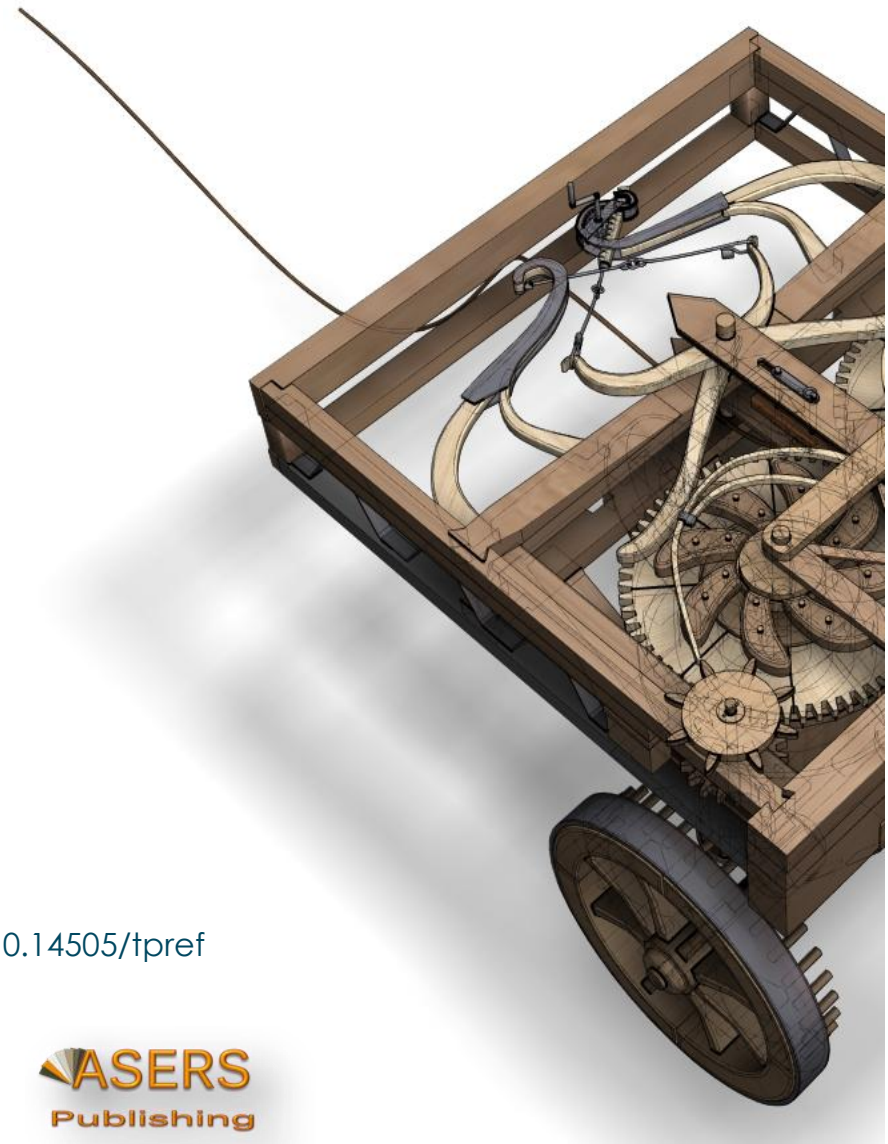
Theoretical and Practical Research in Economic Fields



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Theoretical and Practical Research in Economic Fields

Many economists today are concerned by the proliferation of journals and the concomitant labyrinth of research to be conquered in order to reach the specific information they require. To combat this tendency, **Theoretical and Practical Research in Economic Fields** has been conceived and designed outside the realm of the traditional economics journal. It consists of concise communications that provide a means of rapid and efficient dissemination of new results, models, and methods in all fields of economic research.

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Prevention of Tax Criminal Offences as a Factor in the Financial Stability of the State

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Abstract: Effective counteraction to tax offences strengthens the financial stability of the state and ensures the filling of the state budget. The aim of the research is to compare the effectiveness of measures to prevent tax offences, applied separately and in combination, using the example of developed economies and developing countries. The research employed correlation, regression analyses, and mediation testing. The study found that the introduction of innovative technologies in the tax sphere can increase the efficiency of detecting tax offences and reduce tax evasion. The effectiveness of the use of Artificial Intelligence (AI), electronic invoice mechanisms, Robotic process automation (RPA), Application programming interfaces (API), Cloud computing was confirmed. The impact of AI and electronic invoice mechanisms is mediated by the efficiency of tax audits, where these technologies can be useful for automation, increasing accuracy and scalability. It is proven that the effective implementation of technologies also depends on the amount of expenses incurred, as well as investment in infrastructure and human resources (HR). The findings may be useful for government officials in the development of tax policy and determining the most effective measures to combat tax evasion.

Keywords: tax offences; tax evasion; new technologies; artificial intelligence; electronic taxation systems; tax audits.

