impact of the AI development and the amount of losses arising from tax abuse. This was achieved by identifying a statistically significant impact of the Intercept, Talent, Infrastructure and Commercial variables on the Annual tax loss: Corporate tax abuse (% of GDP). The relationship is inverse with Intercept and Talent, and positive with Infrastructure and Commercial. It follows that the development of infrastructure and the active commercial use of AI is accompanied by an increased volume of tax losses from corporate tax abuse. Increased level of human capital development, expressed through the Talent indicator, is accompanied by a decreased amount of tax losses. Accordingly, the human capital development can become one of the main success factors along with the establishment of legal restrictions and the use of technology-based countermeasures. The research findings can be useful in the process of updating the legal framework regarding the limitations of the AI use and the development of an appropriate ethical framework.

**Keywords:** *Artificial Intelligence, Corporate Tax Abuse, Tax Evasion, Tax Fraud, Tax Security.*

## 1. INTRODUCTION

Tax security is critically important for the countries' development, as it ensures the appropriate amount of state budget revenues to finance services for society [1], [2]. Besides, tax security plays a key role in ensuring the stability of the economy, reducing the shadow economy size [3], [4]. The proper functioning of the tax system contributes to increasing trust in the state authorities and ensuring social equality.

At the same time, various tax evasion schemes and tax fraud still exist in society [5], [6]. Tax evasion schemes are taking on new forms and methods in view of the rapid technological development [7]. Traditional state countermeasures may prove insufficiently effective and lag behind development. Therefore, studying the possibilities of new technologies to combat tax evasion is a relevant topic for many studies [8].

AI occupies a special place among technologies capable of fundamentally changing

traditional approaches to the functioning of the tax sphere [9], [10]. It is one of the key technologies for analysis and logical interpretation of events, as well as for supporting automated decisions. Tax administrations must have large amounts of data, which is often a significant challenge without the AI use [11]. AI is capable of identifying risks, improving the accuracy of analysis and forecasting [12], and significantly improving the convenience of paying taxes for taxpayers. The ability to detect certain patterns that may indicate tax evasion and fraud is a particularly important function of AI [13].

At the same time, there is a possibility of using AI in the opposite direction – to develop and support new tax evasion schemes. In other words, if AI is capable of detecting criminal algorithms, it makes sense to analyse its potential role in their creation. This study aims to prove that the development of AI contributes not only to combating tax offences based on empirical data, but also to their realization. If this assumption is confirmed, it would be fair to talk about the need to improve state measures (traditional and AI-based) to counter the use of AI for illegal purposes.

It follows that the high technological development of the country can contribute both to increasing the effectiveness of combating tax abuse and to the emergence of new forms and methods of tax evasion and tax fraud. As noted in The State of Tax Justice 2023 report [14], countries with higher income levels, which usually have more opportunities for technological development, lose more revenue because of the abuse of corporate taxes. This explains the focus of the research on European countries, which are characterized mainly by a high level of technological development. The aim of this research is to analyse the impact of AI on the volume of losses from tax abuse in European countries. The aim involves the fulfilment of the following research objectives:

- Assess the problems caused by the realization of tax evasion schemes in European countries;
- Analyse the AI capitalization and its use in the tax field;
- Conduct a correlation and regression analysis between indicators of AI development and the volume of losses from tax abuses.

Thus, the work aims to investigate both the positive and negative impact of AI on the tax sphere. First of all, the focus of the study is on the analysis of the relationship between AI and tax losses of states due to corporate tax abuse, excluding other types of taxes. Also, the study does not cover other aspects of the application of AI in

the tax sphere, for example, for automating inspections or forecasting. The main attention of the work is paid to European countries, which are characterized by a high level of technological development, where the noted problem is very relevant.

Previous works that considered the use of new technologies in the tax sphere focused mainly on the impact of these technologies on the efficiency of tax administration and control. Many works were devoted to the characterization of the benefits of technologies for automating systems to combat tax evasion. At the same time, only a limited number of studies discussed the potential two-way impact of technologies on the tax sphere. The proposed work seeks to fill this gap by analyzing both the positive and negative impact of AI on the volume of losses from tax abuse. Accordingly, the motivation of the study is to seek to clarify how new technologies can simultaneously bring benefits and create new challenges for the tax system.

