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Актуальность тематического фокуса журнала
Обмен компетентными мнениями в сфере налоговых реформ разных стран имеет важное значение для разработки теоретического обоснования практики налоговых реформ и содействия внедрению передового опыта, чтобы сделать налоговые системы более простыми, справедливыми и эффективными.

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Международный характер журнала обеспечивается универсальностью налоговой тематики и международным спросом на внедрение передового опыта в области налоговых реформ. Широкое методологическое сходство методов, используемых для анализа результатов налоговых реформ, проводимых в разных странах, упрощает международное сотрудничество и трансграничные аналитические сопоставления.

Миссия и цель

Миссия рецензируемого журнала "Journal of Tax Reform" заключается в содействии всесторонним исследованиям налоговых реформ и эффектов различных налоговых преобразований, ведущих к повышению качества и достоверности исследований в области налогообложения.

Цель журнала "Journal of Tax Reform" – представление значимых выводов оригинальных социо-экономических исследований, проведенных специалистами разных стран в области налоговых реформ и налогообложения в целом.
В журнале публикуются оригинальные эмпирические и обзорные статьи, связанные с административно-управленческими, экономическими проблемами налоговых реформ, а также рассматривающие вопросы, связанные с историей налоговых реформ и практикой противодействия уклонению от уплаты налогов.

Journal Policy

Relevance of the thematic focus of the Journal
The exchange of competent opinions on tax reforms carried out in different countries is important for strengthening the theoretical grounding of tax reform practice and facilitating the implementation of best practices for simpler, fairer and more efficient tax systems.

International character of the Journal
The international character of the Journal is ensured by the universality of taxation topics and the international demand for the implementation of best practices in the field of tax reform. The facilitation of international collaborations and cross-border analytical comparisons is informed by a broad methodological similarity between techniques used to analyse the results of tax reforms carried out in different countries.

Mission and Objective

The mission of the peer-reviewed Journal of Tax Reform is to promote comprehensive research into tax reform and the effects of tax system reorganisation leading to improvements in the quality and credibility of research in the field of taxation.

The Journal of Tax Reform is aimed at presenting significant findings of original socio-economic research carried out by professionals from various countries in the field of tax reform and taxation in general.

The Journal publishes original empirical and review articles elucidating administrative-managerial and economic problems in tax reform, as well as those discussing issues related to historical tax reform and practices for countering tax evasion.

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Development of the tax administration in Russia: Results and prospects

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ABSTRACT

The study aims to identify the milestone events in the development of the tax administration in post-Soviet Russia and to offer recommendations for its further improvement. We tested the hypothesis about the relationship between the development of the tax system and tax administration, which, once established, can play a role in the improvement of the tax administration's efficiency. The study relies on quantitative (regression and correlation analysis, factor analysis, principal component analysis) and qualitative methods (classification, thesaurus analysis, SWOT-analysis, critical points method). We also analyzed the legal acts describing the goals (target indicators) for the development of the tax system and tax administration and propose a set of integral indices characterizing these processes. The key events (factors) for the period starting from the 1990s to the present were identified and ranked in order of importance. Their impact was investigated with the help of SWOT-analysis and factor analysis methods. We found that in the given period, there was an increase in the correspondence between the goals of the tax administration and the goals of the tax system. This means that the tax administration's management and staff have become more motivated to upscale their priorities and to orient their activities towards public good. The analysis of indices for the given periods has shown improved performance of the tax system and tax administration. The index of tax administration development is based on four indicators. Between the 1990s and 2010s, the index grew by 13% mainly because of the expanded scope of functions of the tax administration, staff downsizing and optimization of the remuneration system. We found that there is a significant statistical relationship between the indices of development of the tax system and tax administration.

KEYWORDS

tax system, tax service, tax authorities, tax administration, civil service, reform, SWOT-analysis

JEL E62; H30; K34

Итоги и перспективы развития налоговых органов России

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АННОТАЦИЯ

Цель статьи состоит в выявлении критических точек в развитии налоговых органов в постсоветский период и выработке предложений по дальнейшему совершенствованию налоговых органов. Была выдвинута гипотеза о наличии взаимосвязи между развитием налоговой системы и налоговых органов, которая может быть использована для повышения эффективности налоговых органов. Использованы количественные (регрессионно-корреляционный анализ, факторный анализ, метод главных компонент) и качественные методы (классификация, тезаурусный анализ, SWOT-анализ, метод критических точек). Изучены нормативные правовые акты, содержащие цели (целевые показатели) развития налоговой системы и налоговых органов. Предложены интегральные индексы, характеризующие динамику развития налоговых органов и налоговой системы. Выявлены ключевые события (факторы) с начала 1990-х гг. до настоящего времени, осуществлено их ранжирование по уровню значимости, проведен SWOT-анализ и факторный анализ влияния ключевых событий на развитие налоговых органов и налоговой системы. Исследование показало, что усиливается взаимосвязь целевых показателей деятельности налоговых органов и целей развития налоговой системы. Это ориентирует руководство и служащих налоговых органов на реализацию приоритетов более высокого уровня и достижению общественно значимых результатов. За анализируемые годы значение индексов развития налоговой системы и налоговых органов улучшилось. Индекс развития налоговых органов построен по четырем показателям, и его значение за 1990-е – 2010-е гг. увеличилось на 13%, главным образом, за счет увеличения объема функций при сокращении численности и оптимизации материального обеспечения налоговых служащих. Между индексами развития налоговой системы и развития налоговых органов выявлена значимая статистическая связь.

КЛЮЧЕВЫЕ СЛОВА

налоговая система, налоговая служба, налоговые органы, налоговое администрирование, государственная служба, реформа, SWOT-анализ

1. Introduction

From the structural point of view, the tax system enables the government to meet its national and international liabilities, therefore, an efficient tax system is of great importance in the politics of any country. In its turn, the efficiency of a tax system is determined by the quality of tax administration, that is, how well the computation and collection of taxes and other mandatory payments is organized. This process involves multiple actors, but the main role is played by the tax authorities.

In post-Soviet Russia, the tax administration evolved together with other spheres of economic and social life. At present, the ongoing digital transformation of the Russian state affects all spheres of public

administration, the tax administration being no exception.

The study focuses on the Russian tax system, more specifically, the development of tax administration bodies in the context of the tax system's transformations in the post-Soviet period.

The study aims to identify the milestone events in the development of the tax administration in the post-Soviet period and to offer recommendations for its further improvement.

Our initial hypothesis is that the development of the tax system and tax administration are intertwined processes and that once established, the relationship between them can play a role in the improvement of the tax administration's efficiency.

In line with the research problem and purpose, we addressed the following objectives in a successive manner:

1. To compare the official indicators characterizing the development of the tax system and tax administration in the 1990s, 2000s and 2010s and find to what extent the indicators of the tax administration's efficiency are connected to the goals of the tax system's development.

2. To build integral indices characterizing the development of the tax system and administration.

3. To identify the key events (factors) in the development of the tax system and tax administration for the given period and rank them in order of importance; to conduct a SWOT analysis and factor analysis of their impact on the development of the tax system and tax administration.

The structure of this paper is determined by the above-described research tasks. The final section discusses the prospects of the tax system's development and contains recommendations for further improvement of the tax administration in Russia. Thus, our research has both theoretical significance and practical implications because it can help gain a better understanding of the theoretical and practical aspects of tax administration.

2. Literature review

There is a vast body of research discussing the efficiency of tax administration and ways of assessing it. According to the classical approach formulated by H. Strauss et al. [1] and V. Tanzi et al. [2], tax administration is effective as long as it provides tax compliance. Another popular approach (see, for example, O. Farny et al. [3]) associates the efficiency of tax administration with lower expenditures in comparison with the revenues collected from taxes. The third approach was formulated by D. Frampton [4], who distinguishes between the notions of efficiency (achieving the best cost-quality balance) and productivity (the degree of goal attainment).

P. Bejaković [5] defines the performance of a tax system as a balance between efficiency (maximization of tax revenue) and equity (distribution of resources). In general, the quality of tax services and people's trust in tax authority, according to A. Augustine et al. [6], determine the efficiency of tax systems in developed and developing countries.

The methodological considerations discussed by D. Mookherjee [7] are of particular interest in this regard:

a) the expected value of the government's net revenues is given by the difference between expected tax revenues and the wage bill for tax collectors.

b) the government sets the lowest possible level of tax collectors' wages that induces them to agree to work in the bureaucracy.

c) halfhearted, piecemeal reforms contribute to increasing corruption; only a large-scale discrete reform can eliminate corruption.

d) the type of corruption in tax administration is captured by the Nash bargaining solution.

Mookherjee [7] proposes the model of the expected utility of the tax collector (1):

$$W + r(t + q \cdot f)d - l \cdot c \cdot e + B - E(p), \quad (1)$$

where W is the tax collector's salary; r is the fraction of additional revenues generated; t is the tax rate; q is the time discount factor; f is the constant

rate of penalties on the amount of income concealed; *d* is the expected present value; *l* is the likelihood of penalties imposed on the tax collector for underassessment; *e* is the amount of the taxpayer's underreported income; *B* is the expected value of the bribe; *p* is the probability that the tax collector will detect tax evasion; and *E(p)* is the amount of effort devoted to inspection.

The efficiency of tax administrators is related to the way they perform their functions. M. Grote [8], an expert of the IMF, identifies four key functions that a tax policy unit encompasses: a law-making function (participation in drafting of tax legislation); analytical function (revenue and economic impact analysis); explanatory function (explaining the economic rationale and intent behind changes in the tax policy and legislation); and controlling function (control over the application of the existing tax codes and regulations). As R. Bird justly observes [9], the distribution of taxing authority between the center and regions also has a considerable institutional significance. S. Jang and R.J. Eger [10] describe the effects (both positive and negative) of delegating tax collection to private agencies.

M. Klun [11] analyzes the case of Slovenia and reasonably argues that in transition countries, the performance of the tax administration is predominantly evaluated on the basis of the indicators used by the tax authorities themselves while other indicators and the evaluation made from the taxpayers' perspective are often ignored. H. Güler and H. Kaba [12], in their turn, focus on the case of Turkey to show that enhanced efficiency of the tax administration there was the result of reforms, which made the tax administration unable to allocate its own budget, increase its staff, hire or dismiss new employees and negotiate their wage levels.

In Russia, the research agenda evolved in parallel to the development of taxation. The resulting body of research is rich and diverse. For the purposes of this paper, we divided the most significant

publications into two groups. The first group of deals with the stages in the tax system's transformations in the given period. For example, S. Vasiliev [13] describes the development of taxation from the Soviet era to the present day. N. Shibaeva and her colleagues [14] discuss the increasing centralization of the present-day tax system in comparison with the 1990s. S. Belev et al. [15] describe the transformation of the fiscal policy in 2008–2018. V. Gromov [16] outlines the stages of tax competition between 1991 and 2005. V. Vishnevsky and his colleagues [17] make a reasonable observation that 'it is important to assess the quality of a tax system not only according to a set of formal criteria but by taking into account the specific historical, technological and socio-cultural context'.

All of these studies, however, only briefly touch upon the matters related to the work of tax agencies as an institution of tax administration. The current stage in the history of the Federal Tax Service is discussed by D. Moloshnikova and K. Baytemirova in the light of digitalization [18]. Signs of the tax system's inefficiency are justifiably associated with the 'lack of coordination to balance the development of the legislation and the algorithms for the implementation of the institutional instruments of control'. [19] As far as is known, however, no attempts have been made in Russia to consider the connection between the development of the tax system and of the tax administration bodies. A. Pogorletsky and N. Bashkirova came close to exploring this topic: in their study they trace the tax system's evolution by looking at the changes in the forms and tools of tax administration [20].

Another group of studies deal with the methodology for assessment of the efficiency of the tax system and tax administration. This research has been conducted in Russia since the late 1990s, when the first outcomes of the economic reforms became visible. For instance, G. Kartashova [21] argues that the efficiency of the tax system should be measured by looking at the amount of uncollected taxes and the efficiency of the tax administration, by

looking at the data on tax revenue collection. In the mid-2000s, S. Alekhin [22] introduced an indicator of tax potential calculated as a sum of tax accrued and tax revenue after subtracting uncollected tax. As more statistical data have been accumulated, more recent methodologies started to make use of a wider variety of indicators. For example, S. Boyko [23] suggests that the efficiency of a tax system should be assessed by using tax revenue, GDP per capita, administrative costs of taxation and inflation.

Since the 2000s, which saw some large-scale reforms of the Russian tax service, there has been a surge in studies addressing the topic of cost effectiveness of the tax administration. For instance, I. Kalashnikova [24] proposed to focus on the rate of tax collection calculated as the ratio of total revenue of the state budget to the sum of actual tax revenue and growth in tax debt. V. Moroz and S. Moroz [25] propose to measure the tax administration's efficiency as a ratio of tax revenue to the costs of tax administration. These are but a few of the studies and publications on this topic. The classification and discussion of the proposed approaches are given further in this article.

In general, it should be noted that, first, similar indicators are used to assess the performance of the tax system and tax administration, which, in our view, gives us a somewhat inaccurate picture. Second, the existing methodologies are mostly based on macro-economic indicators. There is only one study [26] that takes into account the factor of trust in the tax system. Russian researchers are obviously more oriented towards 'old' rather than 'new' institutionalism, which might be a result of the current state of affairs in the research field or in the institutional environment.

3. Data and methods

To address the first research task, we are going to consider the following hypothesis (*Hypothesis* 1 (*H*1)): institutional goals (target indicators) of the development of the tax administration

in the corresponding time period follow logically from the goals of the national tax system.

To test this hypothesis, we are going to apply the following methodology:

1. We searched through the legal reference systems and found the key normative acts setting the goals of development of the tax system and tax administration in the 1990s, 2000s, and 2010s.

Since 2014, the Federal Tax Service has been publishing its goals and reports on the official web-site. The range of sources used for this study also includes framework documents (legal, strategic) for the development of the tax system as an institution and methodologies for the evaluation of the tax administration. We also analyzed two normative acts of the 1990s describing the priorities of development of the tax system, three similar documents of the 2000s and five of the 2010s. Methodologies for the tax administration included one legal act of 1999, five acts of the 2000s and two departmental legal acts of the 2010s.

2. Based on these documents, we compiled lists of goals (indicators). If the documents were in force in the same period, the goals (indicators) that were repeated were regarded as the same.

3. The indicators specified in the strategic documents of the tax system were checked against those in the corresponding documents of the tax administration. We also identified the extent of the indicators' correspondence to each other.

4. If the indicators had similar names and measurement units, they were deemed correspondent to each other. If the indicators had different names and measurement units but were similar in meaning, they were deemed partially correspondent to each other. In other cases, a conclusion was made that no correspondence was detected.

5. We calculated the degree of mutual correspondence of the indicators in percentage for each decade. We conducted a pairwise comparison of the documents focusing on the correspondence between the goals they describe.

6. All of the above has led us to the conclusion that the results demonstrated by the tax administration are related to the institutional goals of the tax system. The second degree of correspondence signifies that the tax administration is orientated towards achieving the goals of the national tax system.

The study also aims to address the shortcomings of the existing methods and to develop a new methodological approach to assessing the efficiency of the tax system and tax administration. To this end, in accordance with the second research task, we built integral indices to test *Hypothesis* 2 (*H*2), which states that the development of the tax administration follows the general trends in the development of the national tax system.

International research literature provides a range of methods and indicators that can be used for diagnostics of tax administration efficiency[1]. In theory, these indicators can be used to evaluate the performance of national tax agencies in accordance with the international standards of efficiency and cost effectiveness. In Russia, however, these approaches are not always practically possible due to the lack of data, which is why we chose to develop our own methodology.

1. We identified the goals (target indicators) specified in federal planning documents and evaluated them according to the criteria of measurability, objectivity, relevance, independence (absence of repetitions), comparability (continuity of observation) and data availability.

2. We collected the values of the indicators for the period between 1992 and 2019 from the materials of the Ministry of Economic Development, Ministry of Finance, Accounts Chamber of the Federal Tax Service and the official statistical data.

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[1] OECD Comparative Series; USAID Collecting Taxes Database; Tax performance assessment (GDI/DIE); PEFA framework (tax administration indicators); EU Fiscal Blueprints; Tax simplification handbook (WB); Diagnostic framework for Revenue Administration (WB); Diagnostic missions (IMF).

3. The significance and mutual influence of the indicators were evaluated with the help of the principal component method.

4. The indicators were aggregated according to formula (2) and the index of tax system development was built (I_a):

$$I_a = \frac{\sum_{i=1}^{N}\left(\dfrac{X_{r,i}}{X_{b,i}}-1\right)\cdot 100}{N},\qquad (2)$$

where $X_{b,i}$ is the value of indicator i in the base (first analyzed) year; $X_{r,i}$ is the value of indicator in the accounting (last) year; and N is the number of indicators.

5. We selected the indicators characterizing the development of the tax administration in the same years, identified and summarized their values. We decided against using expert evaluations due to their subjective nature as well as the indicators whose impact is hard to measure such as age, length of service and level of education of tax officers. In taxation, the educational and staffing trends of the last decades have been quite ambiguous and the formal indicators do not always reflect the real state of things. Students at the universities specializing in taxation and sponsored by the Federal Tax Service often demonstrate a poor quality of education [27].

6. We evaluated the mutual influence of indicators through the method of principal component analysis and built the index of tax administration development (I_{pa}) according to formula (3):

$$I_{pa} = \frac{1}{T}\sum_{t}^{n}\frac{1}{I}\sum_{i}^{n}\frac{\sum_{i=1}^{n}X_{t,i}}{\sum_{i}^{n}X_{t,i}},\qquad (3)$$

where i is the number of indicators; $X_{t,i}$ is the value of indicator i for year t; and T is the total number of years.

7. We evaluated the statistical relationship between the two indices over the given period and built a panel data regression to forecast further development of the tax system.

If the connection between the development of the tax system and tax administration is detected, it will make sense to look at the factors shaping these pro-

cesses. Therefore, we are also going to test *Hypothesis* 3 (*H*3), stating the existence of certain milestone events (factors) that had an institutional impact on the tax system and tax administration.

To test this hypothesis, we applied the following methodology:

1. First, we selected the events in the evolution of the tax system and tax administration in the given period. To this end, we used normative acts and academic publications.

2. Next, we compiled two separate chronological tables showing the development of the tax system and tax administration.

3. The events were ranked by assigning them the following weights:

'3' signifies a milestone event that had a crucial and lengthy influence on the given sphere (10% of all the events or less);

'2' means an important event that had a considerable and lengthy influence on the given sphere (25% of all the events or less);

'1' stands for a remarkable event that had a certain limited impact on the given sphere.

The events that failed to meet the above-described criteria were filtered out.

4. We also used visualization of the key events and their impact by superimposing them upon a graph showing the dynamics of the corresponding indices.

5. Finally, we conducted a SWOT-analysis to identify the key events in the development of the tax system and tax administration in the given period and to make recommendations for further improvements in this sphere.

4. Results

The first research task was addressed by comparing the key indicators of tax administration development in Russia (as specified by the official documents) with the indicators used by tax administrators themselves. The results are shown in Table 1.