JEL Classification: G10; G18; G28; H21; H26; C10; A12.

Introduction

Prevention of tax criminal offences is one of the key factors in the financial stability of the state (Ozili, 2020; Rieznik *et al.* 2020). Failure to fulfil tax obligations, violation of tax legislation and tax evasion using various fraudulent schemes significantly reduce the revenue part of the state budget (Pițu *et al.* 2021; Abdulaziz *et al.* 2022). This weakens the country's economic capabilities and prevents it from performing its functions properly.

The ways to prevent criminal tax offences are a relevant topic and have been considered in numerous studies from different perspectives (Smiesova *et al.* 2019). Apriwarto (2024) states that the fulfilment of tax obligations depends on numerous economic, demographic, social and psychological factors. This necessitates a comprehensive approach to solving the problem of tax evasion, incorporating social and educational initiatives, economic incentives, etc. (van Brederode, 2020; Okeke *et al.* 2024). Furthermore, a set of measures to prevent tax evasion may include the use of new technologies (Bolifaar & Sinaga, 2020; Atayah & Alshater, 2021), as well as effective tax enforcement (Araújo Marques *et al.* 2020; Widuri *et al.* 2023).

What is new in the work is the assessment of the simultaneous impact of regulatory, technological, social, financial and punitive measures to prevent tax crimes on reducing tax losses and corporate tax abuse. An important aspect of the study is the analysis of how these measures interact with each other, in particular, what is their cumulative impact on reducing tax losses and corporate tax abuse, and whether this impact is mediated by certain additional factors.

The aim of the research is to compare the effectiveness of tax fraud prevention measures applied separately and in combination, using the example of developed economies and developing countries. The aim involves the fulfilment of the following research objectives:

- Conduct a correlation analysis between the tax loss of countries and indicators that quantitatively characterize the measures taken to prevent tax offences;
- Conduct a regression analysis to identify the impact of tax offence prevention measures on the amount of tax losses of countries;
- Conduct mediation testing to assess the mediating role of the amount of assessments that rely on the results of tax audits.

1. Literature Review

A large number of studies focus on the impact of new technologies on the tax offence rates. The authors of these studies mostly argue that technological changes will contribute to the reduction of tax evasion, as Belahouaoui & Attak (2024) stated. The increased information flow to governments is one of the main advantages of using new technologies to reduce tax evasion. El-Manaseer *et al.* (2023) added that access to accurate and immediate information by governments will contribute to the expansion of the tax base and the reduction of tax fraud. According to Oduro *et al.* (2024), the acceptance of information technologies by taxpayers will encourage them to evade taxes less in order to avoid tax audits and fines. Yamen *et al.* (2023) are sure that digitalization contributes to the reduction of tax evasion but is much more effective in countries with low corruption rates. These views can be agreed with, but it should be considered that the development of technology can also have negative consequences because of the emergence of new criminal schemes that involves technology.

Rahayu (2024) focused on the AI use in the tax system. The researcher determined that AI improves the quality of tax services and facilitates tax compliance, also helping to detect tax fraud. Saragih *et al.* (2023) also believe that AI will promote tax compliance and improve fairness for taxpayers. According to Nuryani *et al.* (2024), AI has great potential for detecting tax evasion schemes. The researchers proposed their own approach to developing an AI model that can be used by tax authorities to improve the detection of tax evasion. This model uses Machine Learning (ML) technology and considers the taxpayers' individual and network characteristics. Xavier *et al.* (2022) developed AI-based models that can identify the profile of potential tax evaders. The proposed models enable predicting tax evasion companies with an accuracy of up to 98%. So, the effectiveness of using AI to detect tax evasion is a generally recognized fact, but its impact on the amount of tax losses remains poorly studied.

A number of studies have assessed the potential of e-taxation systems to reduce tax fraud. Do *et al.* (2022) found that attitudes towards and implementation of e-taxation systems are positively and strongly correlated with tax compliance. Similar conclusions are reached by Nguyen *et al.* (2024) and Saptono *et al.* (2023). The researchers emphasize that e-taxation systems have a positive impact on tax compliance and taxpayers' intentions to comply with their tax obligations. Zamani *et al.* (2024) noted that aligning the e-services system with taxpayers' information needs will foster a culture of creating and sharing information. This will reduce the number of offences and reduce tax evasion. As with other technologies, the researchers have tended to focus

on the positive aspects of implementing e-taxation. At the same time, the possible negative consequences and side effects of using e-taxation systems should be assessed.