## 2. LITERATURE REVIEW

For a thorough selection of the research problem, an in-depth analysis of scientific sources of literature related to tax security, combating tax evasion and the use of AI in the tax sphere was conducted. The literature analysis was conducted using scientific sources located in the Scopus, Web of Science, and Google Scholar databases. The main criteria for selecting literature included:

- relevance – all analyzed works were published within the last five years and address current issues of the problem under study;
- emphasis on the tax sphere – studies focus on the use of the latest technologies specifically in the tax sphere;
- clearly substantiated methods – preference was given to studies that offer a detailed description of the methods used and clear evidence of the conclusions obtained;
- consideration of the geographical context – the literature review included, first of all, works that discussed the topic under study using the example of European countries.

Many studies that consider this issue from different angles provide the description and assessment of European approaches to ensuring tax security and combating tax evasion. A thorough study by Turksen [15] provides a wide range of countermeasures to combat tax problems. These countermeasures are proposed in terms of four groups of problems. These include: tax fraud, tax

evasion (illegal reduction of tax liabilities), tax avoidance (use of legal loopholes), non-compliance with tax legislation. Countermeasures are primarily aimed at ensuring proper control and sanctions, transparency, cooperation, monitoring, as well as support of tax legislation. In addition to these measures, Mazurenko et al. [16] note the importance of tax morality in ensuring the tax competitiveness of countries.

At the same time, some researchers criticize European measures to ensure tax security. Van Brederode [17] provides a critical assessment of certain coercive methods to combat tax fraud from an ethical perspective. At the same time, the researcher emphasizes that despite the contradictions of the substantive measures, tax legislation is an integral element of ensuring tax security. De La Feria [18] and Mia et al. [19] also criticize the overwhelming use of coercion to combat tax fraud, which is effective in raising revenue but not in combating fraud.

In view of some imperfection of the existing approaches, individual researchers propose their own concepts for improvement. Sarnowski and Selera [20] note the effectiveness of bilateral agreements, proposing a new concept for the exchange of VAT data and technology between European Union (EU) countries. A number of researchers noted the effectiveness of digitalization for increasing tax security and discipline. Kitsios et al. [21] concluded that digital technologies contribute to mitigating tax fraud. Heinemann and Stiller [22] noted the effectiveness of using electronic invoicing in Italy to reduce cross-border fraud.

AI deserves special attention among the new technologies that can be used in the tax field. Owens et al. [11] noted the effectiveness of AI with regard to its use in tax administration. The researchers noted the capabilities of technology for risk analysis and information selection. Saragih et al. [23] described the AI potential to modernize tax administration and tax compliance. Faúndez-Ugalde [24] noted the use of AI to describe taxpayer risks and the robotization of tax audits. Ihnatišínová [25] points out that AI is important to ensure the connection between the tax administration and taxpayers. Adelekan et al. [26] conducted a comparative analysis between AI technologies and traditional methods for tax compliance and fraud detection. The researchers

found a significant increase in efficiency thanks to the AI use, but it is accompanied by data privacy issues. These problems, along with the advantages of AI use, are also studied in other works. Adelakun et al. [27] believe that AI has the potential to improve tax administration. At the same time, it creates new complications regarding the anonymity of transactions and the difficulty in tracking digital assets. Nembe et al. [28] see AI as a transformative technology in tax compliance and tax evasion mitigation. At the same time, the researchers note the importance of creating the regulatory framework and observing ethical principles.

Therefore, most of the works are focused on the analysis of the ways of using AI in the tax field for a number of purposes, including for combating tax evasion. The problems of ethics and privacy are most often mentioned among the problems of AI implementation. At the same time, the issue of whether AI affects the expansion of opportunities for tax evasion and other abuses in the tax sphere remains poorly resolved.

### 3. METHODOLOGY

#### 3.1. Research design

The research design is based on the previously expressed assumption that the high technological development of countries can contribute not only to the fight against tax evasion, but also to the realization of new criminal schemes. In accordance with the aim of the study, the first paragraph of the work outlined the amount of losses from tax abuse for the countries of Europe. The logical continuation was outlining the scope and directions of the AI use by European countries in the tax sphere in the second paragraph. The final paragraph is designed to test empirically whether the volume of losses from tax abuse (using corporate tax as an example) correlates with the technology development level (with an emphasis on AI technology).

#### 3.2. Sample

The sample of countries and indicators for the study is presented in Table 1. The sample of countries consists of European states, for which data are available in the AI Global Index ranking. The data on the amount of losses from tax abuse for these countries is available in The State of Tax Justice 2023 report [14].