We found that in each of the given periods at least a half of the goals (target indicators) set for tax administrators completely or partially corresponded to the goals of the tax system.

In the 2000s, most of the priorities set for the tax system (strengthening of tax federalism, elimination of internal offshores, increase in voluntary contributions, improvement of the quality of taxpayer services, staff optimization, promoting compliance for timely declaration submission, online filing services, tax audit, etc.) were not included in the tools for the tax administration assessment. As a result, some of the important priorities remained on paper.

In the 2010s, the degree of correspondence grew and most of the goals of the tax administration were aligned with the institutional priorities. This period saw the introduction of taxpayer satisfaction indicators. At the same the tax administration's role in stimulating business activity also came to the spotlight. Tax dispute resolutions were evaluated. Nevertheless, the evaluation methodologies still failed to include the indicators that would reflect the authority of the Federal Tax Service to administer revenue from alcohol taxes and social contributions, to conduct tax

Table 1

Correspondence between the goals of the tax system and tax administration in Russia

Period	Sphere	Indicators Total	Correspondence		
			complete	partial	no correspondence
1990s	Tax system	14	3	4	7
	Tax administration	21	3	9	19
2000s	Tax system	21	0	5	16
	Tax administration	18	0	9	10
2010s	Tax system	30	8	10	12
	Tax administration	25	8	9	8

Source: hereinafter the tables are compiled by the authors based on their own calculations

audit and work with SMEs and there was still a perceived lack of indicators related to digitalization.

In further analysis, we used sets of indicators corresponding to the key indicators specified in strategic documents of the tax system and tax administration that can be evaluated statistically (see Tables 2 and 3).

What distinguishes our methodology is that it relies on different sets of indicators to evaluate the tax system and tax administration. All indicators are statistically measurable, relevant (included into official documents), comparable in time, independent and can be used to calculate the integral index.

To assess the informative value of our indicator sets, we used the method of principal components. The difference be-

tween the values of the tax burden indicator from those provided by the Federal Tax Service can be explained by the fact that in Table 4 we used the data of the Federal State Statistics Service while the Federal Tax Service uses its own data.

The first, second and third principal components have eigenvalues greater than 1. Together they cover about 89% of all the data variations. However, when we calculated the correlation with the index of tax administration development (see below), we found that other components also had a positive impact on the index's informative value.

Indices of five out of seven indicators showed positive dynamics over the given period: there was an increase in the tax-to GDP ratio, a reduction in the tax burden on business, improved tax collection,

Table 2

Indicators of the development of the tax system

No	Indicator	Unit	Description	Optimal dynamics	Statistical forms used for data collection
1	Share of tax revenue in the consolidated budget revenue	%	Contribution of the tax system to economic development. Used worldwide	Growth	Tax revenue of the consolidated budget GDP
2	Tax to GDP ratio	%	Fiscal function of the tax system	Growth	Consolidated budget Tax revenue of the consolidated budget of the Russian Federation
3	Actual tax burden on business	%	Regulatory function of the tax system. Calculated as the ratio of the sum of taxes and levies to the financial results of organizations	Decline	Pre-tax profit (loss) of organizations Tax revenue of the consolidated budget
4	Tax collection rate	%	Controlling function of taxes. Calculated as the quotient of two figures – the sum of tax collected and the tax debt in the accounting period.	Growth	Tax debt Tax revenue of the consolidated budget
5	Number of individual entrepreneurs, incl. farm businesses	mln	The regulatory function of taxes is measured as the size of the tax base. Most accurately describes the macro-economic and fiscal climate in the country	Growth	Key indicators of individual entrepreneurs' performance by type of economic activity Number of peasant (farming) enterprises
6	Number of enterprises and organizations	mln	Regulatory function of taxes. Calculations do not cover the number of branches	Growth	Number of enterprises and organizations by type of economic activity
7	Types of taxes, levies, excises, and contributions	mln	Degree of complexity of the tax system. All levels of taxes are considered	Decline	Tax Code of the Russian Federation

Table 3

Indicators of the development of the tax administration

No	Indicator	Unit	Description	Desired dynamics	Sources of data
1	Number of functions of the tax administration	units	Workload of the tax administration. All functions of the tax administration are considered equally important	Growth	Regulations concerning the tax administration
2	Tax staff as a percentage of total civil service	%	The task of staff reduction is described in the Personnel Policy Concept of the Federal Tax Service. A more objective approach is to compare the number of tax officers with the overall number of civil servants rather than consider this indicator alone	Decline	Number of federal employees and their wage level (statistical data form)
3	Ratio of average salary of the tax staff to the average salary in civil service	%	Characterizes the adequacy of the wage level of tax staff	Growth	Number of federal employees and their wage level (statistical data form)
4	Costs of the tax administration as a percentage of total federal expenditures	%	Economic efficiency of the tax administration. Takes into account public spending on tax staff wages	Decline	Execution of the expenditure part of the federal budget

Table 4

Principal components of the tax system indicators

No	Indicators	Median	Standard deviation	Minimum	Maximum	Variation	Share of explained variation	Eigenvalue	Explained variation	Rate of indicator growth by period (%)			
										1990s	2000s	2010s	Entire period
1	Share of tax revenue in the consolidated budget revenue, %	58.7	8.4	49.4	77.7	71.4	0.498	3.487	0.498	97.4	70.3	84.7	85.1
2	Tax to GDP ratio, %	32.8	4.0	25.2	40.2	16.1	0.241	1.69	0.74	85.9	122.1	96.5	122.6
3	Actual tax burden on business, %	0.9	0.8	-2.8	2.2	0.7	0.145	1.018	0.885	120.2	113.3	94.1	127.2
4	Tax collection, %	0.9	0.1	0.4	1.0	0.0	0.056	0.395	0.941	127.2	113.1	97.9	151.3
5	Number of individual entrepreneurs, incl. farm businesses, mln	3.1	0.8	1.7	4.6	0.6	0.034	0.237	0.975	211.3	68.9	93.8	161.1
6	Number of enterprises and organizations (branches not included), mln	3.7	1.3	0.9	5.0	1.7	0.019	0.13	0.994	322.4	158.0	128.8	416.1
7	Types of taxes, levies, excises and contributions, units	27.0	12.4	16.0	49.0	154	0.0003	0.002	1	125.6	37.8	94.1	43.6

and a growth in the number of registered legal entities. The index of tax system development calculated according to formula (2) in the given period rose by 15.4%. The index reached its minimum in 1994, 1998, 2002, 2008, 2014, and 2017.

The first and second principal components have eigenvalues greater than 1 (Table 5). Together they explain 55% of all data variations but to increase the informative value of the index, we are going to provide the calculations for all the principal components of the set.

The index of tax administration development calculated according to formula (3) increased by 13% in the given period, which was achieved primarily through the expansion of the tax administration's functions (almost threefold) combined with staff downsizing and optimization of the remuneration scheme.

There is a statistical relationship between the indices for tax system and tax administration (the correlation coefficient is 0.79 at $p < 0.001$), which means that we can build a dual regression on panel data where the index of tax system development is a dependent variable (Y) and the number of observations corresponds to the number of years (Table 6).

The equation with the calculated regression coefficients shows the relationship between the development of the tax system and tax administration and looks the following way:

$$y = 27.5 + 0.72x. \qquad (4)$$

The sample coefficient of determination R^2 equals 0.62, which means that the model explains almost two-thirds of the variations of the dependent variable.

The coefficient of multiple correlation (0.79) indicates a high degree of association between the factors.

The approximation error $2.9 \cdot 10^{-16}$ signifies high accuracy of the model.

The significance of the model was evaluated with the help of the *F*-test.

Table 5

Principal components of the tax administration indicators

No	Indicators	Me-dian	Stan-dard devia-tion	Mini-mum	Maxi-mum	Varia-tion	Share of exp-lai-ned varia-tion	Ei-gen-value	Exp-lai-ned varia-tion	Rate of indicator growth by period (%)			
										1990s	2000s	2010s	En-tire pe-riod
1	Number of functions of the tax ad-ministration, units	83.0	21.1	56.0	130	447.0	0.566	3.396	0.566	112.5	125	151.8	225
2	Tax staff as a percentage of total civil service, %	39.8	11.0	26.6	66.2	120.5	0.183	1.099	0.549	215.3	63.6	107.6	126.6
3	Ratio of the average sala-ry of tax staff to the average salary in civil service, %	115.4	19.2	74.4	151.6	368.2	0.016	0.095	0.991	69.3	110.0	115.4	87.5
4	Costs of the tax admin-istration as a percentage of total fed-eral expendi-tures, %	0.6	0.2	0.2	0.9	0.0	0.0002	0.002	1	280.7	61.5	126.1	401.5

Table 6

Protocol of regression analysis

Regression statistics		Analysis of variance					
Multiple R	0.79		Df	SS	MS	F	Significance F
R^2	0.63	Regression	1	3446.3	3445.3	44.6	$4.4 \cdot 10^{-7}$
Normalized R^2	0.762	Residual	26	2009.6	77.3		
Standard error	8.79	Total	27	5454.9			–
Observations	28						

	Coefficients	Standard error	t-statistic	P-value	Lower 95%	Higher 95%
Y-intersection	27.5	11.2	2.45	0.02	4.45	50.6
X	0.72	0.11	6.68	$4.4 \cdot 10^{-7}$	0.49	0.94

The calculated significance level of the coefficient (44.5) exceeds the tabular F-value (0.004) at $\alpha = 0.05$, that is, the regression equation is significant at $\alpha = 0.05$ and it can be used for analysis and forecasting.

We conducted a pairwise comparison of the coefficients and their standard errors and came to the conclusion that the calculated coefficients are statistically significant. This conclusion is supported by the p-values of the coefficient (0.02), which are below the significance level $\alpha = 0.05$. Confidence intervals with the confidence level 95% do not include zero, which also confirms the significance of the regression coefficients.

The significance of the coefficient of the regression equation was tested by using the Student's t-test. The calculated value of the coefficient (6.92) is higher than the tabular value (2.06), that is, the values of the coefficient are significant.

Testing of the significance of the regression coefficients for the factorial analysis confirms the adequacy of the equation. By calculating the coefficient of elasticity (E) we can give an economic interpretation of this equation:

$$E = 102.8 \cdot \frac{0.72}{101.7} = 0.73. \quad (5)$$

The coefficient shows an increase in the index of development of the tax system by 0.73% while the index of development of the tax administration increases by 1%.

It makes sense to forecast further development of the tax system by using the regression model since we have already shown its high significance.

Let us now create a point forecast for a 2-year interval. To this end, we are going to calculate the mean absolute growth (MAG) in the index of tax administration development:

$$MAG = \frac{114.9 - 99.5}{28 - 1} = 0.57. \quad (6)$$

For Step 1:

$$x_1 = x + MAG \cdot 1 = \\ = 114.9 + 0.57 = 115.47. \quad (7)$$

For Step 2:

$$x_2 = x + MAG \cdot 2 = \\ = 114.9 + 0.57 \cdot 2 = 116.04, \quad (8)$$

where x_1 is the value of the independent variable in the first year of projection; x_2 is the value of the independent variable in the second year of projection; and x is the value in the last year for which empirical data are available.

To get point forecast estimates of the dependent variable, we will substitute the values obtained into regression equation $y = 27.5 + 0.72x$:

$$y_1 = 27.5 + 0.72 \cdot 115.47 = 110.64, \quad (9)$$

$$y_2 = 27.5 + 0.72 \cdot 116.04 = 111.05, \quad (10)$$

where y_1 is the value of the dependent variable in the first year of projection and x_2 is the value of the dependent variable in the second year of projection.

For the point forecast we obtained we are now going to calculate an interval forecast containing possible deviations from the predicted value.

For Step 1, the confidence interval of the prediction has the following bounds:

upper bound: $y_1 + U_1 = 110.64 + 2.6 = 113.24$;
lower bound: $y_1 - U_1 = 110.64 - 2.6 = 108.04$.

$$U_1 = \sigma \cdot t_a \cdot \sqrt{1 + \frac{1}{n} + \frac{(x_1 - x_{cp})^2}{\sum_{i=1}^{n}(x_i - x_{cp})^2}} =$$
$$= 11.23 \cdot 2.055 \times \quad (11)$$

$$\times \sqrt{1 + \frac{1}{30} + \frac{(115.47 - 102.77)^2}{6614.717}} = 2.6.$$

For Step 2, the confidence interval of the prediction has the following bounds:

upper bound: $y_2 + U_2 = 111.05 + 2.6 = 113.65$;

lower bound: $y_2 - U_2 = 111.05 - 2.6 = 108.45$.

$$U_2 = 11.23 \cdot 2.055 \times$$
$$\times \sqrt{1 + \frac{1}{30} + \frac{(116.04 - 102.77)^2}{6614.717}} = 2.6. \quad (12)$$

Thus, the regression model is significant and is suitable for forecasting the development of the tax system (Fig. 1).

Forecast of the development of the tax system based on the regression model of the tax administration has *R*-squared value of 0.79. In its turn, a forecast built for the same interval with the help of the trend extrapolation method and based on empirical data has the accuracy of 0.81. Regression models have a higher predictive power since they take into account the impact of hidden variables (regressors).

As Fig. 1 illustrates, the predictive models form a confidence interval from 108.45 to 113.65 with the most precise value 111.05. This is the value that appears to be the most likely in the light of the current trends after the two years of implementation of the current tax policy and tax administration system.

To analyze the development of the tax system and tax administration, we need to identify the key factors that influenced these processes in different periods. Therefore, we selected the main events in the development of the tax system and tax administration, putting them into chronological tables comprising about 200 events in the period of 1991–2020. After that, the events were ranked by their significance. For the sake of brevity, the tables are not included in this article and we are going to limit ourselves to the major milestone events and the changes in the corresponding indices (see Fig. 2 and 3).

The key events include the following legislative changes: adoption of the Tax Code; introduction and elimination of some taxes, for instance, the Unified Social Tax (UST), mineral extraction tax, and the personal income tax (PIT). Other events include the introduction of taxpayer registration systems (Taxpayer Identification Number – INN, Unified State Register of Taxpayers, and the Unified State Register of Legal Entities).

$$y = -0.0123x^3 + 0.4807x^2 - 3.1691x + 88.894$$
$$R^2 = 0.8134$$

—— Index of tax administration development

—— Index of tax system development

—— Polynomial (Index of tax system development)
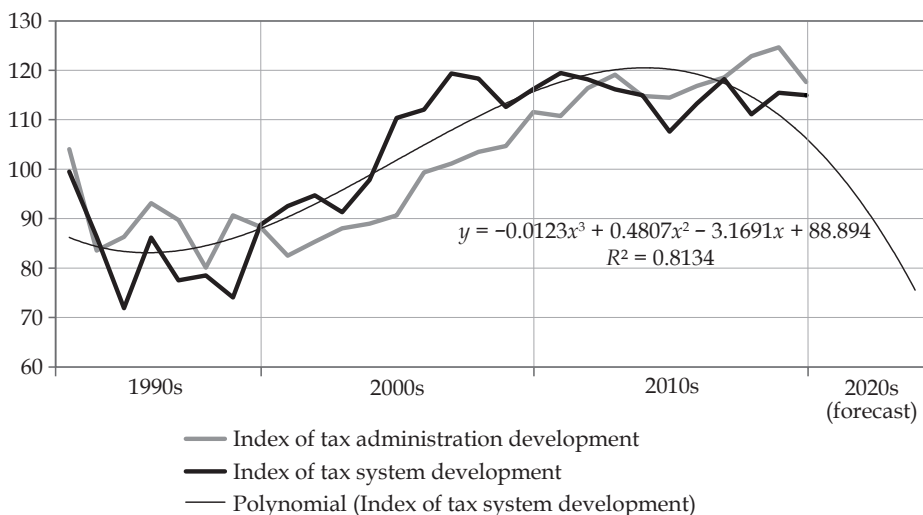
Fig. 1. Dynamics and projected development of the tax system, %
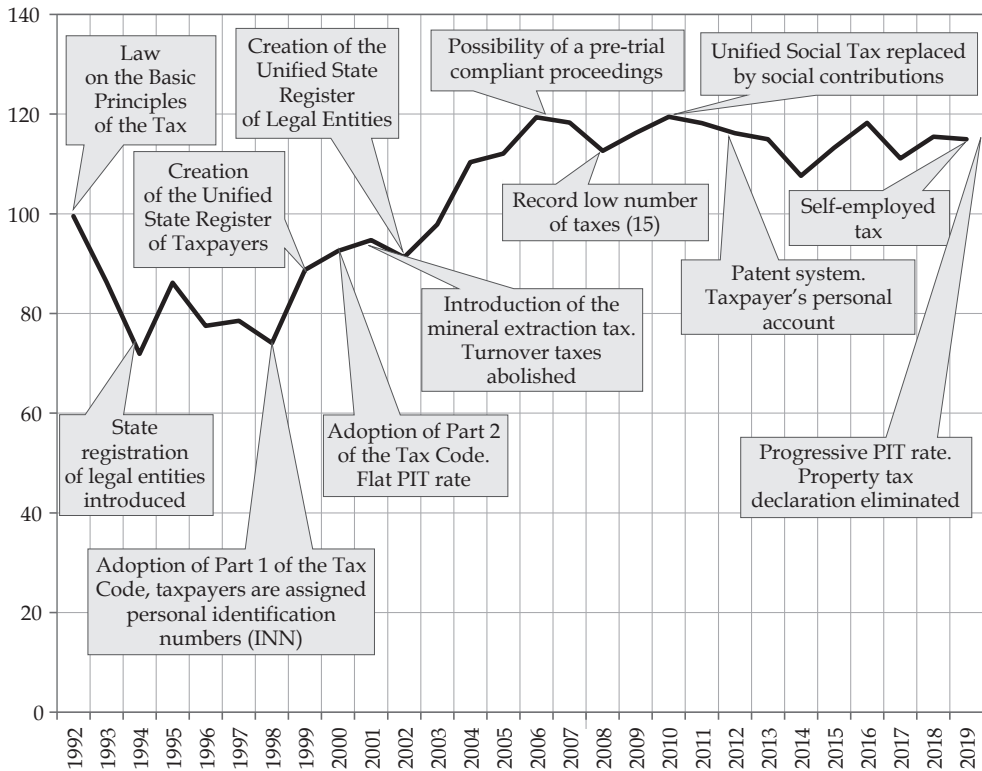
Fig. 2. **Key events in the development of the tax system**

A more detailed analysis of the dynamics of the indicators included in the index of tax system development shows that after a long-lasting decline in tax revenue, in 2014 the government's tax revenue started to grow. It is in this period that the individual property tax and sales tax were introduced, and some changes were made into the corporate property tax computation procedure. The tax-to-GDP ratio hit its record high by 2008. Afterwards there was a decrease, which in all likelihood was caused by the economic recession. The reduction in the number of taxes in 2008 and a series of subsequent reforms slowed this process. In the following years, the tax-to-GDP ratio rose again. The tax burden on businesses was quite volatile. The burden was minimal in 1998, when the bankruptcy law was adopted, and enterprises' tax debt was written off. After a sharp fall in tax collection in the 1990s, this indicator recovered in the following period. Since 2008, however, it has been stagnant, possibly because the effect of the previously taken measures has worn off. The number of individual entrepreneurs and farm businesses has been declining steadily since 2014 and the number of registered legal entities, since 2015. This decline can be explained by the changing market conditions rather than by the changes in the tax system. Finally, the number of taxes and levies increased after 2018, when the excess-profits tax and the self-employment tax were introduced.