Some studies examined other factors that affect tax offences that are not related to technological change. In particular, an appropriate system of deterrence and punishment plays an important role in tax compliance. According to Suriyadi & Hani (2024), tax audits, fines, and taxpayer awareness reduce tax evasion. In contrast, Yan & Wangdra (2024) found that tax fines do not significantly affect tax compliance. The differences in the researchers' findings can be explained by the differences in the studied regions and the socio-economic factors that affect them. Therefore, it is appropriate to test the effectiveness of deterrence and punishment systems in a larger sample of countries, which will ensure a wider coverage and increase the representativeness of the results. Farrar & King (2023) argue that tax compliance improves when tax fraud is punished only when the offenders perceive that they deserve to be punished. Accordingly, the effectiveness of certain sanctions for violation of tax laws is closely related to people's behavioural and psychological characteristics. Esmaeil Darjani *et al.* (2023) and Utama *et al.* (2024) analysed behavioural factors that influence tax compliance intentions. The study show that various external and internal factors can significantly influence people's dishonest tax behaviour.

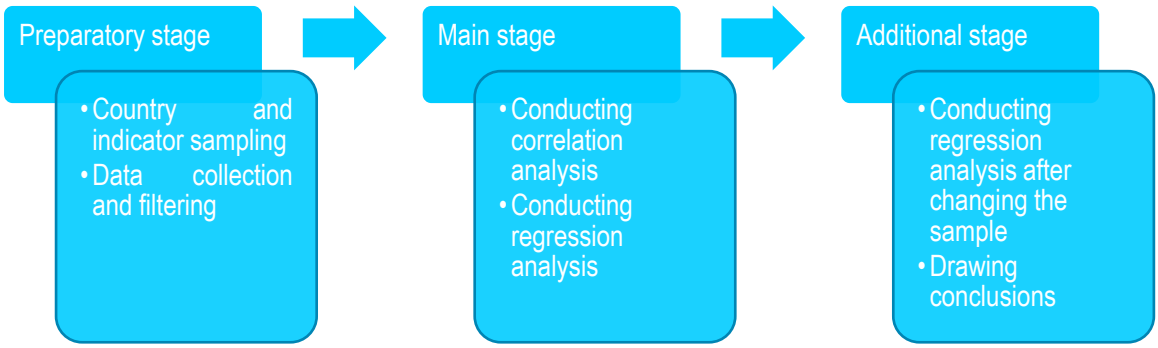
So, the approach to preventing tax crime can encompass regulatory, technological, social, financial, punitive and other measures. At the same time, the comprehensive impact of these measures remains understudied. This study seeks to fill the gap in comparing the effectiveness of various preventive measures applied separately and in combination.

2. Method also Called Materials and Methods or Experimental Methods

Research Design

The research design is divided into preparatory, main, and additional stages. All stages are logically interconnected and follow from each other. The main content of the stages is presented in Figure 1.

Figure 1. Research design



Source: developed by the authors

Sample

The sample of countries for the study is formed by 57 countries, including: Argentina, Australia, Austria, Belgium, Brazil, Bulgaria, Canada, Chile, China, Colombia, Costa Rica, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Japan, Kenya, Korea, Latvia, Lithuania, Luxembourg, Malaysia, Malta, Mexico, Morocco, Netherlands, New Zealand, Norway, Peru, Poland, Portugal, Romania, Saudi Arabia, Singapore, Slovak Republic, Slovenia, South Africa, Spain, Sweden, Switzerland, Thailand, Türkiye, United Kingdom, and United States. The sample was formed based on the data provided by the Organization for Economic Cooperation and Development (OECD) and available in open access on the OECD iLibrary (2023). The approach to forming the sample is determined by the availability of qualitative and standardized data from countries with different levels of development and different features of their tax systems. Accordingly, the formed sample provides sufficient diversification and variety of data for the purposes of the study, which makes it representative for the purposes of in-depth analysis.

The sample of indicators for the study is divided into two groups for analysis, the first of which consists of indicators of tax losses of countries. It includes Total annual tax loss (USD million), Total annual tax loss (% of GDP), Corporate tax abuse (USD million), and offshore wealth (USD million). These indicators reflect various

aspects of tax losses and violations, as well as their interrelationships. Total annual tax loss is a basic indicator for assessing the impact of factors causing tax losses. Corporate tax abuse and Offshore wealth are included in Total annual tax loss, but reflect different areas of tax losses. Corporate tax abuse is of particular importance, because corporate tax is quite vulnerable to abuse, and the corporate sector is a key source of tax revenues. The second group contains indicators that quantitatively characterize the measures taken to prevent tax violations. In turn, such indicators are divided into subgroups that provide for the use of technological, regulatory and control, financial, and penalty instruments (Table 1).