Table 1: The Sample Of Countries And Data For The Study (2021)

Country	Talent	Infrastructure	Operating Environment	Research	Development	Government Strategy	Commercial	Total score	Shifted profits outward (USD million)	Annual tax loss: Corporate tax abuse (USD million)	Annual tax loss: Corporate tax abuse (% of GDP)
United Kingdom	39.65	71.43	74.65	36.5	25.03	82.82	18.91	40.93	87885	16698.1	0.60
The Netherlands	33.83	81.99	88.05	25.54	30.17	62.35	4.97	36.35	4898	1224.5	0.10
Germany	27.63	77.22	70.22	35.84	24.79	84.65	8.29	36.04	54363	16213.8	0.40
France	28.32	77.15	80.02	25.48	21.44	91.2	7.65	34.42	80508	27718.9	1.00
Ireland	29.93	89.5	70.15	16.79	30.85	69.44	3.94	33.04	4904	613	0.20
Finland	24.99	71.6	78.76	25.21	18.32	85.99	4.64	31.36	1460	292	0.10
Denmark	27.07	74.08	85.39	26.01	8.92	74.23	3.46	30.87	2394	526.7	0.10
Luxembourg	21.66	94.88	66.96	19.39	19.95	66.69	4.68	30.73	5250	1365.5	1.90
Switzerland	25.63	78.43	44.14	38.24	23.11	12.18	7.76	30.25	1288	272.4	0.00
Sweden	28.21	75.19	66.77	27.61	17.81	40.35	4.51	29.85	4292	944.2	0.20
Spain	17.61	73.32	75.36	18.6	10.87	91.28	3.08	26.95	19525	4881.2	0.30
Austria	16.97	64.49	76.3	23.56	17.81	72.14	3.08	26.89	2946	736.5	0.20
Estonia	18.74	63.65	88.67	11.75	9.31	72.08	12.51	26.6	422	84.4	0.30
Norway	27.61	76.2	36.65	21.18	13.56	59.05	3.95	25.77	4209	968.1	0.20
Belgium	15.17	65.1	64.08	22.15	19.81	63.58	5.31	25.52	4473	1323.1	0.20
Poland	14.21	70.96	99.56	10.6	9.09	78.14	2.25	25.2	14549	2764.3	0.50
Slovenia	13.02	72.06	94.55	19.1	1.06	80.38	0.61	25.19	573	108.9	0.20
Italy	11.09	64.76	83.25	20.3	14.66	61.43	2.64	24.45	5518	1534.3	0.10
Malta	15.87	67.12	70.96	5.96	11.72	70.49	4.3	21.85	470	23.5	0.20
Portugal	13.43	64.2	80.66	8.96	3.92	70.69	2.05	20.89	2238	705	0.30
Czech Republic	11.11	64.26	76.97	11.26	2.7	70.29	1.75	20.31	3572	678.7	0.30
Iceland	18.45	72.45	41.19	18.29	0.19	22.15	5.74	19.81	613	122.6	0.50
Lithuania	14.3	63.19	80.67	3.22	6.18	64.28	1.77	19.59	695	104.3	0.20
Greece	7.62	55.44	83.58	15.12	2.21	22.15	0.92	17.33	2183	633.1	0.30
Slovakia	8.55	65.36	88.71	2.97	0.34	43.07	0.67	17.24	2374	498.5	0.50
Hungary	10.34	69.17	58.01	4.31	5.4	55.01	1.08	17	3568	321.1	0.20

Source: [14], [29]

### 3.3. Methods

Statistical analysis was applied to assess the problems of corporate tax abuse, which made it possible to outline and analyse the extent of such problems in European countries. The case study was applied in the process of analysing the implementation of the Connect system in Great Britain, which allowed to assess the way this system is used and the potential negative consequences. Correlation analysis was useful for identifying the relationship between AI development indicators and the volume of losses from tax abuse in European countries. Regression analysis made it possible to assess the influence of AI development indicators on the dependent

variable Annual tax loss: Corporate tax abuse (% of GDP) with the aim of confirming the assumption about the potential AI use for tax evasion purposes.

## 4. RESULTS

### *Statistical assessment of problems arising from the realization of tax evasion schemes*

Corporate tax is one of the most important sources of income for the state budget. Corporate tax avoidance schemes can be extremely confusing, especially given the use of offshore zones and various complex manipulations. Figure 1 provides a comparison of individual European countries in terms of annual tax losses arising from corporate tax abuse.