Regarding the dynamics of the index of tax administration development, it is worth taking a look at one of its indicators – the number of functions performed by the tax administration. This indicator was rising steadily between 2008 and 2018, which, among other things, could have been a result of the government's efforts to create better conditions for business, to give the Federal Tax Service the authority to control the use of cash registers and

so on. In 1998–2013, there were staff reductions in the tax administration due to the centralization of staffing procedures (introduction of assessment criteria, standard structure and staff schedules for territorial tax offices) and to the creation of automated information systems (*AIS*) and data processing centers (*DPC*).

In 2004, the wage level of tax professionals hit the record low – in this year no bonuses were paid because the *Ministry of Taxes and Levies* transformed into the *Federal Tax Service*. The record high was achieved in 2007 due to the introduction of an incentive payment system. Spending on tax administration was at its minimum in 2006 and maximum, in 2017. In the former case this could be explained by the accelerated

growth in the government's expenditures in the pre-crisis period and in the latter, the opposite process of budget shrinkage during the crisis. The cost of tax administration in both cases was relatively stable.

The above-described trends are objective while their interpretations are more probabilistic in nature. Since the purpose of this paper is just to test the possibility of such factor analysis, we are not striving here for absolute precision.

The results of our analysis of the key events can now be used for a SWOT-analysis: we are going to build a SWOT matrix bringing to light the strengths and weaknesses, opportunities and threats in the development of the tax system and tax administration (see Table 7).
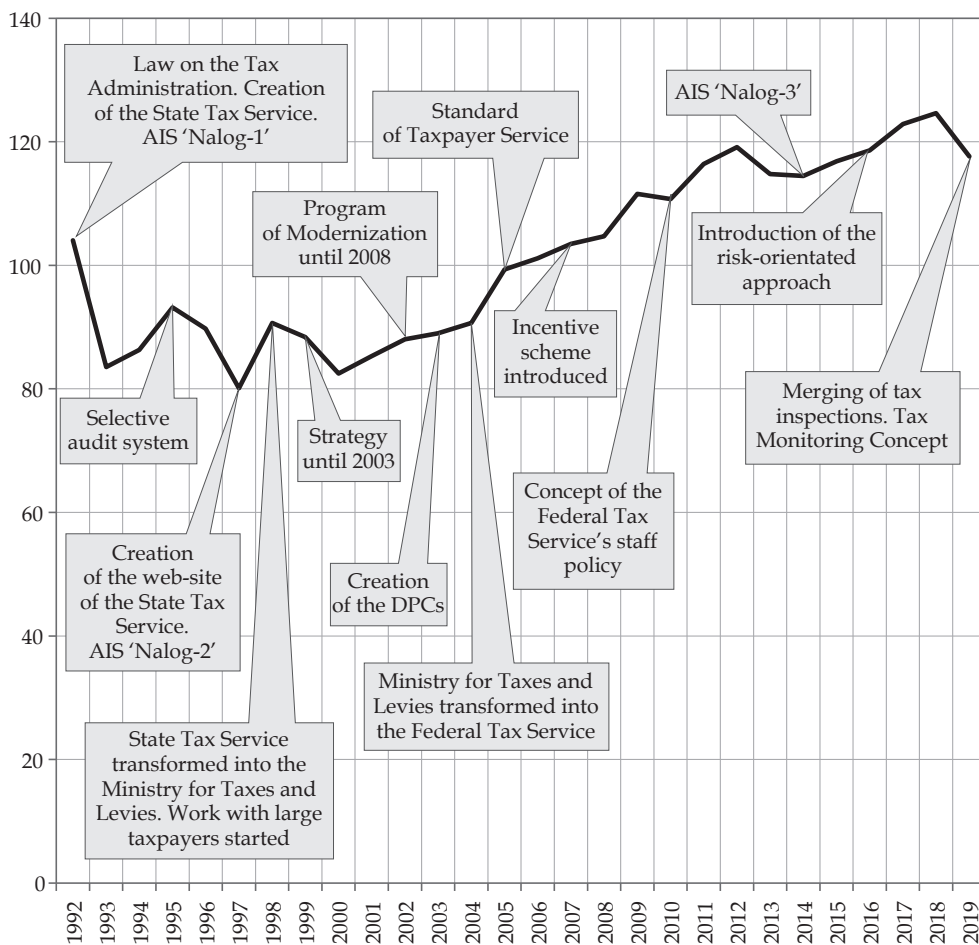
Fig. 3. **Key events in the development of the tax administration**

SWOT matrix for the tax system and its agencies

1. Strengths		2. Weaknesses	
1.1. Tax system	1.1.1. Interactions with business 1.1.2. Reduction of the tax burden 1.1.3. Increase of the collection of mandatory payments	2.1. Tax system	2.1.1. Unstable legislation 2.1.2. Persisting corruption risks 2.1.3. Declining number of taxpayers
1.2. Tax administration	1.2.1. Concentration of functions 1.2.2. High percentage of young people 1.2.3. Competitive wage levels	2.2. Tax administration	2.2.1. Growing staff number 2.2.2. High staff turnover 2.2.3. Inadequate incentive schemes
3. Opportunities		**4. Threats**	
3.1. Tax system	3.1.1. Digitalization 3.1.2. Increase in the share of tax revenue in the government's total revenue 3.1.3. Optimization of tax regimes, their flexibility	4.1. Tax system	4.1.1. New methods of tax evasion 4.1.2. Economic instability (COVID-19 pandemic, sanctions, etc.)
3.2. Tax administration	3.2.1 Stable staff costs 3.2.2. High education levels of the tax staff 3.2.3. Merging of tax offices in regions	4.2. Tax administration	4.2.1 Excessive staff in regional tax offices 4.2.2 Poor qualification of the graduates of specialized universities

The analysis of the indicators included in the calculated indices has led us to align the key events with elements of the matrix. For example, the establishment of interregional inspections for data processing centers is considered an element of digitalization, which will open up new opportunities for the development of the tax system (factor 3.1.1). Changes in the structure and staff size of the Federal Tax Service are considered as one of the reasons behind the increased staff turnover (factor 2.2.1). As a result, all the key indicators and events were included in our matrix.

5. Discussion

Our findings agree with the previous research and can be used to formulate recommendations on how to enhance the tax administration's efficiency.

The digital transformation will inevitably lead to the death of paper-based reporting and will reduce the number of face-to-face interactions between tax officers and taxpayers (see, for example, Moloshnikova & Baytemirova [18]). Account statements are now sent by banks in an electronic form to the unified system of the Federal Tax Service. With the help of specially designed software, the tax authorities can now control the assessment of the value-added tax at each stage of the production process, reducing the risk of non-compliance (the so-called 'tax gaps'). It is also possible to automatically compare different indicators. The results of compliance control performed by individual tax officers are now available across the whole system. Digital technologies hold huge gains for tax administrators and enable them to practically exclude the possibility of prolonged non-compliance. By now, digital technologies have already started to contribute to the increased growth in tax revenue.

In future, the majority of the routine tasks of tax administration will be digitized and delegated to taxpayers themselves. The number of tax officers, who accounted for two-thirds of the total number of federal civil servants 20 years ago, now hardly exceeds one third. The majority of the staff have job security guarantees. Some of the tax officers are transferred to

other offices with new functions. In 2020, territorial tax inspections in 11 Russian regions were liquidated while in others the number of inspections was cut down. At the same time, however, new specialized units were established such as tax debt centers. The above-described changes are part of the state optimization initiative, which aims at eliminating the duplication of functions through downsizing of the public service and cost-cutting. In the light of the above, it would be advisable to develop a strategic approach to workforce reduction and retraining well in advance.

The ongoing organizational transformations involved in the transition of the tax system to a two-tiered structure of tax inspections can be taken further and include the transfer of taxpayer service functions to multifunctional centers of public services and the transfer of control functions to specialized institutions. International research describes cases of delegating tax functions to private institutions [10], however, such possibility has an inherent limitation due to the differences in the ways state and non-state subjects of the tax system negotiate moral imperatives [28]. We believe that this might also be true for Russia.

In line with the latest international trends, the new functions of the Federal Tax Service will deal primarily with law-making, data analytics and cybersecurity, public outreach and awareness raising [8]. All of the above will require fundamentally new staff competencies in comparison with the present-day qualification criteria. There is a good reason why within the new structure of the Federal Tax Service the creation of centers of competence is so widely discussed. In general, the staff working in tax administration are not quite prepared for the new tasks. It should be noted that until now, in the Russian tax administration, there is a prevalence of graduates of private universities (these usually have lower admission standards and are often associated with a lower quality of education) and some of the lagging state universities [27]. To attract more promising graduates, the tax administration needs to offer them competitive pay. In other words, the remuneration system in taxation should be oriented towards development rather than stability. This confirms the theory that the government keeps the wage level for the tax administration staff as low as possible, just enough to retain them [7].

Staff rejuvenation does not change the current state of affairs since the majority of Russian universities cannot offer students opportunities to develop these competencies. In 2010, Mikhail Mishustin, the current Prime Minister of Russia, who was then the head of the tax service, called the tax administration a 'service company'. No matter how appealing this idea seems to those in the central tax office, however, they are having a hard time trying to sell it to the staff in regional offices, including young staff members. The lower levels of the system are often unable to catch up with the transformations initiated by managers at the upper levels although they are generally willing to follow the instructions. The culture of mutual trust and partnership with the taxpayers, which is seen as a foundation for the institutional transformation of the tax administration [6], has not been fully formed in Russia. One of the steps in this direction is the simplification of procedures for reporting and payment of taxes.

Quite illustrative in this respect is the self-employment or professional tax, which extends tax collection into the informal economy. Self-employed citizens can declare their income fast and easily and pay the tax at a low rate. Simplified procedures of tax accounting and reporting were also introduced for small businesses using online cash registers. The requirement to file transport tax and land tax declarations was abolished. Since 2021, the procedure for the personal income tax deduction for the acquisition or construction of an apartment or house has become faster since the Federal Tax Service now shares a common database with the banks. In the future, the amount of any tax could be calculated automatically, which will save the taxpayers time and effort but at a certain point will inevitably mean job losses for tax accountants.

The plans of the Federal Tax Service to introduce electronic document flow will spare the taxpayers the effort of having to regularly submit their documents for a tax inspection. A sharp drop in the number of field tax inspections in recent years stems from the 'soft enforcement' principle upheld by the Federal Tax Service, which means that compliant businesses should be less frequently subjected to the inconvenience of an audit. In the case of suspected non-compliance, companies would be requested to check their tax liabilities thus avoiding having to be subjected to a tax audit. All of the above enhances trust in the tax administration and the whole tax system. The same role is performed by tax monitoring. The new policy of the Federal Tax Service is based on the so-called soft law – the term coined by H. Gribnau [29]. This concept implies a shift away from the traditional deterrence approach to a more flexible strategy with an emphasis on justice, trust, and cooperation.

In general, however, such processes may be tricky and sensitive since an increase in tax transparency and automated tax computation may create the need for further downsizing of the tax administration and staff layoffs. There is a certain paradox in the fact that enhanced staff performance will make some of the jobs redundant.

Finally, we need to consider the limitations of this study and the future research avenues. As the empirical data accumulate, our findings could prove useful for cross-country analysis of the efficiency of the tax administration. In the Russian context, a promising avenue would be to consider the positive role played by the Bank of Russia in the development of the tax administration, more specifically, the 'cleaning up' of the banking sector in 2013–2014, which turned the banks into an important element of tax control. R. Hainsworth and W. Tompson [30] pointed out the potential role that the banks in Russia can play as agents of the state in the sphere of tax administration. It is also necessary to move gradually from studying formal processes, that is, from classical institutionalism, to evaluating the impact of such factors as trust and morality of tax subjects, in other words, to the neo-institutionalist approach. This shift in approaches is particularly relevant in the light of the ongoing transition to outsourcing some of the functions of tax administration.

6. Conclusions

As part of the first research task, we found an increase in the number of target indicators of the tax administration accompanied by their growing consistency with the institutional goals of the tax system. In the 2010s, there was a growth in the number of indicators for which comparable calculation methodologies were provided. Thus, our analysis has confirmed *Hypothesis* 1 (*H*1): there is an increasingly strong correspondence (relationship) between the key indicators of the tax administration and the goals of the national tax system, which means that the tax administration is now more orientated towards institutional priorities and, as a result, towards the provision of a public good.

To address the second task, we used indices reflecting the institutional development of the tax system and tax administration. The index for the tax system comprises seven indicators which meet the criteria of measurability, objectivity, relevance, comparability, independence and the accessibility of data. We have also outlined the drawbacks of the existing methodologies and ways of overcoming them. In general, in the given years, the index rose by 15.4%, which can be explained by the increasing tax-to-GDP ratio, reduction in the tax burden and improved tax collection processes. The index of tax administration development is based on four indicators. Between the 1990s and 2010s, the index grew by 13% mainly because of the expanded scope of functions of the tax administration accompanied by staff downsizing and optimization of the remuneration system. We found a significant statistical relationship between the indices of the tax system and tax administration, which supported *Hypothesis* 2 (*H*2)

that the development of the tax administration follows the general trends in the development of the country's tax system. The use of a regression model for predicting the development of the tax system has shown a moderate fall in the early 2020s but overall, the evidence fits into the general trends.

Our last research task was to identify the key events in the development of the tax system and tax administration. We compiled chronological tables and ranked the events in the order of importance. We showed the connection between the major milestone events and the dynamics of the corresponding indices. The analysis of these connections with a focus on selected indicators has confirmed *Hypothesis* 3 (*H*3) about the existence of the key events whose outcomes affected the development of the tax system and tax administration.

Thus, our analysis has confirmed the base hypothesis about the relationship between the development of the tax system and tax administration. There is, however, room for further research, both theoretical and practical, to see how this relationship can be used to enhance the efficiency of the tax administration.

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Для цитирования

Информация о статье

Evaluation the impact of the personal income tax reform in the Czech Republic in 2021 on effective tax rate and tax progressivity

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ABSTRACT

Legislation governing personal income taxation is often subject to changes. A significant personal income tax reform was carried out in the Czech Republic in 2021. The reform implements a progressive tax rate, changes the way the tax base is determined, and increases the tax relief for the taxpayer. The aim of the article is to evaluate the impact of the personal income tax reform on the effective tax rate and tax progressivity. To that end, methods of regression analysis have been used. The source of information for analysis was the data published by the Czech Statistical Office. It was found that in 2021, in comparison with 2020, the tax burden represented in this study by the effective tax rate, in all cases became lower, approximately by 5%. The main reason for this decline is the adjustment of the method of construction of the tax base, which, for the first time in the history of the Income Tax Act, is gross wages. Until the end of 2020, the tax base was a super-gross wage, or the gross wage increased by social security contribution borne by the employer at his costs. The second factor that reduces the tax burden is a CZK 3,000 increase in the deduction per taxpayer per year. This fact increases the degree of tax progressivity, as confirmed by the results of the progressivity analysis and the regression analysis. The changes that have taken place in the personal income tax this year have a positive impact on the taxpayer, but from the point of view of the state, this reform has reduced the state budget revenues.

KEYWORDS

personal income tax, tax reform, effective tax rate, gross wage, tax burden, tax deduction, tax progressivity, Czech Republic

JEL C10; H24; K34

Оценка влияния реформы подоходного налога 2021 года в Чешской Республике на эффективную ставку и прогрессивность налога

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АННОТАЦИЯ

Законодательство, регулирующее подоходное налогообложение, подвержено частым изменениям. В Чешской Республике значительная реформа подоходного налога прошла в 2021 г. Реформа ввела прогрессивную ставку налога, изменила способ определения налоговой базы и увеличила налоговые льготы для налогоплательщиков. Целью статьи является оценка влияния налоговой реформы на эффективную ставку налога и прогрессивность налогообложения.

Для достижения цели статьи использованы методы регрессионного анализа. Источником информации для анализа послужили данные, опубликованные Чешским статистическим управлением. Был сделан вывод, что в 2021 г., по сравнению с 2020 г., налоговая нагрузка, представленная в данном исследовании эффективной налоговой ставкой, во всех случаях стала ниже примерно на 5 %. Основной причиной этого снижения является корректировка метода формирования налоговой базы, в качестве которой впервые в истории Закона о подоходном налоге стала применяться валовая заработная плата. До конца 2020 г. налоговой базой по подоходному налогу являлась сверх брутто заработная плата, то есть валовая заработная плата, увеличенная за счет взноса на социальное страхование, который работодатель списывал на свои расходы. Вторым фактором, снижающим налоговую нагрузку, стало увеличение вычета на налогоплательщика на 3000 чешских крон в год. Этот фактор увеличил степень прогрессивности налогообложения, что подтверждается результатами анализа прогрессивности и регрессионного анализа. Принятые изменения оказывают положительное влияние на налогоплательщика, но с точки зрения государства реформа ведет к сокращению доходов государственного бюджета.

КЛЮЧЕВЫЕ СЛОВА
подоходный налог, налоговая реформа, эффективная налоговая ставка, валовая заработная плата, налоговое бремя, налоговый вычет, прогрессивность налогообложения, Чешская Республика

1. Introduction

Personal income tax is a direct tax. In the Czech Republic, this tax has been part of the tax system since its inception in 1993 [1; 2]. As of the date of the establishment of the Czech Republic, significant tax reform took place, which resulted from the need to transform the outdated tax system into a modern method of taxation. According to A. Vančurová and L. Vítek [3], the Income Tax Act came into force this year, according to which the income of natural persons is taxed to the present day.

During the entire period of validity, the Income Tax Act has undergone significant changes. The extensive reform on 1 January 2021 changes, among other things, how the tax base from dependent activities is constructed, adjusts tax rates or increases the value of tax relief for the taxpayer.

The aim of the article is to evaluate the impact of this tax reform on the tax burden of taxpayers – employees receiving income from dependent activities. Since 2021, the tax base has been only the value of the employee's gross wage. This reduces the tax base, as in 2008–2020 the tax base was the amount of the super-gross wage. This was the gross wage increased by social security contribution born by the employer in his

costs. At the same time, in 2021, the basic deduction was increased – tax relief for the taxpayer from CZK 24,840 to CZK 27,840. The original reform proposals envisaged an increase in the basic taxpayer relief to CZK 34,250. In order to reduce the impact of these changes on public budgets, the amount of this relief was finally adjusted to the aforementioned CZK 27,840. In the period 2008–2020, only one nominal tax rate of 15% was valid. This 15% rate has remained in the law since 2021 but is supplemented by a second rate of 23% for incomes that exceed four times the average wage per month. The implementation of this second tax rate also has an impact on the progressivity of the personal income tax, which, according to N. Papanikolaou [4] or C. Tran and N. Zakariyya [5], is one of the typical features of this tax.