Table 1. Selection of indicators for the study

Indicator	Possible impact on the tax system
Indicators of the use of innovative technologies	
Data science / analytics tools	Capabilities for detecting anomalies indicating tax evasion and predicting risks
Robotics Process Automation (RPA)	Increasing transparency and minimizing errors through automation
Application programming interfaces (APIs)	Integrating different systems in real time, which allows for broader possibilities of checking data for compliance with legal requirements
Distributed ledger technology / Block chain	Increasing transparency and immutability of data, which allows for increased efficiency of checks
Artificial intelligence (AI), including machine learning	Automation and expanding possibilities for detecting anomalies
Cloud computing	Allows storage of large volumes of data and access to them at any time for checks and audits
Indicators related to control and regulatory initiatives taken	
Administration uses behavioural insight methodologies or techniques	Such methodologies involve studying taxpayer behaviour to identify motives for tax evasion, which enables adjusting approaches to preventing abuse
All or certain taxpayers are required to use an electronic invoice mechanism for tax purposes	Electronic invoices enable automating the process of recording tax transactions, reducing the scope for manipulation
Certain taxpayers are required to use electronic fiscal devices / cash registers	Reducing opportunities for manipulation and falsification
Percentage of payments received electronically by number of payments	The increase in the number of taxpayers using electronic means of payment may contribute to improving control over tax revenues
Percentage of payments received electronically by value of payments	Indicates the effectiveness of tracking large financial flows by tax authorities
Financial indicators relating to expenses incurred and the amount of additional charges	
Operating expenditure	Reduction or increase in expenditures indicates the efficiency of resource use to prevent abuse in different areas (expenditures on technology, infrastructure, human capital, etc.)
Salary expenditure	
Information and communications technology expenditure	
Capital expenditure	
Value of additional assessments raised from audits and verification actions (including penalties and interest)	Indicates the amounts of funds additionally accrued based on the results of tax audits, which may indicate the efficiency of carried out tax audits

Source: developed by the authors based on (OECD iLibrary, 2023)

Note: the indicators for which categorical data were presented were coded as 1 or 0 for analytical purposes. 1 indicates that a particular technology or methodology is used by the jurisdiction, 0 indicates that the methodology is not used or is in the implementation phase

Methods

The research employed correlation analysis using the Pearson correlation coefficient to identify linear correlations between the groups of studied indicators. The first group was represented by tax loss indicators, the second — by indicators that quantitatively characterize the measures taken to prevent tax offences. Regression analysis using the linear regression method was applied to assess the cumulative impact of tax offence prevention measures on tax losses in the countries that were dependent variables. Mediation testing was additionally conducted by repeating the regression analysis with the exception of the variable Value of Additional Assessments Raised from

Audits and Verification Actions. It was assumed that the effectiveness of inspections can explain the positive impact of AI and electronic taxation on the volume of tax losses, which explains the use of the indicator as a mediator. The greater the volume of assessments after tax audits, the greater the documented losses, which indicates the effectiveness of using the latest technologies in detecting violations. The direct impact of AI and e-taxation could have been interpreted in a contradictory manner without an additional stage of analysis. In particular, it could be assumed that new criminal schemes using these technologies would emerge.

3. Research Results

The results of the correlation analysis conducted at the initial stage of the study provided a preliminary idea of the existing relationships between the studied indicators. The results of the analysis were visualized through a rectangular matrix containing correlations between two groups of indicators. The first group consisted of indicators of tax losses of countries, the second - of indicators that quantitatively characterize the measures taken to prevent tax offences (Table 2).

Table 2. Results of the correlation analysis between indicators of tax losses and indicators that quantitatively characterize the measures taken to prevent tax offences

		Data science / analytics tools	Robotics Process Automation (RPA)	Application programming interfaces (APIs)	Distributed ledger technology / Blockchain	Artificial intelligence (AI), including machine learning	Cloud computing	Administration uses behavioural insight methodologies or techniques	All or certain taxpayers are required to use an electronic invoice mechanism for tax purposes	Certain taxpayers are required to use electronic fiscal devices / cash registers	Operating expenditure	Salary expenditure	Information and communications technology expenditure	Capital expenditure	Percentage of payments received electronically by number of payments	Percentage of payments received electronically by number of payments	Value of additional assessments raised from audits and verification actions (including penalties and interest)
Total annual tax loss (USD million)		0.170183	0.428846	0.127052	-0.096592	0.363325	-0.003747	0.412914	-0.198409	-0.279516	0.494445	0.472882	0.494442	0.337549	0.096544	0.124988	0.461516
Total annual tax loss (% of GDP)		0.116985	0.300403	0.066332	-0.116985	0.228842	0.071621	0.118228	-0.300323	-0.235103	-0.061078	-0.063522	-0.035939	-0.184911	0.134926	0.046426	-0.097713
of which:	Corporate tax abuse (USD million)	0.195277	0.211323	0.094884	-0.042599	0.298195	-0.177329	0.391822	0.166909	-0.226542	0.624892	0.637798	0.547186	0.500856	0.012154	0.025211	0.799401
	offshore wealth (USD million)	0.110755	0.394739	0.103654	-0.090971	0.285345	0.068839	0.302490	-0.291665	-0.220705	0.298078	0.266536	0.330083	0.172905	0.103456	0.130031	0.189196

Source: calculated by the authors based on Tax Justice Network, 2021 and OECD iLibrary, 2023