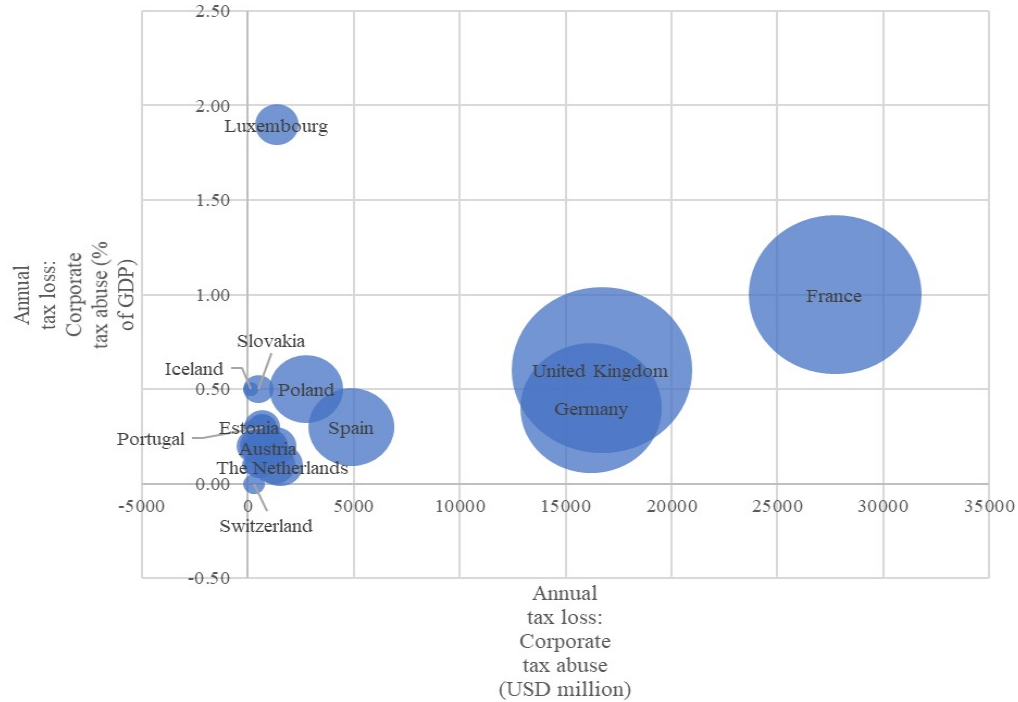


Figure 1: Comparison Of Some European Countries By Annual Tax Losses Arising From Corporate Tax Abuse (In \$ Million And % Of Gdp)

\* The Bubble Size Corresponds To Shifted Profits Outward (Usd Million)

Source: Graphed By The Author Based On [14]

Figure 1 shows that Luxembourg experiences the largest tax losses expressed as a percentage of GDP. At the same time, the highest losses in monetary terms are characteristic of France, Great Britain and Germany. These countries also have the largest bubble size, which shows the volume of profits transferred abroad. The State of Tax Justice 2023 noted that the UK is the largest source of abuse at the global level, according to the studied indicator. Accountable for approximately 27% of all corporate tax losses, this state, along with a number of dependent territories, is a worth player. Dependent territories of Great Britain serve as offshore zones, which are used for

the movement of illegal financial flows. Luxembourg, the Netherlands, and Switzerland are often mentioned alongside Great Britain — together these countries are responsible for about 46% of the global risks of corporate tax abuse.

*Analysis of the AI capitalization and its use in the tax field*

The size of the AI market is steadily growing and is projected to reach over \$2.5 trillion in 2032. This means that the market will more than quadruple in the next eight years. Figure 2 shows the current and forecast size of the AI market for 2022 to 2032.

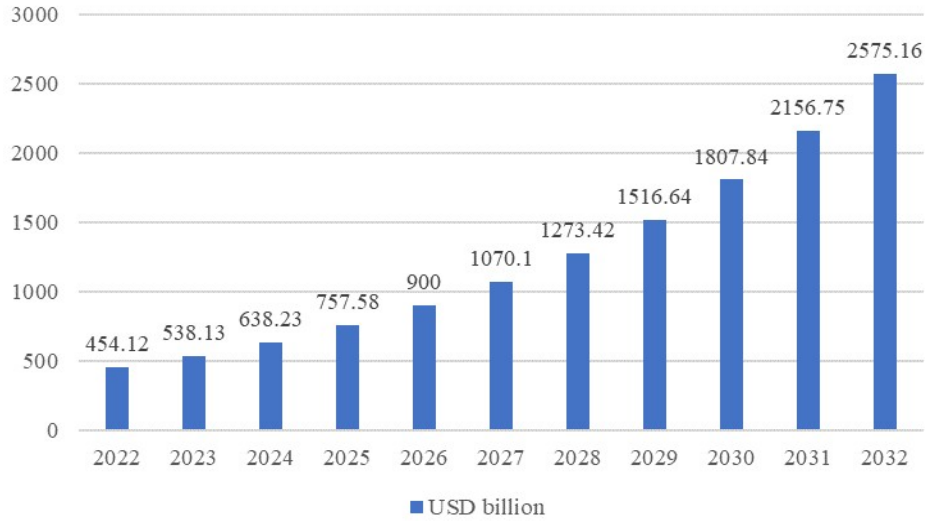


Figure 2: AI Market Size [30]