According to the aim of the article, the following hypotheses are formulated, the validity of which will be confirmed or refuted:

• Tax burden on employees since 2021 has reduced.

• Tax progressivity is increasing due to the establishment of the nominal progressive tax rate.

• Taxpayers receiving income only the amount of minimum wages will not pay income tax from 2021.

The paper has a following structure. The introduction is followed by an outline of the theoretical background (Section 2) with a focus on the personal income tax and its reform. Section 3 presents methodology used in the research. The main part of the article is Section 4 in which are presented the results of the analysis. The last section of the paper summarizes the main results of our research topic.

2. Literature review in the context of tax reform

Tax laws change very often. One of the reasons for implementing tax reforms is the need to improve the competitiveness and efficiency of the tax system [6]. E. Ilzetzki [7] suggests that large changes in the tax code may be easier to enact than marginal reform. Aspects of personal income tax reform are the subject of the research in many studies. At first section are summarized the studies which were done in the Czech Republic, in the next part are studies which were done under the conditions of other states of the world.

J. Široký and K. Maková [8] analysed the effect of replacing the nominal progressive tax rate with a nominal linear tax rate in the Czech Republic in 2008. According to the results of the analysis authors found out the tax remains progressive even with the nominal linear tax rate in force. The progressivity of the personal income tax after 2008 is also confirmed in their study by M. Genčev et al. [9]. J. Široký et al. [10] mentions that other taxes than income tax, such as real estate acquisition tax, also changed in 2008.

Dušek et al. [11] also mention that the reform of the personal income tax in 2008 led in some cases to a reduction in the tax burden, but that income tax remains a progressive tax. Data from the TAXBEN model were used in this study. The study also evaluated the expected impacts related to the abolition of the super-low wage on 1 January 2015. However, in the end, this reform did not take place in the Czech Republic. The main result of this study is that tax reform in 2008 influenced the tax burden of taxpayer very positively.

The personal income tax also changed its parameters in 2005, as mentioned by J. Večerník [12]. This year, the form of a deduction for children changed from the non-taxable part to a tax credit. Another change took place a year later when other non-taxable parts of the tax base (e.g. per taxpayer, per student) were also replaced by tax reliefs. In the area of the legislative framework governing personal income taxation, three significant tax reforms took place in the Czech Republic in 1993, 2006 and 2008. According to J. Tepperová and J. Pavel [13], these reforms significantly affected the amount of tax revenues and the distribution of the tax burden personal income tax in the Czech Republic. All mentioned authors found out that this reform reduced the tax burden of personal income tax especially for a taxpayer with children or taxpayer with above-average level of wage.

Tax reforms in the Czech Republic did not only take place in the area of direct taxes, the parameters of indirect taxes also changed, as mentioned, for example, by K. Krzikallová and F. Tošenovský [14] or V. Paszto et al. [15]. All these changes have an impact on tax revenues, but sensitivity to changes is not the same as stated according to the results of the study by T. Havránek et al. [16].

The parameters of the personal income tax do not change only in the Czech Republic. In addition to studies solving the effects of tax reforms only in the Czech Republic, studies analysing the effects of tax reforms in several countries were also carried out. J. Hutton and A. Ruocco [17] determined the impact of tax reforms on employment and tax progression in Europe. The results of the study confirm the destimulating effects of high labour taxation. In addition to European countries, attention to reforms in the area of personal income tax is also an object of analysis to studies on a global scale. K.S. Peter et al. [18] evaluated the impact of tax reforms on the progressivity of personal income tax, the average and marginal tax rate. It was found that there is a trend to reduce tax rates in the highest bands or to increase the number

of deductions that taxpayers can use to reduce tax liability. It is also confirmed that tax reforms may affect the level of tax evasion [19].

The reason for tax reforms is also the effort to ensure higher efficiency to integrate inflation indexation into its personal income tax system in order to reduce distortions of tax liabilities and additional tax burdens. For example, the reform of personal income tax in Germany according to Ch. Nam and Ch. Zeiner [20] found out that the least benefited from this reform were taxpayers with an average income, while taxpayers with below-average or above-average incomes received more. According to R. Li and G. Ma [21] or C. Horioka and S. Sekita [22], the impact of tax reforms on tax progression is usually not the same and depends on the amount of the employee's earnings.

According to J. Cui [23], tax reforms also affect tax fairness. The so-called flat tax can be considered fair, as claimed by e.g. G. Cornia et al. [24]. The issue of tax fairness is closely related to the taxation of taxpayers with above-average incomes. S. Bach et al. [25] analysed the taxation of taxpayers with above-average incomes in Germany. Tax reforms in this state have also reduced the tax burden. As the burden on taxpayers with above-average incomes has decreased in Germany, according to the results of the study, it occurred in Slovenia, as mentioned by M. Čok et al. [26] to reduce the tax burden also for low-income taxpayers. The results of all mentioned abroad studies also confirmed the fact that aspects of personal income tax has changed very often. The effect on the tax burden is usually not the same but depends on the amount of wages and the number of tax advantages like non-taxable parts or tax reliefs that taxpayers use for the reduction of their tax burden.

The form of tax reforms and tax policy goals is also influenced by tax harmonization. H. Appel [27] or P. Concori et al. [28] states that it affects this in particular in the field of indirect taxation, as in the field of direct taxation it is an area with a great sensitivity to issues of national sovereignty.

3. Methods

Standard economic methodology, including such methods as description, deduction, and comparison as well as the study of legal sources and synthesizing methods is used in all parts of article. For analysis of dependences is used method of regression analysis. This method is applicated due to the fact that is examined two factors (minimum wage and effective tax rate). Method of regression analysis was also used in tax studies by K. Teplicka and M. Daubner [29] or G. Savic et al. [30].

To evaluate the development of the tax burden between the years 2020 and 2021, it is necessary to calculate the amount of personal income tax. Due to the reform carried out on 1 January 2021, the technique for calculating the tax liability has changed. In 2020, the tax was calculated according to relation (1),

$$T = [(GW + 0.248 \cdot GW + 0.09 \cdot GW) \cdot TR] - R, \quad (1)$$

where T is tax, GW gross wage, TR tax rate and R is tax relief for taxpayer. This methodology was valid as long as there was no solidarity tax surcharge. Wages were subject to this if the amount of the monthly gross wage was higher than 4 times the average monthly wage. The calculation procedure in this case is according to the formula (2),

$$T = [(GW + 0.248 \cdot MAXB + 0.09 \cdot GW) \cdot TR_1] + \\ + [(GW - 1{,}672{,}080) \cdot TR_2] - R, \quad (2)$$

where T is tax, GW gross wage, TR_1 is tax rate 15%, $MAXB$ is maximum assessment base of social security premiums and contributions to the state employment policy, TR_2 is solidarity tax surcharge and R is tax relief for taxpayer.

From 2021, the tax liability is calculated according to the equation (3),

$$T = (GW \cdot TR_1) - R, \quad (3)$$

if the amount of the gross wage per year is higher than CZK 1,701,168, the calculation of the tax liability is carried out using (4),

$$T = [(1{,}701{,}168 \cdot TR_1) + \\ + (GW - 1{,}701{,}168) \cdot TR_2] - R, \quad (4)$$

where T is tax, GW gross wage, TR_1 tax rate of 15%, TR_2 tax rate of 23% and R is tax relief for taxpayer.

It is not correct to assess the tax burden based on the nominal tax rate, as the nominal tax rate may not always inform about the real tax burden [31]. A more appropriate indicator for assessing the tax burden is the effective tax rate determined (5),

$$ETR = \frac{T}{GW},\qquad(5)$$

where *ETR* is effective tax rate, *T* is tax and *GW* is gross wage.

Tax progressivity, which is one of the subjects of this study, is calculated in income intervals differing by a multiple of the minimum wage in the Czech Republic in the analysed period. One of the widely used interval indicators for measuring tax progression is the progressiveness of the tax obligation PTO comparing the elasticity of tax liability to the income before taxation [32]. Generally it´s formalized according to (6),

$$PTO = \frac{\dfrac{T_1 - T_0}{T_0}}{\dfrac{GW_1 - GW_0}{GW_0}},\qquad(6)$$

where GW_0 is the gross wage of the taxpayer in the lower income interval, GW_1 is the gross wage of the taxpayer in the upper income interval, T_0 is the tax liability in the lower income interval, T_1 is the tax liability in the upper income interval. The upper income interval is considered to be a higher multiple of the minimum wage, the lower income interval is considered to be a lower multiple of the minimum wage.

Analysis of dependences between observed factors are solved by methods of regression analysis [33]. If the tax is progressive, then with increasing gross wages, the effective tax rate in equation (7) will also increase,

$$Y = b_0 + b_1 \cdot X,\qquad(7)$$

where the dependent variable – minimum wage is *Y* and the independent variable of linear function – effective tax rate is *X*.

The quality of a regression model expressed a coefficient of determination R^2. Testing the significance of the regression

model uses an *F*-test with the test criterion *F*, which is calculated using a formula (8),

$$F = \frac{R^2}{1 - R^2}\cdot(n-2),\qquad(8)$$

where *n* is the number of measurements. For more about F-test see [34].

The independence of the residuals can be verified using the Durbin-Watson test *DW* (9),

$$DW = \frac{\sum(u_i - u_{i-1})^2}{\sum u_i^2},\qquad(9)$$

where u_i is the value of residuals [35].

The relation between the characters *X* and *Y* can be expressed graphically using regression lines. Both lines are passing through the central point, the angle between both of the lines can be defined by (10),

$$cotg\,\varphi = \frac{|r_{xy}|}{1 - r_{xy}^2}\left(\frac{S_y}{S_x} + \frac{S_x}{S_y}\right),\qquad(10)$$

where r_{xy} is an empirical correlation coefficient, S_x is the variance of values of character *X* and S_y is the variance of values of character *Y* [36].

4. Analysis

The input data for verifying the validity of the hypotheses formulated in the introduction part of the text are based on the minimum wages of an analysed year, resp. their multiples. Average wages are not used for the analysis, as the data on the annual average wage is published only retrospectively because at the time of the analysis, information on the average wage for 2020 or 2021 is not available. According to M. Pernica [37] or T. Pavelka et al. [38], minimum wage is approximately 35% of the average wage. Evaluation of the mentioned aspects on basis of the minimum wage, resp. their multiples thus an alternative approach to solving this problem and is the uniqueness of this article.

According to data from the Czech Statistical Office[1], the minimum wage

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[1] Mimimum wage. Prague: Czech Statistical Office, 2021. Available at: https://www.czso.cz/csu/czso/prace_a_mzdy_prace
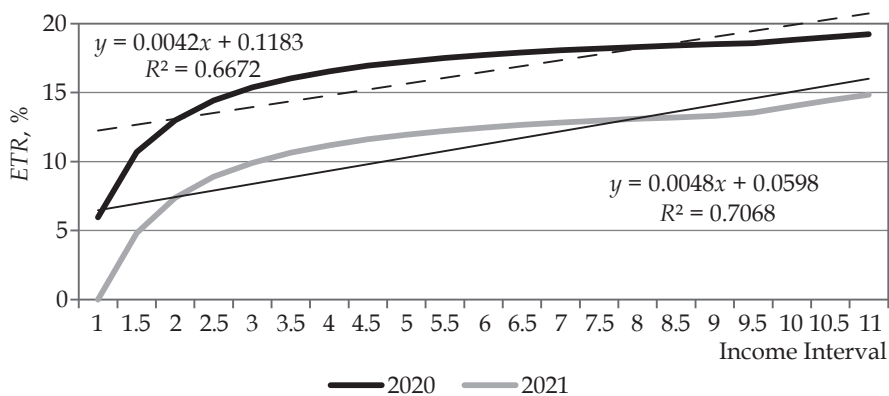
Fig. 1. ETR in the year 2020 and in the year 2021
Source: own processing

in the Czech Republic for 2020 was CZK 14,600, and since 2021 the minimum wage has been CZK 15,200 per month. Tax progressivity is analysed using the interval indicator of the progressiveness of the tax obligation. It is therefore necessary to set limit intervals. These intervals are determined in the analysis by a multiple of the minimum wage from 1.0 to 11.0 times, the width of the examined interval is determined by 0.5 times the minimum wage, therefore a total of 20 income intervals are examined. The reliability of the analysis is ensured by the fact that the graduation up to 11 times the average wage, which covers, according to data from the Statistics of Family Accounts[2], more than 95% of the population.

4.1. Analysis of tax burden in 2020 and 2021

To evaluate the development of the tax burden, effective tax rates are calculated using formula (5). According to the OECD methodology[3], the application of a basic deduction to a taxpayer, which has a form of tax relief in both analysed years 2020 and 2021, is used for the assessment

of tax burden. The tax liability for the year 2020 is calculated according to (1), for the year 2021 according to (3). Effective tax rates are calculated from the minimum wage to 11.0 times the minimum wage with a graduation of 0.5 times. It should be noted that the above formula (1) and (3), for the calculation of the tax liability, can be applied in 2020 up to the amount of CZK 1,672,080, resp. CZK 1,701,168 in 2021. If this amount is exceeded, the tax liability is calculated using the formula (2), resp. in 2021 according to the formula (4). A comparison of the tax burden on wages in the year 2020 and the year 2021 is shown in Fig. 1.

Fig. 1 shows that with an increasing multiple of the minimum wage, the taxpayer's tax burden increases too. The most significant increase occurs in the lowest analysed interval between the minimum wage and its 1.5 times. Then the degree of growth of the tax burden decreases, which affects the tax progressivity analysed in the second part of this chapter.

While in 2020 the taxpayer paid income tax on the minimum wage, in 2021 the taxpayer's tax liability receiving the minimum wage is zero. Also in other cases, a decrease in the tax burden can be observed, on average by 5%. The reason is two facts. Abolition of the super-gross wage as a tax base and increase of the taxpayer's relief by CZK 3,000 per year.

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[2] Statistics of Family Accounts. Prague: Czech Statistical Office, 2021. Available at: https://www.czso.cz/csu/czso/prijmy-a-zivotni-podminky-domacnosti-kf03f95ff5

[3] Tax Database. OECD Tax Database, 2021. Available at: http://www.oecd.org/tax/tax-policy/tax-database.htm#pit

These changes made by the tax reform on 1 January 2021 reduce the taxpayer's tax burden, even if the taxpayer's income is also subject to a second nominal tax rate of 23%. The results of this analysis show that this tax reform has reduced the tax burden on labour. It should be noted that, according to L. Mazanec and A. Bieliková [39], the long-term problem of the Czech Republic remains the high levy burden, which is above the OECD average.

The minimum wage in the Czech Republic is usually set at about 30–35% of the average wage. From the values in Fig. 1 shows that a taxpayer receiving income at the level of the minimum wage does not pay any tax. The second reason is that the taxpayer's tax liability is lower than the value of the taxpayer's relief. If the aim of this reform was to support low-income taxpayers, in this case, this goal may not be 100% met. The reason is the fact that the tax relief is higher than the tax liability before the relief and the entire value of the tax relief, which increased in 2021 compared to 2020, will not be used by the taxpayer receiving only the minimum wage in full.

Absolute changes in effective tax rates between the analysed income intervals are shown in Table 1. For both analysed years, the tax burden increases most significantly in the lowest examined income interval, by almost 5%. The results in Table 1 show that higher effective tax rates in 2021 will lead to increased tax progressivity. With a higher wage, the amount of the absolute change gradually decreases, this trend is reflected up to the value of 9.5 times the minimum wage. The solidarity tax surcharge in force in 2020 increases the effective tax rate at intervals above 9.5 times the minimum wage, despite the fact that the amount that exceeds the maximum assessment base for social security premiums and contributions to the state employment policy was the tax base in 2020 only gross wage increased by public health insurance borne by the employer. From 2021, at intervals above 9.5 times the minimum wage, the effect of the progressive tax rate is reflected, which leads to an increase in the value of the effective tax rate.

The fact that the trend in the development of the effective tax rate in 2020 and 2021 is similar is also evidenced by the angle between the empirical regression lines in Fig. 1, which is generally formalized by relation (10). There is a high direct dependence between the development of values in both analysed years, as the value of the *cotg* angle approaches 0, as indicated by the data below in the calculation.

$$cotg\,\varphi = \frac{0.998}{1-0.998^2}\cdot\left(\frac{0.031}{0.034}+\frac{0.034}{0.031}\right)=0°11'.$$

4.2. Evaluation of personal income tax progressivity

The values of the PTO calculated according to (6) indicate the fact that the personal income tax is progressive, in all examined intervals, because the values of PTO are higher than 1. Although the nominal tax rate (excluding the solidarity tax surcharge) was linear in 2020. The existence of tax deductions, such as tax relief for the taxpayer, influences tax progressivity. As the amount of the gross wage increases, the degree of progressivity gradually decreases, with a slight increase in progressivity occurring in 2020 at the moment when income is also subject to a solidarity tax surcharge.

Table 1

Changes of ETR in %

Year	1.0–1.5	1.5–2.0	2.0–2.5	2.5–3.0	3.0–3.5	3.5–4.0	4.0–4.5	4.5–5.0	5.0–5.5	5.5–6.0
2020	4.73	2.31	1.43	0.95	0.65	0.51	0.40	0.30	0.26	0.22
2021	4.82	2.54	1.53	1.02	0.73	0.55	0.42	0.34	0.28	0.23
Year	6.0–6.5	6.5–7.0	7.0–7.5	7.5–8.0	8.0–8.5	8.5–9.0	9.0–9.5	9.5–10.0	10.0–10.5	10.5–11.0
2020	0.17	0.16	0.14	0.11	0.11	0.10	0.08	0.22	0.22	0.20
2021	0.20	0.17	0.15	0.13	0.11	0.10	0.24	0.47	0.43	0.39

Source: own processing
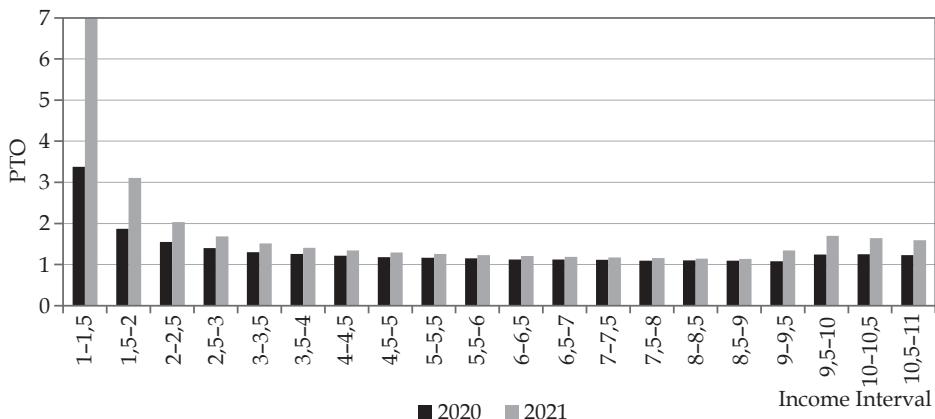
Fig. 2. PTO in the years 2020 and 2021

Source: own processing

In 2021, income tax in comparison with 2020 shows a higher degree of tax progression in all analysed income intervals, as follows from the values in Fig. 2. However, the reason for the increase in this progressivity is in many cases not the progressive tax rate, but the increase in the taxpayer's relief. The existence of a progressive tax rate affects these facts only from the income interval between 9.0 and 9.5 times the minimum wage. In this interval, a nominal rate of 23% is already applied to the part of income exceeding the decisive limit (in 2021 the amount of CZK 1,701,168). The conclusion of this analysis is the finding that the tax reform in 2021 increased the degree of progressivity of the personal income tax, most significantly for taxpayers with below-average or above-average incomes.