There is a moderate direct relationship between the Total Annual Tax Loss in absolute terms and some indicators that quantitatively characterize the measures taken to prevent tax offences. This applies to the following indicators: Operating Expenditure, Salary Expenditure, Information and Communications Technology Expenditure, and Value of Additional Assessments Raised from Audits and Verification Actions. Corporate Tax Abuse is part of the Total Annual Tax Loss and demonstrates a stronger relationship with the observed indicators of tax system expenditures and, additionally, Capital Expenditure. In this case, the strength of the relationship is direct and noticeable (0.5-0.7) or strong (0.7-0.9). On the one hand, the detected trend may indicate insufficiently efficient use of resources, because the volume of losses from tax abuse increases with increasing expenditures. On the other hand, it can be assumed that the increase in expenditure contributes to the detection of a greater number of abuses, which increases documented losses from tax abuse. The assumptions made are mutually exclusive in a sense, which necessitates further analysis. Linear regression analysis was chosen for this purpose, which will provide more information for interpreting the interaction of the studied indicators. This is possible by assessing the impact of several indicators on the amount of tax losses.

Regression analysis was conducted using the Total Annual Tax Loss and Corporate Tax Abuse as dependent variables. During the correlation analysis, these indicators demonstrated a statistically significant relationship with some indicators of the quantitative characteristics of measures to prevent tax abuse. However, , the regression analysis did not reveal statistically significant results for the Total Annual Tax Loss, so further research is focused on Corporate Tax Abuse. As the regression analysis showed, the values of the indicator are under a statistically significant influence of several indicators of the quantitative characteristics of measures to prevent tax abuse (Table 3). The resulting model demonstrated a strong correlation between the dependent and independent indicators for the correlation coefficient, which was 0.98485531. Besides, the model was characterized by high explanatory power, as the coefficient of determination reached 0.98485531, the adjusted coefficient of determination – 0.87374789. So, changes in the selected independent variables can explain about 87.37% of the variation in Corporate Tax Abuse.

Table 3. Results of regression analysis between indicators that quantitatively characterize measures taken to prevent tax offences and Corporate Tax Abuse as a dependent variable

	Regression coefficient	Standard error	t(5)	p-value
Intercept	-1,150.96	1,290.331	-0.89199	0.413262
Data science / analytics tools	-0.00989	0.116273	-0.08506	0.935512
Robotics Process Automation (RPA)	-0.52305	0.192732	-2.71388	0.042081
Application programming interfaces (APIs)	-0.46787	0.132453	-3.53235	0.016698
Distributed ledger technology / Blockchain	-0.23978	0.184934	-1.29656	0.251393
Artificial intelligence (AI), including machine learning	0.63190	0.182564	3.46126	0.018018
Cloud computing	-0.59188	0.139689	-4.23709	0.008192
Administration uses behavioural insight methodologies or techniques	0.14648	0.132108	1.10879	0.317983
All or certain taxpayers are required to use an electronic invoice mechanism for tax purposes	0.39144	0.124353	3.14785	0.025440
Certain taxpayers are required to use electronic fiscal devices / cash registers	-0.19914	0.102635	-1.94027	0.110033
Operating expenditure	2.95162	1.382340	2.13524	0.085833
Salary expenditure	-1.32435	1.097891	-1.20627	0.281672
Information and communications technology expenditure	-0.57741	0.467116	-1.23611	0.271317
Capital expenditure	-0.90574	0.271338	-3.33807	0.020596
Percentage of payments received electronically by number of payments	0.43602	0.197263	2.21034	0.078071
Percentage of payments received electronically by value of payments	-0.05797	0.220430	-0.26297	0.803065
Value of additional assessments raised from audits and verification actions (including penalties and interest)	0.52353	0.172517	3.03465	0.028927

Source: calculated by the authors based on (Tax Justice Network, 2021; OECD iLibrary, 2023)

The regression results show that Corporate Tax Abuse is directly affected by whether the tax system uses AI, including ML. The indicator is also directly affected by whether taxpayers are required to use the electronic invoicing mechanism for tax purposes. Another indicator that is positively correlated with the dependent variable is the value of additional assessments based on the results of audits and inspections. RPA, APIs, Cloud Computing and Capital Expenditure are inversely correlated with Corporate Tax Abuse.

Table 4. Interpretation of the obtained results of the regression analysis from the pessimistic and optimistic perspectives

Interpretation of the results from a pessimistic perspective	Optimistic interpretation of the results
The direct relationship between the amount of tax losses from corporate tax abuse and AI may indicate the emergence of new opportunities for the realization of criminal schemes with the introduction of this technology. Hypothetically, AI can be used to facilitate data manipulation, for example, by generating false information, hiding anomalies or automating fraudulent schemes.	The introduction of AI and the use of electronic invoicing mechanisms may contribute to the detection of fraudulent schemes, with an increase in the volume of documented losses.
The direct impact of the use of electronic invoicing mechanisms on Corporate Tax Abuse may indicate the emergence of new fraudulent schemes through the use of innovative technologies.	
The positive correlation of Corporate Tax Abuse with Value of Additional Assessments Raised from Audits and Verification Actions indicates a direct relationship between the amount of additional funds charged and tax losses. On this grounds, it can be assumed that inspections and penalties do not contribute to the reduction of tax losses, and therefore the amount of abuse.	The identified impact may indicate intensified activity of tax authorities in conducting inspections and greater efficiency in detecting offences committed in previous periods.