The data provided by the OECD [31] were analysed to assess whether the studied European countries use AI technologies in the management of the tax sphere. The data is provided in terms of

individual areas of AI use, one of which is the detection of tax evasion and fraud. Table 2 contains the relevant data, excluding cases where data are not available (empty cell).

Table 2: AI Use In The Tax Sphere Of Selected European Countries

Country	Use of AI	Virtual assistants	Risk assessment processes (PIT)	Risk assessment processes (CIT)	Risk assessment processes (VAT)	Detection of tax evasion and fraud	Assistance of tax officials in making administrative decisions	Making recommendations for actions	Limitations on the use of AI are in place	Ethical framework for the application of AI in place
United Kingdom	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
The Netherlands	Yes	Yes					Yes	Yes	Yes	Yes
Ireland	Yes	Yes							Yes	No
France	Yes	Yes				Yes	Yes	Yes	Yes	No
Sweden	Yes	Yes	Yes	Yes	Yes				Yes	Yes
Germany										
Norway	Yes	Yes	Yes		Yes			Yes	Yes	Yes
Denmark	Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
Switzerland	No									
Finland	Yes	Yes					Yes	Yes	Yes	Yes
Luxembourg	Yes			Yes		Yes	Yes		Yes	No
Estonia	No									
Iceland	Yes			Yes	Yes	Yes			Yes	No
Spain	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	No
Austria	Yes		Yes	Yes	Yes	Yes			Yes	No
Malta	No									
Belgium	No									
Lithuania	Yes	Yes				Yes			Yes	No
Poland										
Portugal	Yes						Yes		Yes	No
Slovenia	Yes		Yes	Yes	Yes	Yes			Yes	No
Czech Republic										
Italy	Yes	Yes	Yes	Yes	Yes	Yes	Yes		Yes	No
Hungary	Yes		Yes			Yes			Yes	Yes
Slovakia	No									
Greece	No									

Source: Generalized By The Author Based On [31]

It is important to note that among the studied countries, the majority uses AI in the field of taxation. However, only eleven countries use AI to detect tax evasion and fraud. All countries for which data is available have set some restrictions on the AI use. At the same time, not all of them have defined frameworks for the ethical use of AI.

Great Britain is the only country among the selected ones that uses AI in all areas noted in the table. In this context, it is appropriate to mention the Connect system launched in 2010 by the country’s tax authority — HM Revenue and Customs (HMRC). The system is designed to detect tax evasion by individuals and legal entities. For this purpose, the algorithm-based system detects certain patterns using a wide range of data sources (about financial transactions, information from

social networks, and travel information). Some of the important problems of using the system are the payers’ fears regarding the confidentiality of information, the high cost, the need to ensure high data quality.

*Analysis of the relationship between the AI development and losses arising from tax abuse*

The conducted analysis of losses from tax abuses and the assessment of capitalization and opportunities of AI in the tax field leads to the final stage of the research. This stage is aimed at determining the relationship between the AI development and the volume of losses from tax abuse. Table 3 contains the results of the correlation analysis between the AI Global Index and its components, on the one hand, and indicators of losses from tax abuse, on the other.

Table 3: The Results Of Correlation Analysis

	Shifted profits outward (USD million)	Annual tax loss: Corporate tax abuse (USD million)	Annual tax loss: Corporate tax abuse (% of GDP)
Talent	0.529440*	0.461327*	0.089128
Infrastructure	0.167470	0.183267	0.463356*
Operating Environment	0.063910	0.066850	0.000677
Research	0.481676*	0.444143*	-0.002183
Development	0.411701*	0.389198*	0.086869
Government Strategy	0.437781*	0.436582*	0.159088
Commercial	0.660210*	0.534907*	0.178988
Total score	0.611893*	0.559507*	0.176593

\* Statistically Significant Correlations At  $P < 0.05$

Source: Calculated By The Author Based On [14], [29]

The correlation analysis revealed statistically significant correlations between a number of indicators marked ‘\*’ in Table 3. It is worth noting that the relationship is positive, that is, a large amount of tax losses is accompanied by a high AI development. At the same time, the regression analysis, which takes into account the influence of other variables, and not only the linear relationship between the two indicators, shows

slightly different results. The dependent variables were Shifted profits outward (\$ million), Annual tax loss: Corporate tax abuse (\$ million), Annual tax loss: Corporate tax abuse (% of GDP). The component indicators of the AI Global Index were taken as independent variables. The results showed a statistically significant relationship only in the case of using Annual tax loss: Corporate tax abuse (% of GDP) as a dependent variable (Table 4).