Increasing the degree of progression of personal income tax may lead to a reduction in inequality in the distribution of income in society, as progressive personal income tax is one of the tools of fiscal policy. However, as the progressiveness of the tax increases especially for low-wage taxpayers, the expected effect of reducing inequality in the distribution of income may not occur.

To verify that the tax is progressive, the relationship between the minimum wage (Y) and the effective tax rate (X_1) is modelled using formula (7). If the value of X_1 is positive, it is true that with increasing wages, the effective tax rate also increases, and thus the tax is progressive. The results of this analysis are summarized in Table 2. Model 1 is based on data valid for 2020, model 2 is based on data after the tax reform in 2021.

Table 2

Regression analysis

	Model 1		Model 2	
	Coef.	Sig.	Coef.	Sig.
X_1 – ETR	1,147,895	0.005	1,212,954	0.008
Constant	–101,746	0.000	–35,186	0.000
Observation	21		21	
R^2	0.816		0.841	
F	38.008	0.000	45.790	0.000
DW	1.5		1.48	

Source: own processing

Both simple regression models 1 and 2 are significant. The dependence between minimum wage and effective tax rate is positive. Comparison of R^2 shows that the dependence is stronger. Testing the significance of the regression model uses an *F*-test (*F*) shows also significance of the model. The positive X_1 coefficients confirm that the tax burden increases with the higher amount of wage, as the effective tax rate increases. The regression analysis also confirmed that the income tax is progressive, in both years analysed, i.e. 2020 and 2021. In both models, the Durbin-Watson (DW) statistic indicating a slightly positive autocorrelation.

5. Conclusion

The aim of the article was to evaluate the impact of the tax reform of personal income tax, which occurred in the Czech Republic on 1 January 2021. The analysis confirmed the hypotheses formulated in the introduction – the tax burden on income from dependent activities decreased in 2021 in comparison with 2020. On the contrary, there has been an increase in tax progressivity, due to an increase in the taxpayer's relief and the replacement of the nominal linear tax rate by a progressive tax rate. The increase in the deduction per taxpayer means that a taxpayer receiving gross wage only at the level of the minimum wage has not paid income tax since 2021.

The tax reform in 2021 caused a decrease in the tax burden on personal income from dependent activities. The decrease of the tax burden on labour is a welcome change from the taxpayer's point of view; on the other hand, according to C. Bronchi and A. Burns [40] or F. Coulter et al. [41], the reforms should focus on reducing the levy burden, which is in the Czech republic higher than the OECD countries average value. If the Czech Republic wants to go this way, it will most likely be necessary to increase other taxes, as this already implemented tax reform means a decrease in state budget revenues by more than 120 billion crowns. In addition, the analysis shows that low-income taxpayers cannot take full advantage of tax reform from 1 January 2021. Due to the low tax base and high relief, the use of other tax deductions is pointless for them, as most of them can be applied to the value of the calculated tax liability, resp. to the value of the tax base. The only difference is in the case of deduction for children. This deduction can also take the form of a tax bonus. As a result, taxpayers with above-average incomes have more benefits from tax reform. If the aim of this reform was to support an increase in household income and thus ensure the growth of consumption, the expected effect may not be fully realized, as taxpayers with above-average incomes will use available funds rather as savings.

The results of the analysis confirm the finding of J. Večerník [42] that personal income tax reforms affect redistribution flows only to a very limited degree. E. Longobardi et al. [43] mention that the aim of tax reforms is increasing the transparency and comprehensibility of the tax for the taxpayer. This reform contributes only partially to this, as already at the moment of the presentation of possible proposals for legislative changes in the area of personal income tax, criticism began to emerge related to the sustainability of financing from a national perspective, because due to the decrease in the tax burden, there will be a decrease in tax revenues to the state budget in 2021. It follows that another income tax reform can also be expected in the coming years. While the reform on January 1, 2021 led to a reduction in the tax burden, the decline in state budget revenues, either due to this reform or due to the consequences of the Covid-19 pandemic, will put pressure on such changes that will lead to an increase in the tax burden. Evaluating the impact of these possible changes is one of the other research topics in the field of personal income tax. As already mentioned in the analytical part of the article, the evaluation of progressivity as well as the development of the effective tax rate is determined by multiples of the minimum wage. However, this limitation of the study is also considered to be the uniqueness of the study, as in the past studies evaluated tax progressivity using interval indicators of progressivity based on intervals determined by average wages. After the publication of data on the annual average wage for the year 2020, resp. 2021, this may therefore be another topic for research in the field of personal income tax.

Despite the decrease in the tax burden and the increase in the tax progressivity of personal income tax in the Czech Republic, the significance of personal income tax as a tax revenue to the state budget and an important instrument of the country's fiscal policy can still be assumed.

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Информация о статье

Fiscal policy and economic growth: Evidence from Central and Eastern Europe

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ABSTRACT
This study aims to estimate the impact of three fiscal instruments (direct tax revenue, indirect tax revenue and government consumption expenditure) on the economic growth of ten new European Union member states from Central and Eastern Europe – Bulgaria, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia. We examine the hypothesis about the effect of expansionary fiscal policy on economic growth. The study employs a vector autoregression and annual Eurostat data for the period 2007–2019. Four control variables (the shares of gross capital formation, household consumption, exports in GDP, and the economic growth in the euro area) are included in the model to account for the influence of non-fiscal factors on economic growth. The empirical results indicate that the real output growth rate in the ten new member states of the European Union is negatively affected by direct tax revenue, while economic growth in the euro area, exports and gross capital formation are positively related to economic growth. The results also imply that government consumption and indirect tax revenue have no significant impact on the growth rate of real output of the ten studied countries from Central and Eastern Europe. It may be inferred that policymakers in the new European Union member states can raise economic growth by encouraging exports and investment and by lowering the share of direct tax revenue in GDP. From the three analyzed fiscal instruments (direct taxes, indirect taxes and government consumption expenditure), only one has proven to be effective in the case of the new member countries.

KEYWORDS
fiscal policy, taxation, economic growth, Central and Eastern Europe, vector autoregression

JEL E62, F43, H24, H25, O47

Фискальная политика и экономический рост: данные стран Центральной и Восточной Европы

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АННОТАЦИЯ
Целью исследования является оценка влияния трех финансовых инструментов (прямых налогов, косвенных налогов и расходов на потребление органов государственного управления) на экономический рост в десяти новых государствах-членах Европейского Союза из Центральной и Восточной Европы – Болгарии, Чехии, Эстонии, Венгрии, Латвии, Литвы, Польши, Румынии, Словакии и Словении. Тестируется гипотеза о влиянии стимулирующей налогово-бюджетной политики на экономический рост. В исследовании используется метод векторной авторегрессии и ежегодные данные Евростата за период 2007–2019 гг. Для

учета влияния на экономический рост нефискальных факторов в модель включены четыре контрольные переменные (доля валового накопления капитала, потребление домашних хозяйств, экспорт в ВВП и экономический рост в зоне евро). Эмпирические результаты показывают, что на темпы роста реального производства в десяти новых государствах-членах Европейского Союза отрицательно влияют поступления от прямых налогов, в то время как экономический рост в зоне евро, экспорт и валовое накопление капитала положительно связаны с экономическим ростом. Результаты также означают, что потребление органов государственного управления и поступление косвенных налогов не оказывают значительного влияния на темпы роста реального производства в десяти изученных странах Центральной и Восточной Европы. Можно сделать вывод, что политики в новых государствах-членах Европейского Союза могут повысить экономический рост за счет поощрения экспорта и инвестиций, а также снижения доли прямых налогов в ВВП. Из трех проанализированных финансовых инструментов (прямые налоги, косвенные налоги и потребление органов государственного управления) эффективным оказался только один.

КЛЮЧЕВЫЕ СЛОВА
фискальная политика, налогообложение, экономический рост, Центральная и Восточная Европа, векторная авторегрессия

1. Introduction

The impact of fiscal instruments on economic growth is a key issue of macroeconomic policy, especially for small open economies like the ten new member states of the European Union located in the Central and Eastern Europe (CEE), namely Bulgaria, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia. It is expected that contemporary fiscal policy should ensure stable public finances, boost employment, competitiveness and growth, while contributing to a fair distribution of income by improving the effectiveness and efficiency of the tax system.

The relationship between fiscal policy instruments and real output has been broadly discussed in both theoretical and empirical research. The conventional economic theory predicts that government spending is growth-conductive, while taxation causes distortions and negatively impacts economic growth. Considering a simple production function it is evident that taxation can affect growth through its effects on physical capital, human capital and total factor productivity. Some studies argue that corporate and personal income taxes are the most detrimental to economic growth, while consumption, environment and property taxes are less harmful [1].

Having in mind these assumptions, this paper aims to study the basic trends in the fiscal policy in ten countries from Central and Eastern Europe (Bulgaria, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia) for the period 2007–2019 and its impact on the economic growth. In addition, the paper sheds a light on the distribution of tax burden as a factor for creating a growth-friendly environment. The paper comprises five sections. Section two presents a brief literature review. Section three provides a descriptive analysis, focused on the general trends in fiscal policy and tax structure in the CEE countries, derived through breakdown of the total tax revenues into standard components such as direct taxes, indirect taxes, and social security contributions. Section four presents the empirical methodology and studies the effects of government consumption and taxation on economic growth applying vector autoregression (VAR) of annual panel Eurostat data. Section five draws inferences and formulates advisable macroeconomic policies for encouraging economic growth in the ten EU member states located in Central and Eastern Europe.

In this research, three hypothesis are tested:

H1: Expansionary fiscal policy positively affects economic growth;

H2: Expansionary fiscal policy negatively affects economic growth;

H3: Expansionary fiscal policy do not affect economic growth.

2. Literature review

The empirical studies on the relationship between fiscal policy and economic growth are mainly focused on providing evidence of the impact of government spending, tax level and tax structure on growth. A number of classic and modern studies have investigated the link between the overall level of public spending or total tax burden and economic growth using one-country or cross-country growth regression models covering different periods and various samples of countries. However, the empirical researches on the relation between government size and economic growth have arrived at widely different conclusions.

For example, the authoritative research conducted by Barro [2], using a dataset for a cross-section of 98 countries in the period 1960–1985, presented empirical evidence in favor of the view that a large public sector is growth-impeding. These results have been confirmed by several subsequent studies. Engen and Skinner [3] analyzed data from 107 countries for the period 1970–1985 and found that a balanced-budget increase in government spending and taxation reduces output growth rates. Folster and Henrekson [4] conducted an econometric panel study on a sample of rich countries covering the 1970–1995 period. They revealed a robust negative relationship between government expenditure and growth in rich countries. Moreover, when the rich country sample is extended to non-OECD countries both public spending and taxation are found to be negatively associated with economic growth.

Chu, Hölscher and McCarthy [5] applied ordinary least squares (OLS) and generalized method of moments (GMM) techniques on panel data from 37 high-income and 22 low-to-middle-income countries covering the period 1993–2012. They identified a negative and significant impact of total government expenditure on economic growth for both high-income and low-to-middle-income groups. The expected negative and significant impact of increased tax revenue on growth was confirmed for low-to-middle-income countries, but was not supported by the results for high-income countries.

Esener and Ipek [6] used 1999–2014 annual panel data for 33 countries, classified as upper and lower middle-income countries by the World Bank. The empirical analyses were performed by both the static panel data approach and dynamic GMM techniques. The public expenditure were found to cause significant decreasing effects on economic growth. Ozpence and Mercan, [7] studied the relationship between tax burden and economic growth in Turkey for the period 1970–2018. Applying VAR analysis and Granger causality test they found a negative impact of tax burden on economic growth. This is confirmed by Koester and Kormendi [8], who analyzed data from 63 countries and identified apparent negative effects of tax rates on growth.

However, there are several studies that challenge these results. Kalaš, Mirović and Andrašić [9] studied taxes and economic growth in the United States for the period 1996–2016 and found a strong and positive relationship between tax revenue and GDP growth. A positive impact of taxation on growth is identified by Gashi, Asllani and Boqolli [10], who applied regression analysis on 2007–2015 data for Kosovo. Similar results are observed by Krysovatyy et al. [11], who revealed a positive correlation between the tax burden and GDP growth in Ukraine.

Alzyadat and Al-Nsour [12] found a positive impact of public expenditures on economic growth in Jordan by applying VAR model and Vector Error Correction Model (VECM) on annual data for the period 1970–2019. Moreover, a positive impact on growth was confirmed for tax revenues in the short term, but the

effect turned to negative in the long term. Gemmell, Kneller and Sanz [13] examined the long-run GDP impacts of changes in government expenditure for a sample of OECD countries. They concluded that total spending impact is positive for long-run output levels, if the spending is reallocated towards infrastructure and education. Paparas and Richter [14] studied the relationship between fiscal policy and economic growth in the EU-15 for the period 1995–2008 and found that an increase in government spending on infrastructure has a significant positive impact on the economic growth.

Several research favor the existence of a non-linear relationship between government size and economic growth. Christie [15] used a cross-country growth regression and observed a non-linear relationship between government spending and economic growth. These results are further confirmed by Lupu and Asandului [16]. They applied the auto-regressive distributed lag (ARDL) model using a sample of eight Eastern-European countries for the period 1995–2014. The findings revealed a significant co-integration of public spending and economic growth. Moreover, the results suggest that the optimal level of public spending varies between 37% and 41%.

At the same time there are studies that dispute the existence of an evident relationship between government size and economic growth. Easterly and Rebelo [17] analyzed a dataset of a broad cross-section of countries for the period 1970–1988 and concluded that the effects of taxation are difficult to isolate empirically. They believe that fiscal variables are highly correlated among themselves (countries that have higher tax burden also have higher public spending), so the empirical results are fragile and it is difficult to find a distinct relation between government size and growth. These conclusions are further supported by Oyinlola et al. [18], who applied the GMM estimation technique on 1995–2015 data for 27 sub-Saharan African countries and found that taxation does not have a significant impact on growth.

Agell, Ohlsson and Thoursie [19] share a similar view. They argue that some of the estimated correlations between size of the public sector and economic growth are statistically insignificant and highly unstable across specifications. They concluded that cross-country growth regressions are unlikely to come up with a reliable answer to the question of the growth effects of government spending and taxation.

The literature review demonstrates that there is no consensus about the nature and significance of the relationship between the government size (measured by public spending or total tax burden) and economic growth. This is not surprising, having in mind that the overall size of the public sector has two opposite effects. On the one hand, higher taxes cause potentially higher distortions and hamper economic activity and growth, but on the other hand, higher taxes suppose higher levels of public expenditure, some of which may foster economic growth. The positive impact of tax revenue on public service delivery is empirically proven by a contemporary research conducted by Omodero and Dandago [20].

The discussion on the impact of the tax structure on growth is mainly focused on the relative merits of direct versus indirect taxes, and especially on their ability to create a more growth-friendly environment. The prevailing view favors indirect taxation, and suggests a shift of the fiscal burden towards indirect taxes, especially those on consumption. For example, Myles [21] reviews the findings on the topic and concludes that almost all the results support the claim that a move from income taxation to consumption taxation will raise the rate of growth. Moreover, a general tendency to shift the fiscal burden from direct to indirect taxation, and in particular from labor and capital towards the consumption taxes, has been observed in some of the EU member states over the last years [22; 23].

The results from the empirical analyses of Kneller, Bleaney and Gemmell [24], Widmalm [25], Lee and Gordon [26], Gemmell, Kneller and Sanz [27],

Arnold [28], Schwellnus and Arnold [29], Vartia [30], Dackehag and Hansson [31], Szarowska [32], Bernardi [33], Canavire-Bacarreza, Martinez-Vazquez and Vulovic [34], Ahmad, Ahmad and Yasmeen [35], Stoilova [36], McNabb [37], Korkmaz, Yilgor and Aksoy [38], Oz-Yalaman [39], Ayoub and Mukherjee [40], Nguyen, Huy, Hang, Bui and Tran [41], Chugunov, Makohon, Vatulov and Markuts [42], Hakim [43], Neog and Gaur [44] and Todorov [45] shed a light on the nature and significance of the relationship between tax structure and growth.

Kneller et al. [24] used a panel of 22 OECD countries for the period 1970–1995 and identified a depressing effect of so the called "distortionary taxes", which include taxes on income and property. These findings are further confirmed by the analysis of Gemmell et al. [27], which provided new evidence on the long-run impact of distortionary taxes on growth in OECD countries by updating and extending datasets to cover 1970–2004. Lee and Gordon [26] applied cross-country regressions and found a significant negative correlation between statutory corporate tax rates and growth for 70 countries during the period 1970–1997. Dackehag and Hansson [31] report similar results. They studied how statutory tax rates on corporate and personal income affect economic growth in 25 rich OECD countries by using panel data for the period 1975–2010 and found that both taxation of corporate and personal income negatively influence economic growth. Oz-Yalaman [39] used a panel VAR for 29 OECD countries over the period 1998-2016 and found that corporate tax rate has a significant negative effect on economic growth. The empirical analyses of Schwellnus and Arnold [29] and Vartia [30], based on large datasets of firms and industries across OECD countries, also indicated a negative effect of corporate taxes on productivity and investment.

Widmalm [25] used pooled cross-sectional data from 23 OECD countries, between 1965 and 1990, and found evidence that the proportion of tax revenue raised by taxing personal income has a negative correlation with economic growth. This is further confirmed by McNabb [37], who concluded that revenue-neutral increases in income taxes are associated with lower long-run GDP growth in a panel of 100 countries. Arnold [28] entered indicators of the tax structure into a set of panel growth regressions for a sample of 21 OECD countries over the period 1971–2004 and found that property taxes are the most growth-friendly, followed by consumption taxes and then by personal income taxes. At the same time corporate income taxes appear to have the most negative effect on growth.

Szarowska [32] applied regression analysis on annual panel data for EU-24 member states during the period 1995–2010 and found statistically significant positive effect of consumption taxes on GDP growth. Ayoub and Mukherjee [40] investigated the role of value-added tax (VAT) on the economic growth in China by using time series data for the period 1985–2016 and found a significant positive relationship. Nguyen et al. [41] applied regression analysis and concluded that value added tax and personal income tax have a positive effect on economic growth in the localities of Vietnam for the period 2007–2017.