Source: developed by the authors based on (Tax Justice Network, 2021; OECD iLibrary, 2023)

It is appropriate to explain the results obtained from an economic perspective. Regarding indicators that are inversely correlated with Corporate Tax Abuse, it can be assumed that the use of appropriate technologies and methods reduces the volume of tax abuse. For example, the inverse relationship with the implementation of cloud computing may indicate increased transparency and monitoring capabilities, resulting in a decrease in the abuse level. RPA expands the possibilities of automation, thereby reducing the chances of manual intervention in the system and the realization of fraudulent schemes.

Table 5. Results of the regression analysis after excluding the variable Value of Additional Assessments Raised from Audits and Verification Actions

	Regression coefficient	Standard error	t(5)	p-value
Intercept	1,626.78	5,927.908	0.27443	0.786104
Data science / analytics tools	-0.05620	0.104873	-0.53591	0.596956
Robotics Process Automation (RPA)	-0.09478	0.118064	-0.80280	0.429972
Application programming interfaces (APIs)	0.03304	0.094593	0.34926	0.729940
Distributed ledger technology / Blockchain	-0.09887	0.093641	-1.05586	0.301547
Artificial intelligence (AI), including machine learning	0.09519	0.121336	0.78455	0.440392
Cloud computing	-0.13119	0.100527	-1.30507	0.204244
Administration uses behavioural insight methodologies or techniques	0.07420	0.090832	0.81686	0.422044
All or certain taxpayers are required to use an electronic invoice mechanism for tax purposes	0.06488	0.096399	0.67305	0.507348
Certain taxpayers are required to use electronic fiscal devices / cash registers	-0.08211	0.092697	-0.88577	0.384533
Operating expenditure	-6.21570	1.958182	-3.17422	0.004088
Salary expenditure	6.06207	1.919399	3.15832	0.004248
Information and communications technology expenditure	0.32996	0.154504	2.13559	0.043120
Capital expenditure	0.80537	0.187882	4.28658	0.000255
By number of payments	-0.13072	0.145340	-0.89943	0.377362
By value of payments	0.14850	0.142713	1.04055	0.308454

Source: calculated by the authors based on (Tax Justice Network, 2021; OECD iLibrary, 2023)

APIs are used to integrate data from different sources, which also improve monitoring and allows them to detect anomalies. Capital expenditure can also contribute to reducing losses from tax abuse using funds for the development of infrastructure and equipment.

The interpretation of indicators that directly affect the dependent indicator is more difficult. This is determined by the fact that the regression results obtained can indicate both positive and negative trends. Table 4 presents the interpretation of the results obtained from the pessimistic and optimistic perspectives.

The Value of Additional Assessments Raised from Audits and Verification Actions (including penalties and interest) shows the amounts of funds additionally assessed as a result of tax audits. These assessments may include amounts of unpaid taxes identified during the audit, penalties, and interest. For the purposes of further analysis, it was assumed that this indicator acts as a mediator, mediating the relationship between other variables. Therefore, this indicator was excluded from the analysis to check which of the hypotheses noted in Table 4 are more realistic. Table 5 contains the results of the regression analysis without considering Corporate Tax Abuse with Value of Additional Assessments Raised from Audits and Verification Actions.

The results presented in Table 5 give grounds to draw several important conclusions. After excluding the variable Value of Additional Assessments Raised from Audits and Verification Actions, several other independent variables lost their statistically significant effect on Corporate Tax Abuse. Instead, the variables related to costs became statistically significant. This suggests that the excluded variable is the main mediator. In other words, the volume of additional assessments, which may indicate an increase in the efficiency of tax audits, mediates the relationship between the other variables. It is most likely that new technologies by themselves do not significantly affect the volume of tax losses, either positively or negatively. However, they increase the efficiency of tax audits due to increased accuracy, scalability, automation, and other advantages. This can be represented as a scheme: *Use of electronic invoices, implementation of AI technologies → Increase in the efficiency of tax audits → Detection of new fraud schemes*. Accordingly, the results of the additional stage of regression analysis suggest that the interpretation of the analysis results from an optimistic perspective in Table 4 is closer to reality. The increasing impact of costs at this stage of analysis can be explained by the fact that they are the initial condition for the effective implementation of technologies.

4. Discussion

The obtained results demonstrate that the introduction of new technologies in the tax sphere (AI, electronic invoice mechanisms, RPA, APIs, Cloud computing) can increase the efficiency of tax fraud detection. However, their impact is mediated by the efficiency of tax audits, during which the technologies observed can be useful for automation, increasing accuracy and scalability. The effective implementation of technologies depends on the amount of expenses incurred.