Table 4: Results Of Regression Analysis For The Dependent Variable Annual Tax Loss: Corporate Tax Abuse (% Of GDP)

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95%	Upper 95%
Intercept	-2.776073415*	0.822452836*	3.37536*	0.00337*	-4.50398*	1.04816*	-4.50398*	-1.04816
Talent	-0.037480764*	0.016663722*	2.24924*	0.037252*	-0.07249*	0.00247*	-0.07249*	-0.00247
Infrastructure	0.047469893*	0.011052433*	4.294972*	0.000436*	0.02425*	0.07069*	0.02425	0.07069
Operating Environment	0.003137916	0.004938799	0.63536	0.533188	-0.00724	0.013514	-0.00724	0.013514
Research	-0.000611753	0.009786593	-0.06251	0.950846	-0.02117	0.019949	-0.02117	0.019949
Development	-0.011217389	0.011352662	-0.98808	0.336208	-0.03507	0.012634	-0.03507	0.012634

Government Strategy	0.001490922	0.003633336	0.410345	0.686396	-0.00614	0.009124	-0.00614	0.009124
Commercial	0.06685276	0.023281464	2.871501	0.010151	0.01794	0.115765	0.01794	0.115765

\* Statistically Significant Correlations At  $P < 0.05$

Source: Calculated By The Author Based On [14], [29]

Statistically significant variables are Intercept, Talent, Infrastructure, and Commercial. At the same time, there is an inverse relationship with the first two, and a positive relationship with the others. Accordingly, the growth of the Talent indicator is accompanied by decreased tax losses in % of GDP. The increase in Infrastructure and Commercial indicators is accompanied by an

increase in tax losses. Intercept can mean the influence of other variables not included in the model, because the amount of tax losses depends on numerous factors, in addition to technological development — legislative aspects, tax morale, etc. At the same time, the built model can explain up to 54.1% of the variation in the dependent variable. A bubble chart below illustrates the results (Figure 3).

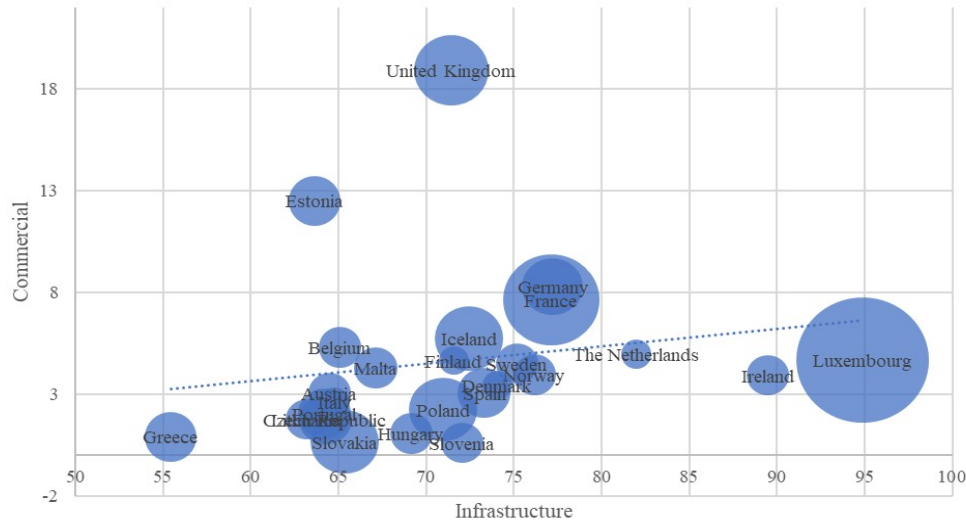


Figure 3: Comparison Of Some European Countries According To Indicators Of The Ai Index (Infrastructure And Commercial)

\*The Bubble Size Corresponds To Annual Tax Loss: Corporate Tax Abuse (% Of GDP)

Source: Graphed By The Author Based On [14], [29])

The indicators of the AI Index was taken to build the diagram, where the increased values are associated with greater losses from tax abuse. By adding a trend line to the figure, you can note its positive slope, which visualizes a positive correlation between variables. Figure 3 clearly shows the leadership of Great Britain in terms of Commercial and Luxembourg in Infrastructure. Moreover, the size of the country’s “bubbles” is one of the largest, which indicates the highest losses from abuse of the commercial tax as a % of GDP. So, it can be concluded that states should improve work on the implementation of technological countermeasures in response to the use of technology for tax evasion and fraud purposes. In addition, it is worth reviewing the

approaches to the limitations of the AI use in the commercial sphere and increasing transparency.