Hakim [43] used the GMM estimation in a panel of 51 countries over the period 1992–2016 and concluded that tax structure based on direct taxes such as taxes on income, profit and capital gains is harmful to the economic growth, yet more efficient in terms of collecting the tax revenue in a country. Neog and Gaur [44] investigated the relationship between tax structure and economic growth in India for the period 1980–2016 applying ARDL model. They found that personal income tax, corporate income tax and excise tax are harmful to growth in the long-run. Examining Turkey from 2006 to 2018, Korkmaz et al. [38] employed the ARDL approach and found a positive and significant impact of indirect taxes, as well as a negative and significant impact of direct taxes on economic growth.

In contrast to these findings, Bernardi [33] performed an aggregated analysis

of tax trends across euro area (EA-17) member countries, and a disaggregated, country-by-country analysis, with regard to the 2000–2014 period. He found that the gains from a tax shift (from direct to indirect taxes) do not appear to be as straightforward as claimed by the previous researches. On the contrary, he predicts that the tax shift may exacerbate the economic slump spreading across the European Union, particularly as an effect of the general adoption of restrictive fiscal policies by almost all member countries.

Canavire-Bacarreza et al. [34] evaluated the effect of different tax instruments on growth for Latin American countries using vector autoregressive techniques and panel data estimation. They found that personal income tax does not have the expected negative effect on economic growth. For corporate income tax, their results suggest reducing tax evasion and greater reliance on collection may boost economic growth in the region. The reliance on consumption taxes has significant positive effects on growth in Latin America in general, although they found slight negative effects in some of the selected countries.

Stoilova [36] studied the impact of taxation on the economic growth in the EU-28 member states for the period 1996–2013 through regressions on pooled panel data. She found that imposing value added tax affects negatively EU-28 economies and concluded that a tax system based on selective consumption taxes, taxes on personal income and property is more supportive to the economic growth. Ahmad et al. [35] investigated the impact of tax revenue on economic growth of Pakistan by using time series data for the period 1976–2011 and concluded that direct taxes should be increased (rather than indirect taxes) to support the economic prosperity of the country. Chugunov et al. [42] estimated the impact of government revenue on economic growth in Ukraine for the period 2014–2018 using a correlation-regression analysis and the multiplier effect concept. The authors substantiated that the increased share of direct taxes is growth-conductive, whereas the increased share of indirect taxes causes decrease of the real GDP.

3. Tax revenues and government spending in the cee countries (2007–2019)

Government spending in the CEE countries demonstrates cyclical dynamics over the analyzed period, as illustrated by the Fig. 1. The most apparent increase in government spending is seen during the
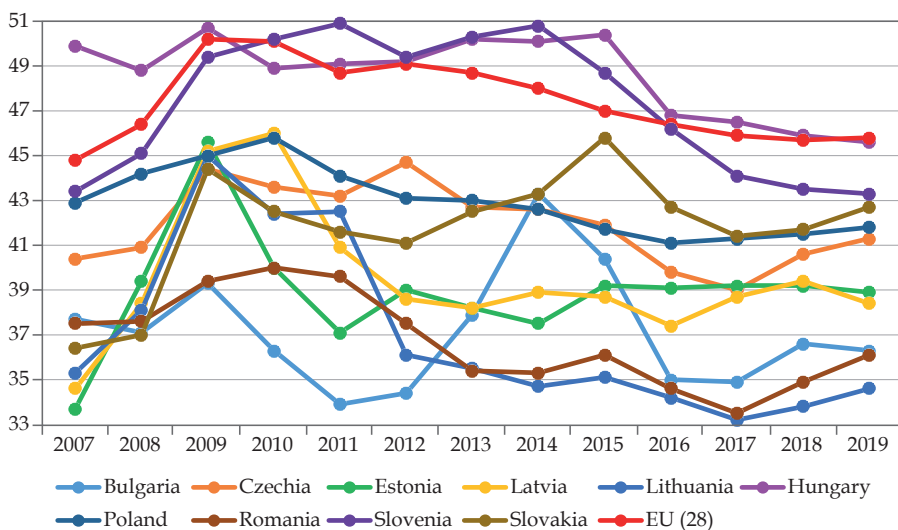

Fig. 1. **Dynamics of Total Government Expenditure in the CEE countries (% of GDP)**

Source: Eurostat http://ec.europa.eu/eurostat

periods of crisis. Although the average for the EU-28 ratio of government spending to GDP ranges within narrow limits (45%–50%), the values of this indicator vary widely from country to country. For example, total government expenditure in Bulgaria, Romania, and Lithuania range around 35% of GDP, which is far below the EU-28 average. At the same time the government spending in Hungary and Slovenia is comparable with and even outpaces the EU-28 average.

The average ratio of total receipts from taxes and social contributions to GDP in the EU-28 is comparatively high (39.5%), due to the traditional strong social protection which entails higher amounts of government expenditure and tax burden (Fig. 2). However, the tax burdens in the new EU members from the Central and Eastern Europe are lower, as a result of liberal economic reforms of democratic transition. As seen, the total tax burden varies considerably from country to country. The lowest average total-tax-to-GDP rates were reported by Romania (27.3%), Bulgaria (28.2%), Lithuania (29.0%), and Latvia (29.4%), while the highest rates were observed in Hungary (38.0%) and Slovenia (37.7%).

During the analyzed period, the mean tax burden in the EU-28 was close to equal distribution between the direct taxes, indirect taxes, and social security

contributions. On average, the receipts from direct taxes and social contributions numbered to 13.2% of GDP, while indirect taxes represented 13.1% of GDP. Due to the different patterns of national tax systems, the importance of direct taxes, indirect taxes, and social contributions vary considerably from country to country in terms of the generated revenues. Specific for the EU member states located in the Central and Eastern Europe is the reliance on indirect taxes as a main revenue source. As seen, all of the ten CEE countries report lower than the EU-28 average shares of direct taxes in GDP, while half of them register higher than the EU-28 average levels of indirect taxes-to-GDP ratio. The lowest average direct-taxes-to-GDP ratios among the CEE countries (as well as among all EU member states) were observed in Bulgaria (5.5%), Romania (6.0%), and Lithuania (6.0%). Among the countries, which reported comparatively high relative figures are Czechia, Latvia, and Slovenia, which raised 7.8%–7.9% of GDP through the direct taxes. The biggest average ratios of indirect tax revenue-to-GDP were reported by Hungary (17.5%), Bulgaria (15.1%) and Slovenia (14.2%), while the lowest ratios of the indirect taxes among the CEE countries were detected in Slovakia (11.2%) and Lithuania (11.5%).
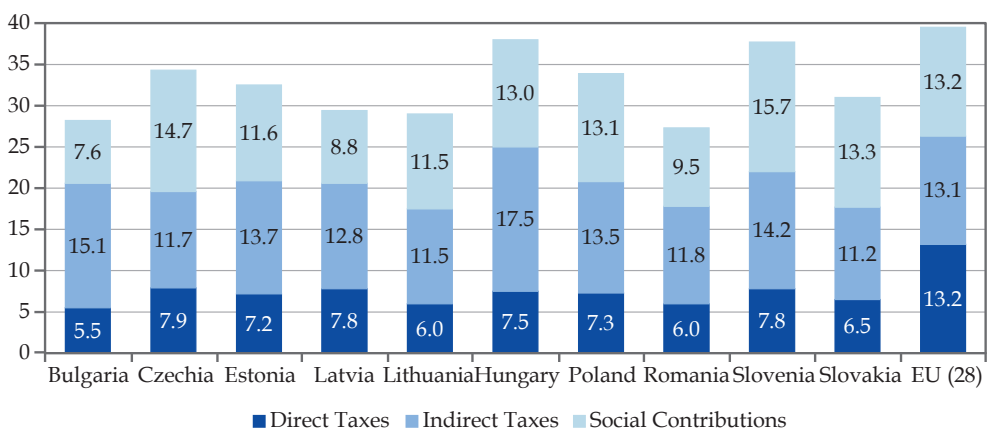

***Fig. 2.* Distribution of total tax burden in the CEE countries, average for the period 2007–2019 (% of GDP)**

Source: Eurostat http://ec.europa.eu/eurostat

4. Empirical estimation of the impact of fiscal policy on the economic growth of the cee countries

4.1. Methodology and data

This research uses a vector autoregression (VAR) and annual Eurostat data over the period 2007–2019. The VAR includes the following variables:

$GDPGR_{ij}$ – growth rate of the real GDP of country i in year j (percentage change on the previous period);

DIR_TAX_{ij} – direct tax revenue of country i in year j (percentage share in GDP);

$EAGR_j$ – growth rate of the real GDP in the euro area in year j (percentage change on the previous period);

EX_{ij} – exports (percentage share in GDP) of country i in year j;

GCF_{ij} – gross capital formation (percentage share in GDP) of country i in year j;

GOV_CONS_{ij} – final government consumption expenditure (percentage share in GDP) of country i in year j;

$HOUS\_CONS_{ij}$ – final consumption expenditure of households (percentage share in GDP) of country i in year j;

IND_TAX_{ij} – indirect tax revenue (percentage share in GDP) of country i in year j.

The target (dependent variable) is $GDPGR$. The independent variable of interest to this research are the fiscal instruments direct tax revenue (DIR_TAX), indirect tax revenue (IND_TAX) and government consumption expenditure (GOV_CONS). GDP growth rate in the euro area (**$EAGR$**), exports (EX), gross capital formation (GCF) and consumption expenditure of households ($HOUS\_CONS$) are control variables, which reflect the effects of non-fiscal factors of the economic growth of the NMS-10.

4.2. Results and presentation of key research findings

All variables are stationary at level, which requires the application of an unrestricted VAR approach (Table 1). The test for the optimal number of lags in the VAR indicates that according to all information criteria this number is one (Table 2), therefore the VAR is estimated with one lag.

Table 1

Levin, Lin & Chu Unit Root Test on the level values of variables in the VAR

Variable	Probability
GDPGR	0.0000
DIR_TAX	0.0002
EAGR	0.0000
EX	0.0010
GCF	0.0000
GOV_CONS	0.0001
HOUS_CONS	0.0000
IND_TAX	0.0000

Source: Authors' calculations

The equation for the target variable $GDPGR$ in the VAR is as follows:

$$\begin{aligned} GDPGR = &\ C(1) + C(2) \cdot GDPGR(-1) + \\ &+ C(3) \cdot DIR\_TAX + C(4) \cdot EAGR + \\ &+ C(5) \cdot EX + C(6) \cdot GCF + \\ &+ C(7) \cdot GOV\_CONS + \\ &+ C(8) \cdot HOUS\_CONS + \\ &+ C(9) \cdot IND\_TAX. \end{aligned} \quad (1)$$

Table 2

Optimal lag length in the VAR

Number of lags	FPE	AIC	SC	HQ
0	1.362021	3.145844	3.402815	3.247916
1	1.257905*	3.065894*	3.354986*	3.180725*
2	1.294544	3.094068	3.415282	3.221658
3	1.332253	3.122123	3.475458	3.262472
4	1.371193	3.150139	3.535596	3.303247
5	1.399726	3.169793	3.587370	3.335660
6	1.398010	3.167462	3.617161	3.346087

Note: * Shows the optimal number of lags according to the respective criterion
Source: Authors' calculations

The results from the econometric estimation of Equation (1) are reported in Table 3.

The real GDP growth rate in the CEE countries is influenced by shares of direct tax revenue, exports and investment in the output of the analyzed countries as well as by the economic growth in the euro area. The signs of all significant coefficients in Equation (1) are as predicted by the economic theory (the coefficient before *DIR_TAX* is negative, while the coefficients before *EX*, *GCF* and *EAGR* are positive). The highest absolute value of the coefficient before *EAGR* implies that external factors have stronger impact on the economic growth of the CEE countries than internal factors, which confirms the theoretical expectations for small open economies. The value of the regression coefficient before *DIR_TAX* (–0.554720) suggests that if all other variables are held constant, a 1% change in the share of direct tax revenue in GDP will lead to a 0.55% change in the real GDP growth rate of the CEE countries in the opposite direction.

The value of the coefficient of determination (R-squared = 0.74) shows that 74% of the variation of the economic growth in the CEE countries can be explained by changes in the independent variables in Equation (1). The probability of the F-statistic (0.00) implies that the alternative hypothesis of adequacy of the model used is confirmed. It should be made clear that this does not mean that the model is the best possible, but simply adequately reflects the relationship between the dependent and the independent variables.

The AR roots graph (Figure 3) indicates that the VAR is stable since there are no roots out of the unit circle.

Although the literature does not provide a consensus about the nature and significance of the relationship between fiscal policy instruments and economic growth, our results are in compliance with those of several studies. Confirmation of the depressing effects of direct taxes on the economic growth is found by Kneller et al. [24], Widmalm [25], Gemmell et al. [27], Arnold et al. [46], Dackehag and Hansson [31], Macek [47], McNabb [37], Korkmaz et al. [38], Hakim [43], Neog and Gaur [44]. On the opposite side are the results of Canavire-Bacarreza et al. [34], Bernardi [33], Ahmad et al. [35], Havránek et al. [48], and Chugunov et al. [42], which estimate direct taxes as growth-conductive.

Our results show that government consumption expenditure in the CEE countries does not have a significant effect on economic growth, which suggests low efficiency of public spending. Although non-conventional, our results are in line with several studies, which find no discernible relation between government consumption spending and growth. For example, Bose et al. [49] examined the impact of public expenditure on economic growth in a sample of 30 developing countries using 1970s and 1980s data. Applying panel data techniques,

Table 3

Results from the econometric estimation of Equation (1)

| Variable	Coefficient	Standard error	t-Statistic	Probability
C	–20.71839	12.75415	–1.624444	0.1074
GDPGR(–1)	0.103607	0.062498	1.657751	0.1004
DIR_TAX	–0.554720	0.278132	–1.994448	0.0488
EAGR	1.078060	0.149379	7.216956	0.0000
EX	0.217343	0.050692	4.287552	0.0000
GCF	0.438833	0.090405	4.854082	0.0000
GOV_CONS	–0.042410	0.339150	–0.125048	0.9007
HOUS_CONS	0.034863	0.170731	0.204196	0.8386
IND_TAX	–0.038543	0.286398	–0.134580	0.8932

Source: Authors' calculations
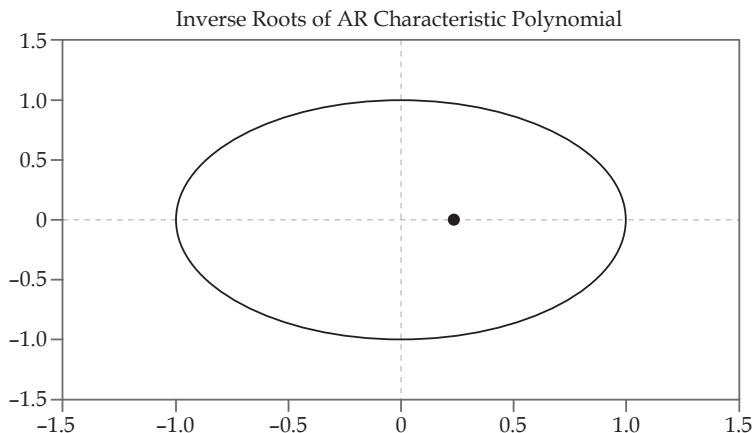
Fig. 3. **AR roots graph of the VAR**

Source: Authors' calculations

they found that current expenditure had no significant impact on economic growth. Taban [50] investigated government expenditure-economic growth nexus for the Turkish economy using quarterly data for the period 1987–2006. Based on the ARDL bounds testing approach, the results claimed that there is no significant relationship between government consumption spending and economic growth. Wahab [51] explored the impact of both aggregated and disaggregated government spending on economic growth using two samples – one for aggregated government spending in 97 developing and developed countries during the period 1960–2004 and another for disaggregated government spending in 32 countries during the period 1980–2000. The study revealed that government consumption spending has no significant output growth effects. Hasnul [52] explored the relationship between government expenditure and economic growth in Malaysia for the period spanning from 1970 to 2014. The study used an OLS technique and confirmed that operating government expenditure had no impact on economic growth.

At the same time, there are studies that challenge our results. For example Barro [2], Gupta et al. [53], Schaltegger and Torgler [54], Gemmell et al. [13], and Okoye et al. [55] estimated a negative impact of consumption spending on growth, while Devarajan et al. [56], Ghosh and Gregoriou [57], Attari and Javed [58], Al-Fawwaz [59], and Leshoro [60] found that current government expenditure has positive and statistically significant growth effects.

5. Conclusion

Our results show that government consumption expenditure in the Central and Eastern Europe countries does not have a significant effect on economic growth, which suggests low efficiency of public spending.

The empirical results from this study reveal that policy-makers in the Central and Eastern Europe countries can raise economic growth by decreasing the share of direct tax revenue in GDP and by encouraging an increase in the shares of exports and investment in GDP. Indirect tax revenue and government's final consumption expenditure do not affect the growth of real output in the analyzed countries, while the economic growth in the euro area, although supportive, is beyond the control of the policy-makers in Central and Eastern Europe.

From the three hypotheses tested in this research, **H1** was found to hold true for direct tax revenue, while **H3** was confirmed for government consumption and indirect tax revenue.

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Для цитирования

Информация о статье

Modelling of a relative income tax bracket-based progression with the effect of a slower tax burden growth

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ABSTRACT

This study aims to model the distribution of the tax burden in schedular progressive taxation and to describe the key characteristics of such models, in particular their differences from the models based on continuously increasing smooth functions of the relationship between the tax burden and the taxpayer's income. Our hypothesis is that the use of the Gompertz function to model the main indicators of tax burden distribution of the schedular progressive income tax will help us approximate and formalize the distribution of the tax burden in a relative income tax bracket-based progression. Our research relies on the hypothetico-deductive model, more specifically, on mathematical hypothesis testing. The methodological framework comprises models of progressive taxation and mathematical methods, including data approximation based on the use of the Gompertz function, analysis of the antiderivative and convexity of functions and their properties. The resulting model can be used to describe the dynamic characteristics of the relationship between the tax burden and certain parameters of schedular taxation. This model can help identify the level of income beyond which the progression of the tax burden becomes formal and does not generate commensurately high revenue growth. The existence of such income level results in what can be considered the key drawback of the relative progression in question – the impossibility to provide a significant difference (step) of the tax burden progression in the whole interval of the taxpayer's income. What makes this research practically significant is that the proposed methodology allows us to take into account the actual tax burden in modelling the parameters of the relative progression.