The conclusions of the study coincide with the views of Alm (2021), who argues that new technologies can both reduce tax evasion and open new opportunities for fraudsters. Ultimately, the researcher is inclined to believe that technological progress will complicate tax evasion in the future. Similar conclusions are reached by Paoki *et al.* (2021), noting that optimizing the use of information technologies in the tax sphere minimizes tax evasion. Yamen *et al.* (2023) also found a negative and strong relationship between digitalization and tax evasion. Moreover, the researchers emphasized the importance of investment in technology, as in our study.

Saragih *et al.* (2023) and Rahayu (2024), as well as the author of this work, demonstrated the positive impact of AI on tax fraud detection and tax compliance. Nuryani *et al.* (2024) emphasized the effectiveness of implementing big data analytics technologies in addition to AI. Xavier *et al.* (2022) demonstrated that using AI with open data can effectively predict tax evasion companies. Saptono *et al.* (2023), Nguyen *et al.* (2024) and Zamani *et al.* (2024) also confirm the direct impact of implementing e-taxation on reducing tax offences. However, our study emphasizes that new technologies and the implementation of e-taxation systems do not significantly reduce tax losses caused by fraud by themselves. The positive effect of technology implementation is mediated by the effectiveness of tax audits.

Some studies noted the role of socio-psychological factors in tax compliance. Apriwarto (2024) states that an anti-tax evasion strategy should be comprehensive, combining social influence, educational initiatives, and economic incentives. Pereira & Silva (2020) and Esmaeil Darjani *et al.* (2023) showed that the use of behavioural analysis results can help to identify approaches to improving tax compliance. However, our study did not reveal a statistically significant impact of the administration's use of behavioural analysis methodologies or techniques. It can be assumed that these technologies are undervalued and require further development and improvement.

So, the author found that the effectiveness of tax audits and the volume of additional assessments are the main mediators mediating the relationship between the use of technology and the detection of fraudulent

schemes. Increasing the effectiveness of detecting fraudulent schemes can help to reduce their scale and consequences. Such findings coincide with the views of Rahmayanti & Prihatainingtias (2020) and Farrar & King (2023), who determined that sanctions and appropriate punishment improve tax compliance. At the same time, Yan & Wangdra (2024) did not find a significant impact of tax fines on taxpayers' compliance with tax legislation. The practical contribution of the study is to substantiate the identified relationships, which can be useful for preventing criminal tax offences. Therefore, an important conclusion of the research is that technological changes and optimization of regulation may not have the desired effect without appropriate control and financial measures.

Limitations

The limitations of the study relate to the lack of data for certain country indicators, which necessitated the recoding of data as "missing data." However, this did not significantly affect the quality of the results because of the sufficient sample size, which compensated for the lack of data.

Recommendations

The results of the study give grounds to provide several key recommendations:

- The introduction of new technologies is effective in combating tax evasion, but it should be accompanied by adequate funding and infrastructure development. It is also advisable to ensure an appropriate level of transparency and control over the development and use of technologies to minimize the possibility of their use for criminal purposes;
- The introduction of technologies in itself may not have the expected effect, as it depends on the effectiveness of tax audits. Increasing such effectiveness involves adequate funding and training of personnel, improving awareness and social consciousness;
- The approach to preventing tax offences should be comprehensive, as the measures analysed in the study demonstrated the highest effectiveness when applied in combination.

Conclusions

Tax crimes are a widespread and significant problem for many countries, as they negatively affect their financial sustainability and the performance of state functions. Effective prevention of tax crimes allows solving the problem of insufficient filling of the state budget, promotes economic growth, increases welfare, and consolidates trust in state authorities.

In the first stage of the regression analysis, several variables had a statistically significant impact on the amount of tax losses of countries. RPA, APIs, Cloud computing and Capital expenditure had an inverse effect, therefore their use contributes to the reduction of tax losses. AI and the use of electronic invoice mechanisms demonstrated a direct effect. On the one hand, this could be explained by the emergence of new fraudulent schemes using these technologies. On the other hand, the relationship can be explained by the increase in documented tax losses because of the effectiveness of technologies in detecting offences.

An additional stage of regression analysis was conducted to check which of the assumptions is closer to reality. At this stage, the variable Value of Additional Assessments Raised from Audits and Verification Actions was excluded, which also demonstrated a direct effect on the increase in tax losses. It was assumed that this variable acts as a mediator, mediating the relationship between other variables. The effect of technology turned out to be statistically insignificant, while the effect of costs increased after excluding the variable. Therefore, it was assumed that the variables that demonstrated a direct effect on Corporate Tax Abuse in the first stage of regression analysis contribute to the detection of fraudulent schemes. The direct effect in this case can be explained by the increase in the volume of documented losses.