### 5. DISCUSSION

The study proved that the development of AI technologies can contribute not only to the improvement of the fight against tax evasion, but also to the expansion of opportunities for the realization of criminal schemes. This is evidenced by the positive correlation of Commercial and Infrastructure indicators with the volume of losses arising from tax abuses. Therefore, the active commercial use and development of AI, as well as the developed infrastructure, can create a favourable environment for further abuses. In this regard, the author considers it necessary to



strengthen state efforts to find ways to prevent such activities — both by traditional methods and by using AI. The example of the implementation of Connect in Great Britain testified that ethical considerations are important to this process and must be taken into account.

Other researchers noted the importance of observing ethical standards when detecting tax offences and imposing appropriate sanctions. Van Brederode [17] classifies a number of coercive methods as ineffective and ethically controversial. Such methods include third-party liability for lost VAT, blacklisting of tax havens, public shaming, and forced cross-border third-party reporting. The researcher calls for ensuring balance in tax legislation, which, among other things, will contribute to voluntary compliance by taxpayers with legal requirements. De La Feria [18] notes that coercive measures are not only unethical but also ineffective in combating fraud. Moreover, their use may signal the transformation of combating fraud into fraud management, resulting in selective tax control and a risk to the rule of law. Agreeing with the mentioned views, it is worth adding that unethical methods can reduce the desire to voluntarily pay taxes and tax morale in general. From the author's point of view, using a system like Connect in the UK could affect tax morale because of data privacy concerns. According to Mazurenko et al. [16], high tax morale in a country is also closely related to reduced corruption and shady dealings. In the researcher's opinion, this relationship is important from the perspective of increasing tax competitiveness based on economic and institutional instruments.

In other works, solving problems in the tax field is seen in the use of "softer" methods, in particular, through the development of cooperation. Sarnowski and Selera [20] find that bilateral agreements to promote cooperation in the EU are more effective than association legislation. This is due to efficient data exchange. The researchers believe that bilateral cooperation can influence the optimization of the legislative framework within the EU.

At the same time, Turksen [15] and Nikonenko et al. [32] confirm that legislation and enforcement are integral components of tax compliance approaches. The researcher singles out the following measures to combat tax fraud: verification of tax investigations, prosecution, punishment, increased transparency, cooperation with the judicial authorities, threat analysis, etc. The researchers noted control measures and the imposition of sanctions among the measures to

combat tax evasion. Monitoring and cooperation measures, in particular, risk management, information exchange, etc., are noted as methods of combating tax evasion. Supporting and simplifying tax legislation, including with the use of technology, is useful for ensuring compliance.

Other researchers emphasized the effectiveness of the use of technologies. Heinemann and Stiller [22] found that the use of electronic invoicing is effective in significantly reducing cross-border fraud. Among other things, it contributes to the reduction of VAT losses, as the case of Italy shows. Kitsios et al. [21] found that the use of digital technologies can significantly increase profits by reducing the level of cross-border tax fraud.

The studies referred to above focus on more traditional ways of ensuring tax security and combating abuses in the tax sphere. Unlike these studies, the author's research focuses on the possibilities of using AI in the tax field. This approach was used in other studies, in particular, Owens et al. [11] consider the effective AI use to assess risks and work with information in the tax field. Researchers emphasize the appropriateness of increasing investment in tools and skills, as well as ensuring coordination. The formation of a team of professionals with experience in various fields — information technologies (IT), statistics, and economics — can be one of the effective measures. Saragih et al. [23] found that AI is useful for tax compliance, increasing the convenience of taxpayers to meet their obligations and reducing costs. Ihnatišinová [25] stated that the main AI tools in the field of taxation are chatbots and automation. A large share of investment in new technologies is determined by their effectiveness in simplifying the payment and registration of taxes. The author's work shows that AI has other areas of application in European countries. It not only increases convenience and improves risk assessment, but is also used in practice to support decision-making and identify patterns that indicate tax evasion.