KEYWORDS

income tax; progressive scale; schedule; tax rates; Gompertz function

JEL H24, J31, O15

Моделирование относительной поразрядной прогрессии подоходного налога с эффектом замедления роста налоговой нагрузки

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АННОТАЦИЯ

Цель исследования заключается в моделировании распределения налогового бремени при шедулярном прогрессивном налогообложении, выявление основных свойств данных моделей и их отличий от моделей, основанных на

применении непрерывно возрастающих гладких функций зависимости налоговой нагрузки от величины доходов налогоплательщиков. Гипотеза исследования заключается в том, что использование функции Гомпертца для моделирования основных показателей распределения налогового бремени шедулярного прогрессивного подоходного налога позволит аппроксимировать и формализовать распределение налогового бремени при поразрядной относительной прогрессии подоходного налога. Процедура исследования опирается на использование гипотетической дедуктивной модели, в частности, на проверку математической гипотезы. Методологической базой исследования являются модели реализации прогрессивного налогообложения и математические методы, в том числе аппроксимация данных с использованием функции Гомпертца, методы анализа свойств первообразной и выпуклости функций. Полученная модель может быть использована для описания динамических характеристик взаимосвязи между налоговой нагрузкой и некоторыми параметрами шедулярного налогообложения. Эта модель может помочь определить уровень дохода, при превышении которого увеличение налогового бремени становится формальным и не приводит к соизмеримому высокому росту доходов. Существование такого уровня доходов обуславливает главный недостаток применения поразрядной относительной прогрессии подоходного налога – невозможность обеспечения существенного шага прогрессии налоговой нагрузки на всем интервале доходов налогоплательщиков. Практическая значимость результатов заключается в разработке методологии, позволяющей учитывать фактическую налоговую нагрузку при моделировании параметров поразрядной относительной прогрессии подоходного налога.

КЛЮЧЕВЫЕ СЛОВА
подоходный налог; прогрессивная шкала; шедулярный подход; налоговые ставки; функция Гомпертца

1. Introduction

Unlike proportional tax models, which differ only in terms of tax rates, non-taxable income and tax deductions as well as all the national models of progressive taxation are unique. Every state sets the parameters of their progressive tax systems following the national traditions, social and economic goals and objectives.

There are two fundamentally different approaches to modelling progressive taxation: global and schedular. The former relies on the use of continuously increasing smooth functions of the relationship between the tax burden and the taxpayer's income. When the global approach is applied, one tax is imposed on all the income, regardless of its nature. The schedular approach is widely used in practice. Different schedules can be taxed at different tax rates (for example, in Russia the schedule of earned income and the schedule of unearned income) and

even in different ways – proportionally or progressively.

The fact that schedular progressive taxation systems that use a relative bracket-based progression are widely spread makes this method of taxation a topic worthy of research interest. Despite the existing evidence of applying a relative progression in taxation, there is still no uniform approach to its modelling. Moreover, there is still a perceived lack of a well-supported theoretical rationale for the available practical solutions and ways of ensuring vertical equity.

This study aims to address these gaps by modelling the distribution of the tax burden in schedular progressive taxation and describing the key characteristics of these models, in particular their differences from the models based on continuously increasing smooth functions of the relationship between the tax burden and the taxpayer's income.

Our hypothesis is that the use of the Gompertz function to model the main indicators of tax burden distribution of the schedular progressive income tax will help us approximate and formalize the distribution of the tax burden in a relative income tax bracket-based progression.

Formalization of the model of a relative progression can reveal the key characteristics of this taxation method and show the threshold level of income beyond which the progression of the tax burden becomes formal and does not generate commensurately high tax revenue growth.

2. Literature review

Income taxation resides at the core of the secondary distribution of income, which can be approached from different perspectives. The main questions that need to be considered in this respect is how to make income taxation more fair and how the chosen taxation model will affect people's labour and business motivation as well as the situation in the public sphere.

The largest body of research on income taxation focuses on the most important question – the fairness of progressive taxation, more specifically, whether the rich pay should more in taxes than the poor (see, for example, Popescu et al. [1], Chambers et al. [2], Krajewski et al. [3], and Mirrlees [4]).

The impact of tax rates on labour supply is another question, which, despite its importance, remains largely underexplored although the research by Luksic [5] and Kireenko et al. [6] suggests that progressive tax scales do not have a negative effect on people's sentiments and motivation. Nevertheless, these matters still require a more detailed in-depth research.

In general, the distribution of the income taxation burden (through progressive or proportional taxation) has a certain effect on the social sphere, positive as well as negative. It is, therefore, interesting to estimate the impact of progressive taxation on the happiness of

A citizens. Such study was conducted by Oishi et al. [7], who found that progressive tax burden distribution has a positive influence on citizens' happiness levels in the USA. This effect, however, was not similar for all social groups as the wealthiest Americans demonstrated a slight decrease in happiness.

Due to the heterogeneity of public interests, increased scholarly attention is paid to political aspects of progressive income taxation (see, for example, Garcia-Muniesa [8], Carriero et al. [9], Oh [10], and Mehrotra [11]).

Another area of research is the analysis of the practical issues of tax reforms such as the adoption or abolition of progressive income tax scales (see, for example, Barrios et al. [12], Balatsky et al. [13], Di Nola et al. [14], Vlad et al. [15], Mayburov [16], and Hyun et al. [17]). The cases of particular countries are of most interest since they provide sufficient evidence to verify many of the theoretically justified hypotheses. One of such hypotheses is that progressive income taxation is associated with higher rates of tax evasion.

The impact of the tax burden on income tax evasion still remains a widely discussed problem in the theory of taxation (see, for example, Holter et al. [18], Belozyorov et al. [19], and Landier et al. [20]).

Other significant areas of research include studies of the impact of progressive income taxation on economy and the social sphere. Despite the substantial research evidence accumulated in each of these areas, there still remain issues for debate.

Studies of the organization of progressive taxation can be roughly divided into two large groups: studies of the first group analyze the international experience of progressive taxation and the influence of specific solutions on economy and the social sphere (see, for example, Stephenson [21] and Musgrave et al. [22]); studies of the second group are based on modelling progressive income tax scales (see, for example, Mirrlees [4], Chistyakov et al. [23], Kim [24], Smirnov

[25], and Saez [26]). This way the existing systems of income taxation can be improved or adjusted to specific needs of national economies and societies.

Our study places a special emphasis on the mathematical analysis of the most widely spread schedular model of progressive taxation.

Chistyakov et al. [23] proposed a game-theoretical model of the optimal scale of average rates of the progressive income tax. A distinguishing feature of this model is that it does not require to take into account the function of income distribution, which means that the impact of other mandatory payments on the model in question can be excluded.

Kim [24] developed various models of progressive income taxation based on the global approach. In comparison with schedular progressive taxation, such models have their own advantages and shortcomings, which, however, fall beyond the scope of our research.

Saez [26] proposed a methodology to determine the optimal tax rate of the non-linear income tax scale for high income based on the elasticity of taxable income. His research [26] develops the optimal income tax formulae proposed by Mirrlees [4], which also described the impact of tax burden on national economy.

This study does not consider the impact of the income tax on economy. Modeling of income tax scales based on income elasticity, although crucial for decision-making in taxation, does not take into account the factors of vertical equity and social stratification. In our view, such models can complement other models that take into account these factors.

Our methodology is based on the use of the Gompertz function, which is applied in other fields of research such as biology [27; 28], medicine [29], geoscience [30; 31], demography [32], agriculture [33; 34], zootechnics [35] and economics [36]. In economics, the Gompertz curves were used to analyze social stratification depending on income distribution [36].

All of the above leads us to the following conclusion. There is a substantial body of research literature on the fairness of progressive taxation, optimal tax rates, the influence of tax burden on labour and the social sphere, the effect of public interests on income taxation, specific cases of income taxation reforms, the impact of income tax rates on compliance, modelling of tax scales and the application of the Gompertz function to describe various empirical relationships. There are, however, no studies that would use the Gompertz curve to analyze the relative income tax bracket-based progression.

3. Modelling of a relative income tax bracket-based progression

The methodology for calculating tax burden distribution proposed in this study relies on the income data, which also take into account the burden from other taxes and levies. Thus, we can exclude the negative influence of the distortions in the estimates of real disposable income caused by the co-existence of several taxes and levies within the tax system.

Our research relies on the hypothetico-deductive model, or, to be more precise, on the most widely spread form of this model – mathematical hypothesis.

Methodologically, the study is based on the use of the Gompertz function, analysis of properties of the antiderivative and convexity of the functions and other methods of function analysis.

The Gompertz function is a sigmoid function and a special case of the generalized logistic function. Gompertz functions are defined and continuous in the entire interval; the first and second derivative exist on each point and are finite. A peculiar feature of the Gompertz function is that it belongs to the type of mathematical models describing a pattern of growth that is the slowest at the beginning and at the end of the interval. Growth slows down at a lower pace than it accelerates [37].

Our analysis covers the average and marginal tax rates, which are defined as follows:

• average (actual) tax rate or tax burden is the ratio of the amount of taxes paid (T) to the total tax base x:

$$N(x) = \frac{T}{x}; \qquad (1)$$

• marginal tax rate $r_{0...i...n}$ is the rate specified in the legislative act on this tax, that is, it is the tax rate established under the corresponding law [38].

The model of tax burden distribution in the schedular progressive tax system is normative since it has a system of limitations stemming from the principles of schedular progressive taxation.

The problem with using the Gompertz function to model the distribution of the tax burden in a schedular progressive tax system is that the function does not equal zero if the argument is zero while the tax cannot be paid in the absence of income. Therefore, to address our research task, we used the antiderivative of the Gompertz function and the domain of the function was limited only to positive values of the argument.

To choose the methodology for calculating the tax burden, we need to take into account the needs of the real economy. Taxpayers' net income should increase together with the growth in their nominal income:

$$\frac{x_i - r_i(x_i)}{x_{i-1} - r_i(x_{i-1})} > 1 \text{ for } x_i > x_{i-1}, \quad (2)$$

where x_i is the income level in the ith step; r_i is the rate of the tax payable in the ith step.

This principle means that there should be no jump discontinuities in the income that would otherwise occur if the effective tax rate was raised disproportionately to the taxpayer's income.

This condition can be met in two ways:

a) the marginal tax rates increase continuously throughout the whole interval of the taxpayer's income;

b) through the use of schedular taxation: the amount of tax is calculated on a cumulative basis. In the case of a higher tax rate, only the sum exceeding the threshold is taxed.

Each of these solutions has its advantages and drawbacks and requires to follow other principles that stem from social needs and the nature of progressive income taxation:

c) higher income is taxed at a higher rate;

d) zero income means the absence of tax burden.

While one can choose either condition (a) or (b), conditions (c) and (d) are mandatory for any model of progressive income taxation.

In addition, the following considerations should be taken into account:

1) Condition (a) will be met by any continuous smooth function. Conditions (c) and (d) are met if the function of the effective tax rate increases continuously from zero. This condition is met if

$$\frac{dy}{dx} > 0, \ x > 0 \text{ and } y < 1.$$

These conditions are also referred to as the conditions of normalcy of the progressive scale [23]. The main advantage of this method of progressive taxation is that there is no need to set income intervals (schedules).

2) The schedular method (b) is widely used in the practice of progressive taxation because it implies simpler calculations.

In schedular progressive taxation, tax is calculated on a cumulative basis as the sum of products of parts of the taxpayer's income multiplied by the marginal tax rates for corresponding income ranges (3).

$$T(x) \begin{cases} x > 0 \\ T_0(x) = r_0 x \\ T_i(x) = r_i(x - a_{i-1}) + T_{i-1}, \quad (3) \\ r_i \in (0,\ 1),\ i = \overline{0;\ n} \\ 0 < a_0 < a_{i-1} < a_i < a_n, \end{cases}$$

where n is the number of income groups; x is the share of the taxpayer's actual income assigned to the ith group; a_i is the marginal income for the corresponding tax rate; r_i is the ith tax rate $T(x)$ is the amount of tax levied on income x.

4. Modeling of the tax burden and marginal tax rates depending on the level of the taxpayer's nominal income

The actual tax burden $N(x_i)$ of a taxpayer with the income (x_i) exceeding a_n in this model of progressive taxation will look the following way:

$$N(x) = \frac{T(x)}{x} = \frac{r_0 a_0 + \sum_{i \in n} r_i (x - a_{i-1})}{x}. \quad (4)$$

Marginal tax rates r_i can be represented by the following model:

$$f(r) = \begin{cases} r_0, \, T(x) \in 0...r_0 a_0 \\ r_i, \, T(x) \in a_{i-1}...r_i a_i \\ ... \\ r_n, \, T(x) \in a_{n-1}...r_n a_n \, . \\ 0 < a_0 < a_{i-1} < a_i < a_n \\ r_0 < r_i < r_n \\ r_i \in (0, 1), \, i = \overline{0; \, n} \end{cases} \quad (5)$$

The system of limitations (5) may be described by the threshold piecewise continuous function of the relationship between the marginal tax rates and the taxpayer's income level. A stepwise increase in the tax rates results in the growth of the tax burden in the entire interval of the taxpayer's income.

At the origin of the coordinates, the marginal tax rate equals tax burden $N_0 = r_0$. Further, tax burden increases in the intervals from a_{i-1} to a_i. In other words, the growth of the tax burden is behind the growth of the marginal tax rate by the share of the tax burden corresponding to lower tax rates.

As the income grows, the portion of income taxed at lower rates becomes smaller $T(x) \to r_i \cdot x$, $N(x) \to r_n$ for $x \to \infty$. This leads to slower growth of the tax burden, which comes close to the level of the highest marginal tax rate but will always remain below this level because there is always a part of the tax burden stemming from lower marginal tax rates. For lower income earners, the tax burden grows slower than for middle income earners. For higher income levels, the share of the income taxable at lower rates is less noticeable in the total tax base and the growth of the tax burden slows down. On drawing near the maximum marginal tax rate, the growth of the tax burden slows down.

Thus, the functional relationship between the tax burden and the taxpayer's nominal income is to a great extent similar to Gompertz curves and is characterized by the following:

- $0 \leq f(x) \leq r_n$;
- $f(x) = 0$ for $x = 0$;
- $f(x) > 0$ for $x > 0$;
- the function is continuous and strictly increasing in the entire interval $x > 0$;
- $\lim_{x \to \infty} f(x) = r_n$.

The relationship between the tax burden and the taxpayer's income described with the help of the Gompertz function looks the following way:

$$f(x) = r_n \cdot e^{b \cdot e^{(c \cdot x)}}, \quad (6)$$

where b and c are negative.

The function has horizontal asymptotes determined by the following formulae:

$$\lim_{x \to -\infty} r_n \cdot e^{b \cdot e^{c \cdot x}} = 0$$

and $\quad (7)$

$$\lim_{x \to \infty} r_n \cdot e^{b \cdot e^{c \cdot x}} = r_n \cdot e^0 = r_n.$$

The curve approaches the asymptotes asymetrically. In accordance with the supposition that the tax burden takes the form of a Gompertz curve, the tax rate approaches r_n when the income (x) approaches ∞.

Parameter b determines the shift of the tax burden curve along the axis of taxable income (x). Its value depends on the breakpoint of the first schedule or the amount of tax-free personal allowance. The higher is the value of this parameter, the longer is the interval of the taxpayer's income preceding the beginning of the interval with the high rate of growth in the tax burden's dependence on the taxpayer's income. A lower value of parameter b signifies higher financial security enjoyed by minimum income citizens.

However, at $x = 0$ the Gompertz function takes the value $f(0) = r_0 \cdot e^b$, which corresponds to the case where the taxpayer with zero income would still bear the minimum tax burden and thus the key principle of income taxation would be compromised (d).

Since the Gompertz function is differentiable in the entire interval and any continuous function has an infinite number of antiderivatives $F(x) + \text{const}$, we are going to use the following antiderivative as a scale of average rates for zero tax burden:

$$N(x) = r_n \cdot e^{b \cdot e^{c \cdot x}} - r_n \cdot e^b. \qquad (8)$$

Function $N(x)$ will equal zero for $x = 0$ and the asymptote will change by the value of the constant. Fig. 1 shows examples of graphs of the Gompertz function and its antiderivative for constant values $r_n = 0.4$, $b = -4$, $c = -0.5$. For dimensionality reduction along the x-axis, linear data normalization is used with the fiducial value of 1 million roubles (Fig. 1).

The value of x where the function reaches the value equal to half of asymptote ($f(x) = r_n / 2$) is determined as

$$x = \frac{\ln\left(\frac{\ln(2)}{-b}\right)}{c}.$$

5. Modelling the level of income characterized by slower growth of the tax burden

The function of the relationship between the tax burden and income is progressive in the entire income interval due to the function's asymmetry and tendency towards the maximum marginal tax rate. However, the step of the progression decreases gradually. The tax burden becomes less and less progressive. For a certain high level of income, the taxpayer's income is to a significant extent liable to the maximum marginal tax rate while the difference between the amount of the tax burden and the maximum marginal tax rate becomes insignificant.

Although there is a certain amount of subjectivity involved in deciding what constitutes a significant or insignificant difference, mathematical analysis enables us to identify the level of income x_p beyond which the growth of the tax burden will start to slow down. In fact,
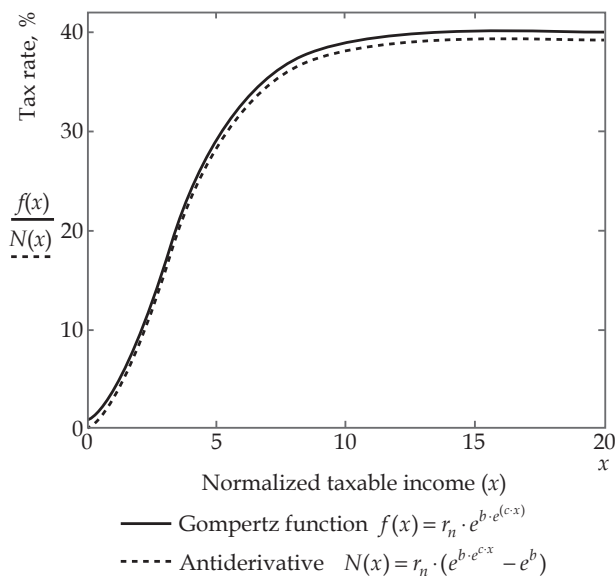
Fig. 1. **Gompertz function** $f(x) = r_n \cdot e^{b \cdot e^{(c \cdot x)}}$ **and antiderivative** $N(x) = r_n \cdot (e^{b \cdot e^{c \cdot x}} - e^b)$
Source: authors' calculations

x_p is the point of inflection of function $N(x)$. The income beyond this level will provide a less significant increment in the tax burden and, therefore, tax progression will become formal and will not result in commensurately higher government revenue.

To find income x_p, we are going to find the point of inflection of function $N(x)$. It is known that if the second derivative in the point in the given interval changes sign, then this point is the function's point of inflection. For a double-continuously differentiable Gompertz function, to find the point of inflection it is enough to find such value of x that the second derivative will take zero value.

To analyze the Gompertz function, we need to find its first and second derivative.

$$f'(x) = r_n \cdot b \cdot c \cdot e^{b \cdot e^{(c \cdot x)} + c \cdot x}, \qquad (9)$$

$$f''(x) = r_n \cdot b \cdot c^2 \cdot (b \cdot e^{c \cdot x} + 1) \cdot e^{b \cdot e^{c \cdot x} + c \cdot x}. \quad (10)$$

Evidently, the second derivative equals zero if one of the factors equals zero. In our case, $b \cdot e^{c \cdot x} + 1 = 0$.

Therefore, in interval $0 \le x < +\infty$, the Gompertz function is absolutely continuous and has a point of inflectionat

$$x_p = \frac{\ln\left(-\dfrac{1}{b}\right)}{c}. \qquad (11)$$

Let us now look at the properties of the convexity of the curve.