It is also worth noting that if the impact of tax audits is excluded, costs come to the fore, which also have a linear impact on Corporate Tax Abuse according to the results of the correlation analysis. Costs can be an initial condition for the effective implementation of technologies. Tax audits could also mediate these relationships, so their exclusion demonstrated that without the corresponding costs, technologies do not have the proper effect. The conclusions obtained have scientific and practical value and can be used by government officials in the process of developing tax policy and determining effective measures to prevent tax criminal offenses. Further research may concern assessing the effectiveness of the implementation of international standards, in particular, the Common Reporting Standard (CRS) and Base Erosion and Profit Shifting (BEPS).

Credit Authorship Contribution Statement

Vasyl Topchii: Conceptualization, Investigation, Writing – original draft;
Yuliia Moroz: Methodology, Project administration, Writing – review and editing;
Natalia Karpenko: Software, Formal analysis, Writing – original draft;
Oleg Khoronovskyi: Supervision, Data curation, Validation, Writing – review and editing;
Volodymyr Tarashchenko: Methodology, Writing – original draft, Supervision, Data curation, Validation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Declaration of Use of Generative AI and AI-Assisted Technologies

The authors declare that they have not used/ or used generative AI (a type of artificial intelligence technology that can produce various types of content including text, imagery, audio and synthetic data.

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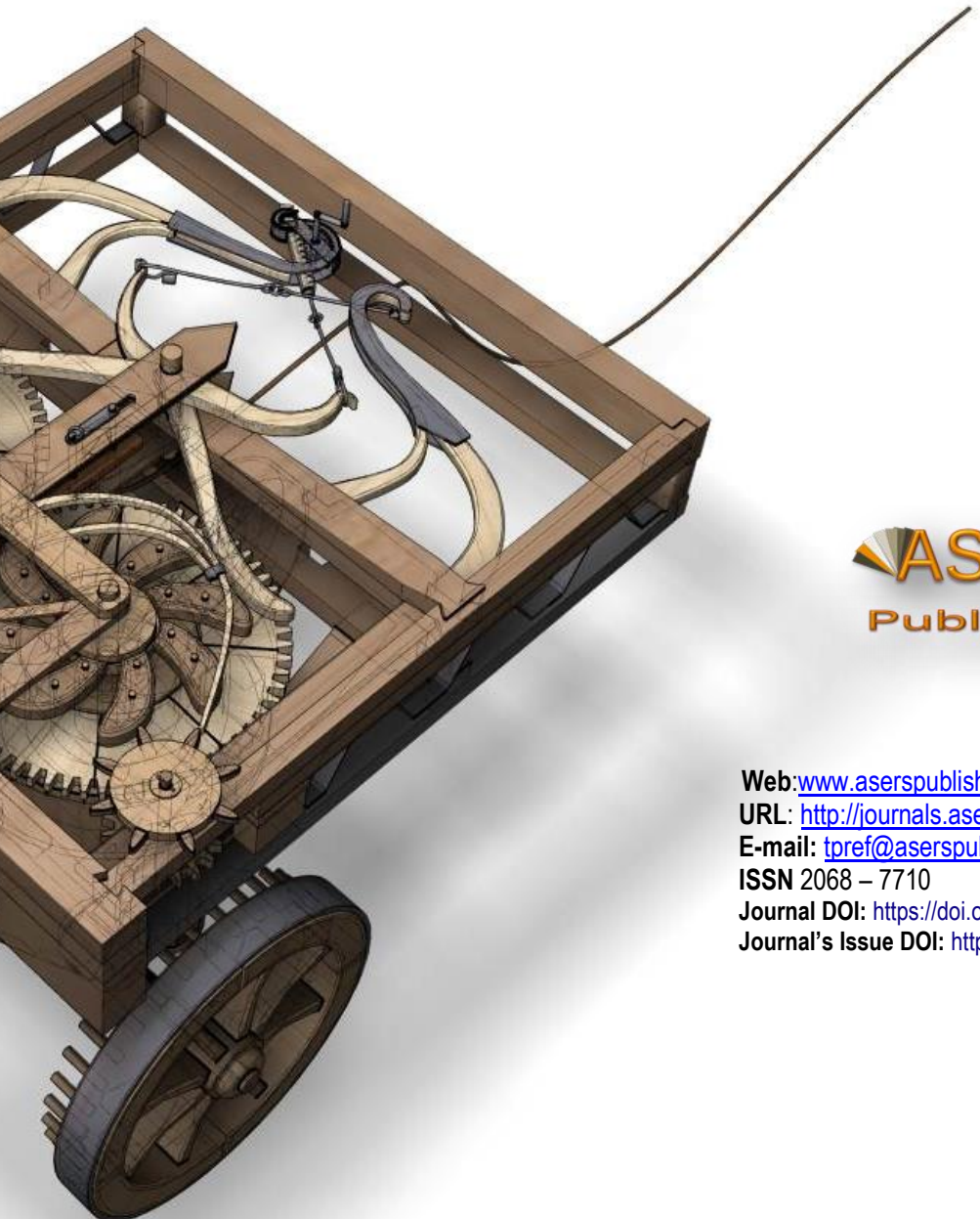

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