The author's views are reflected in the work of Nembe et al. [28] and Tsikaló [33], which indicate the possibilities of AI for solving numerous tasks in the tax field. These include fast and accurate analysis of large data volumes, detection of patterns indicating tax evasion or fraud. AI also has the potential to make more accurate predictions of payer behaviour, identify risks, and process documentation. At the same time, AI decision-making may not be sufficiently transparent and contain biases. Coordination between stakeholders

is essential to achieve the highest impact from the AI use while minimizing risks. The author's findings are also consistent with the results of Adelekan et al. [26]. The researchers determined that the use of AI significantly increases the effectiveness of measures to ensure compliance with tax legislation and detect fraud. However, it needs an appropriate legal framework to minimize the risks associated with ensuring the confidentiality of information. Faúndez-Ugalde [24] and Lysenko et al. [34] analyse how the use of AI relates to taxpayer rights. The researchers emphasize the importance of ensuring taxpayers have access to AI algorithms and formulas. In the author's work, the implementation of AI in the tax field is also considered with a caveat about the need to ensure transparency and confidentiality of information. If these conditions are met, major efforts at the state and interstate level are needed to further develop AI in ways that ensure compliance with tax laws and minimize opportunities for tax evasion. First of all, this concerns the updating and expansion of the legal framework for the AI use. These findings are supported by the results of Adalakun et al. [27]. The researchers insist on the need for international cooperation in the use of innovations, including AI, aimed at adapting the legal framework to new requirements. Among such measures, Bastani and Waldenström [35] suggest lowering barriers to market entry and optimizing competition legislation. From the author's point of view, it is also advisable to review the existing restrictions on the commercial use of AI along with the introduction of clear ethical principles for its use. In practice, the author's conclusions can be useful for the development of policies and measures aimed at countering the AI use for tax avoidance. In particular, the important role of human capital in reducing the amount of losses arising from tax abuse during the development of practical measures should be taken into account.

## 6. CONCLUSIONS

Critically evaluating the results of the study, it is important to note that the use of correlation analysis is an important method for identifying relationships between variables. At the same time, the identified correlations may not always indicate the presence of a causal relationship. Thus, the implementation of AI may be only one of the factors affecting the volume of tax abuse along with the economic situation in the country, political decisions, etc. Therefore, further research should take into account other factors that

may affect the use of AI in the tax sphere, in particular, ethical, legal and social aspects.

The volumes of losses from corporate tax abuse in European countries outlined in the work emphasize the importance of the problem of tax evasion and tax fraud. Given the research focus on AI technology, an important task of the work was to determine its role in ensuring tax security. At the same time, the approach chosen in the work is based on the opposite, because the key assumption of the study was that AI can contribute to the realization of tax evasion schemes.

This assumption was confirmed by a correlation and regression analysis between indicators of AI development and the volume of losses arising from tax abuse. It was found that such variables as Intercept, Talent, Infrastructure and Commercial exert a statistically significant influence on the Annual tax loss: Corporate tax abuse (% of GDP). It is important to note that the relationship is inverse with Intercept and Talent, while it is positive with Infrastructure and Commercial. This means that the development of infrastructure and increased commercial use of AI is accompanied by an increased tax losses arising from corporate tax abuse. At the same time, the increase in the level of human capital development, expressed through the Talent indicator, is accompanied by decreased amount of tax losses.

Thus, given the goal set in the work - to analyze the impact of AI on the volume of losses from tax abuse in European countries, the following key conclusions can be drawn. First of all, the assumption of the presence of a dual impact of AI was confirmed, which emphasizes the importance of increasing attention to the challenges posed by new technologies for the tax sector. In particular, the positive impact of infrastructure and commercial use of AI on the volume of tax abuse requires increased government work on the implementation of technological countermeasures aimed at reducing the use of AI for tax evasion and fraud. Also, approaches to restrictions on the use of AI in the commercial sector should be updated and transparency should be strengthened. At the same time, the analysis conducted showed that the development of human capital can contribute to the reduction of tax losses. This indicates the importance of investing in education and improving the skills of tax sector employees. It should be noted that, despite the statistical significance of the results obtained, the analysis conducted has certain limitations. They concern the need to take into account other external factors, such as political

decisions and the economic situation, which should be taken into account in further research.

Further work should take into account these recommendations and be aimed at identifying gaps and loopholes in existing legislation that allow the AI use in an unscrupulous way. It is also appropriate to propose specific approaches to increase the level of human capital development in view of its important role in reducing losses arising from tax abuse.

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