In interval

$$0 \le x < \frac{\ln\left(\dfrac{-1}{b}\right)}{c},$$

the first derivative is positive and increasing and the second derivative is also positive. Thus, the function is convex down. This means that within the given interval, there is a progressive dependence of the tax burden on the taxpayer's income. The higher is the income, the more substantial is the tax burden.

After the inflexion point, the first derivative is positive and the second derivative is negative, the function is increasing more and more slowly and the curve is convex upwards. In this interval, a higher income does not generate a proportional increment in tax revenue. The progression of the tax burden gradually decreases (Fig. 2).
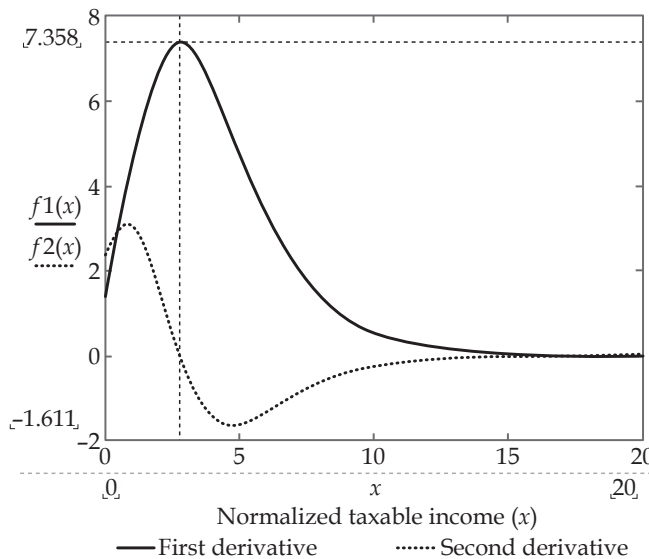
Fig. 2. First and second derivatives of the function of the relationship between the tax burden and the taxpayer's income
Source: authors' calculations

We know that the growth rate of the function, or the relative rate of change of the function, equals the logarithmic derivative of the function.

The growth rate of the function is defined as

$$\frac{d}{dx}\ln(f(x))$$

or

$$temp(x) = \frac{1}{f(x)} \cdot \left(\frac{d}{dx} f(x)\right).$$

Thus, for the Gompertz function, the rate of growth will change in accordance with formula $temp(x) = b \cdot c \cdot e^{c \cdot x}$ and the choice of coefficients b and c determines the curve of the function's growth.

The graph in Fig. 3 shows the rate of increase of the function with coefficients b and c held constant.

At $x = 0$ the growth rate equals $temp = b \cdot c$.

The growth rate drops by half at

$$x = \frac{-\ln(b \cdot c)}{c}$$

(in the given case we take $\Delta x = 1.386$). After that, the growth slows down.

Fig. 4 shows the graph of surfaces of 10 antiderivative curves when changing parameter c from –5 to –0.5 with the step of 0.5.

The flexion of the surface of the curves along the z-axis shows the influence of coefficient c on the graph of the relationship between the tax burden and income. Coefficient c determines the growth rate of the function. The value of c depends on the ratio of intervals (schedules) and the step of the increment (difference) of the values of the marginal tax rates: the faster is the maximum marginal tax rate reached, the higher is the step. In the case of tax burden distribution, this parameter shows how pronounced is the progressivity of the income tax rates. The goals set by the national government in particular circumstances can thus be met effectively through the regulation of the parameters of a progressive tax system.
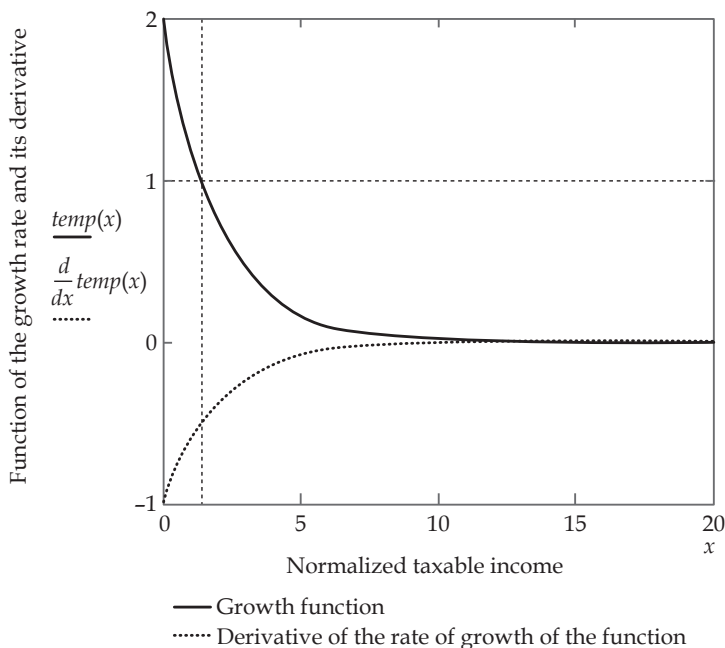
Fig. 3. **Graph of the rate of growth of the function with coefficients b and c held constant**

Source: authors' calculations
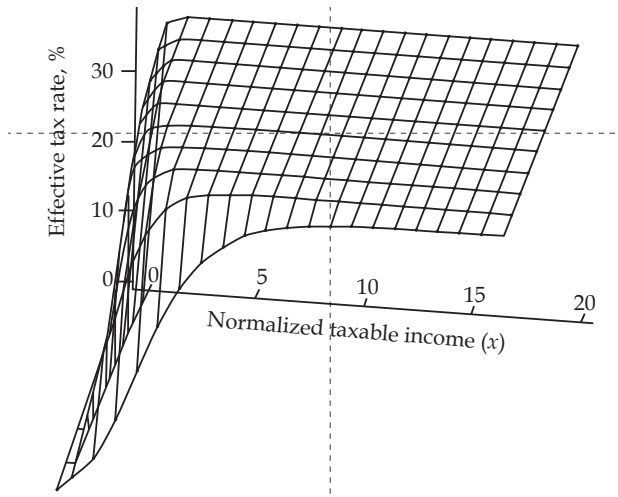
Fig. 4. Surface plot of the curves of function *N*(*x*) showing the effect of changes in parameters *c* and *x* while other parameters are held constant

Source: authors' calculations

6. Conclusion

It should be noted that in our study we assumed that the distribution of taxpayers across income groups is uniform. In reality, however, there may be a lack of taxpayers in certain income ranges but this does not affect the model of a relative progression. The use of variable parameters of an antiderivative of the Gompertz function makes it a universal tool for analysis of any schedular model of progressive taxation based on a relative progression. Our model does not take into account the specific types of respondents and other parameters characteristic of any real tax system and it is not suitable for analysis of 'horizontal' equity' in income taxation.

Our study has confirmed the initial hypothesis that the application of the Gompertz function to model the key parameters of tax burden distribution in schedular progressive income taxation enables us to approximate and formalize tax burden distribution in a system reliant on a relative tax bracket-based progression.

The use of antiderivatives of the Gompertz function to describe a relative tax bracket-based progression has led us to an important conclusion concerning the application of schedules in progressive income taxation: although in schedular progressive taxation the calculations of the tax burden are simpler, such tax systems fail to provide a similar progression in the entire interval of taxpayers' income.

In practice, to overcome this drawback, we would need the data on the maximum income of taxpayers and we would also need to model progressive taxation by using coefficients which would provide the level of income above the maximum level of taxpayers' income and beyond which the speed of the tax burden's growth would start to slow down. The functional relationship between the marginal tax rate and income does not have this shortcoming but is more complicated to calculate and, therefore, its practical use would require its further adjustment to specific conditions in this or that country. Modern high-technology solutions, however, have rendered the task of tax liability calculation much less challenging and both methods of organizing progressive taxation are now practically applicable in equal measure.

The proposed model can also be used to improve the schedular income tax based on a relative tax bracket-based progression as it demonstrates the distribution of the tax burden among different income groups of taxpayers.

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Application of digital technology in enhancing tax revenue collection: the case of micro businesses in Tanzania

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ABSTRACT

In spite of the importance of Micro Businesses (MBs) in forming a wide tax base, there isn't a clear practical approach to tax administration of MBs in many developing countries. Specifically, there is limited information on how digital technology can address tax administration challenges for MBs. This paper explores the potentials of digital technology to enhance tax revenue collection and its administration to Micro Businesses in the Tanzanian context. The data on tax administration, challenges impeding tax administration to MBs, and the potential of digital technology used in tax administration were collected by questionnaire and interview. Interviews were conducted with 24 informants from Tanzania Revenue Authority, and 137 Micro Business candidates from various business sectors were provided with a questionnaire in Dar es Salaam, which is the head office of tax administration and the economic hub of Tanzania. Thematic approach was used to analyse the qualitative data. Descriptive statistics was used to analyse quantitative data through SPPS. The findings revealed that the current tax practices to MBs do not comply with tax theories of low administration cost, wide tax base, and simple-to-administer tax procedure. The findings revealed that the challenges like lack of record keeping, lack of knowledge on tax payment procedures, unknown tax collection channels, and multiple taxes can be tackled by establishing strong relationship mechanisms between TRA and MBs and using digital technology solutions to tackle challenges. The study suggests some digital technology solutions to address the challenges. Leading to that practical aspect of tax administration that can guide policy makers and tax administrators was introduced.

KEYWORDS

tax administration, digital technology, tax avoidance, input tax and micro businesses

JEL H25, H30

Использование цифровых технологий в целях повышения налоговых поступлений (на примере микробизнеса Танзании)

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АННОТАЦИЯ

Несмотря на важную роль микробизнеса для формирования широкой налоговой базы, во многих развивающихся странах не сформировался ясный практический подход к его налоговому администрированию. В частности, нет достаточной информации о том, как можно решить проблемы налогового

администрирования микробизнеса с помощью цифровых технологий. В статье исследуются возможности применения цифровых технологий для повышения сбора налогов и налогового администрирования микробизнеса в Танзании. Данные о налоговом администрировании, о проблемах, тормозящих налоговое администрирование микробизнеса и о возможностях цифровых технологий в налоговом администрировании получены путем анкетирования и интервью. Были проинтервьюированы 24 представителя налогового управления Танзании, проанкетированы 137 представителей различных сфер микробизнеса в Дар-эс-Саламе, являющемся экономическим центром и местом расположения налоговой администрации Танзании. Для анализа качественных данных использован тематический подход, для анализа количественных данных использована описательная статистика с применением пакета SPPS. Результаты показали, что текущая практика налогообложения микробизнеса не соответствует налоговым теориям о низких административных расходах, широкой налоговой базе и простоте налоговых процедур. Результаты показали, что такие проблемы, как отсутствие учета, незнание процедур уплаты налогов, неясные каналы сбора налогов и множественность налогов, могут быть решены путем построения прочных взаимоотношений между налоговой администрацией и микробизнесом, а также путем применения цифровых технологий. Для решения выявленных проблем предложены некоторые цифровые технологические решения. Представлены практические рекомендации по улучшению ситуации, которые могут быть применены в политике и налоговом администрировании.

КЛЮЧЕВЫЕ СЛОВА

налоговое администрирование, микробизнес, цифровые технологии, неформальные операции, уход от налогов, вмененный налог, Танзания

1. Introduction

Micro businesses (MBs) are a form of informal businesses operating in high footfall areas such as markets, bus stands, and road junctions and densely populated residential areas from Gomera and Oreku [1]. MBs have been promoted as important enterprises to the economy and livelihood of many people in developing countries. MBs form the backbone of developing countries' economies as they comprise of a substantial part of people's livelihoods Ferranti & Ody [2]. In most African countries, MBs are directly linked to the national economic development through self-employment and contribution to the Gross Domestic Production (GDP) from Ajmeru [3] Although MBs have a significant contribution to people economies, they are still considered as belonging to the informal sector; and this has an implication in their theoretical and practical inclusion in budgeting and economic strategies of most developing countries. One of the important areas in which the exclusion of MBs in the national budgets and strategies is evident is their involvement in the tax systems, which is either minimal or indirect in most developing countries.

The active tax systems are presumed to mobilize revenues from a wide tax base, in order to reinforce government legality, achieve fair sharing of costs, and catalyze national development. The main administrator of tax systems in many countries is the revenue authority of the country concerned form Fjeldstad and Heggstad [4] Revenue authorities have been assumed to be assisting in raising funds of meeting expenditure in social services through collecting taxes from multitude of taxpayers. Despite that the focus of most revenue authorities is on increasing tax base, the inclusion of MBs is likely to face many challenges.

Moreover, numerous studies have advocated for the usage of digital technology to enhance activities of informal practitioners, MBs inclusive see for example, Gomera [5], Kapinga [6], Mramba [7]. The mobile money service, mobile banking, mobile training, and digital marketing are examples of MBs' activi-

ties undertaken using digital technology. The use of digital technology in MBs has expanded from the level transaction to the level of connecting with other formal institutions Donner & Escobari [8] and Deen-Swarray [9]. Digital technology has also supported government, private, formal, and informal operations. The technological solution brought about by digital technology is its ability to generate and disseminating information to users at any time anywhere.

There are numerous studies on the importance of MBs in the economy Kibassa [10] and Engelschalk [11], the importance of a broad tax base to tax administration systems (Coleman & Evans [12], Kundt [13]) and the ability of digital technology to simplify operations among formal and informal practitioners from Lubua [14]. However, there is limited information on how Tanzania Revenue Authority (TRA) can effectively benefit from digital technology and include players such as MBs in tax system. This study therefore explores the potential of the use of digital technology by TRA in enhancing tax administration to MBs. The study also explores the current practice of tax administration among Tanzanian MBs, the challenges facing the tax administration, and areas where digital technology can potentially be applied to address the challenges. The paper specifically presents the exploratory picture of tax administration challenges thereon and the potential technological solution to facilitate tax administration to micro businesses. The study is based on the aspect of establishing digital technology solution to tackle challenges facing direct tax administration of MBs. In addressing the goal of this study, three specific research questions were posed.

RQ1: What are the current tax administration practices of TRA to MBs?

RQ2: What are the challenges impede TRA in the administration of taxes to MBs?

RQ3: What are the potentials technological solutions to tax administration challenges that suit the MBs operations?

2. Literature review

2.1. Informal operations within Micro businesses (MBs)

Informal business employs majority of the populations in many developing countries. This is despite the fact that the main characteristics of such businesses are fully or partially outside of the government regulation, taxation, and is given less attention by different authorities Ahmad [15] and Ajmeru [3]. However, informal businesses accounts for big proportion of the gross national products (GNP) in sub-Saharan Africa from Elly [16]. In developing countries informal employment is more common than formal employment from Coleman and Evans [12]. Tanzania was found to be one of Africa's largest informal economies engaging 57.9% of the working age from Fjeldstad and Heggstad [4]. One of the common practices of informal business is Micro Business activities.

Micro Businesses (MBs) consist of firms with zero to ten employees that mainly belong to poverty driven sector with lack of resources and poor business record from Gomera [5]. Tanzanian MBs are very small businesses that are located in densely populated areas with permanent but simple structures of buildings. MBs have significant impact in the economic system through self-employment in sectors such as food processing, clothes, electronic, agricultural products, manufacturing, and academia just to name but a few from Gomera and Mikko [17].

Most of the micro businesses have a dominant owner-manager working alone or being assisted by at least one family member from Gomera [18]. MBs exist all over the world but they are more prevalent in developing countries including Tanzania. MBs as for other practitioners in the informal sector are the foundation of most economies that produce legal commodities and services but are not registered and do not comply with government regulations. Since MBs are informal in nature, local administrative authorities, revenue authorities, and other

institutions cannot have accurate statistics of the presence of MBs in their localities. Majority of Tanzanian MBs are located in urban areas with high population pressure. For example, almost 14.7% of MBs are located in Dar Es Salaam from Satta [19]

Tanzanian MBs have been left behind in the tax system for a long time now despite their fast growth since 2010s Diao [10]. Exclusion of MBs in the tax system is attributed to the following: tax generates significant cost to the firm or business, and lack of record keeping Dube & Casale [20]. Almost 72.1% of Tanzanian MBs do not keep proper records for tax assessment from Maskaeva [21]. This makes MBs non-supportive to tax compliance and revenue collections. In addition, MBs lack awareness on how to compare presumptive taxes with formal sector taxes. This makes MBs harbor misguided assumption that they are being charged unfairly. Such perceptions make MBs have low morale and non-compliant with tax payments form Dube and Casale [20].

2.2. Taxing MBs in Tanzania

Tax authorities are important pillars for the collection of national revenue through taxation. Tax is the amount of money collected from the income generated or value added by citizen from employment, or a business undertaken Mahangila [14]. The need of taxing MBs catalyzed by deficit in the national budget form Dube & Casale [20]. For example, in 2015, the average tax collection in Tanzania was below 12%, which was presumed to be lower compared to the average tax collection in other countries in East Africa from Mahangila [14]. In addition, Tanzania has a narrow tax base whereby domestic revenue to GDP is about 15% compared to the national average of the other countries in Sub-Saharan Africa, which is 17% from Maskaeva [21] Moreover, Tanzania's Tax revenue is not enough in meeting the government expenditure, as the average collection was TZS 12.6 trillion against TZS 33.1 trillion-budgeted expenditure for the year 2019. Due to budget deficit of TZS 20.5 trillion, the Tanzanian practitioners

and researchers are called on to think of different ways of increasing revenue.

The TRA introduced presumptive tax to focus on individuals who cannot keep records and are not qualified for Value Added Tax (VAT) registration from Haji [22]. Tax presumptive is considered as the best option of administering tax to individuals earning less than TZS 20 million per year Haji [22] In TRA, presumptive tax is administered by the Department of Domestic Revenue. Presumptive taxes are simplified regimes that are levied on the presumed, rather than on the actual income of formal or informal enterprises Ogembo [23], Mintz & Chen [24]. This is designed basing on sales turnover, rent payable by a client, and business premises. MBs are required to submit business location, rental deeds, and business ID for tax presumption. The question as to whether the client is taxed appropriately has no clear answer because tax assessment depends only on the available often-incomplete information.

Apart from presumptive tax, MBs are required to make other contributions such as environmental cleaning levy, business registration fees, agent fee, and car parking fees, and market fees for those operating in the market areas. Fees are collected by municipal and submitted to the government by the responsible authority. Moreover, in 2018, MBs in Tanzania including street hawkers were required to be registered and be issued with identification cards. However, the process needs practitioners and researchers' support from Meinzer [25] to achieve tangible results.

In Tanzania, IT has also improved compliance among taxpayers, which in turn, has boosted revenue collections. Currently, TRA uses a number of electronic tax administration systems which include systems with the most Integrated Tax Administration System (ITAX), Taxpayer Identification System (TIN), Computerized Motor Vehicle Registration System (CMVRS), Customs Administration System (ASYCUDA++) and Computerized Drivers' License System (CDLS). All these have reduced

the pressure of manual operations. Variable Tax assessment brackets are automated online, and a customer can fill in the required information and print it out for tax payment from Maskaeva [21].

In addition, the TRA recently introduced Block Tax Management System (BMS) with the aim of bringing more tax payers in the tax system. The set-up of BMS consists of areas of trading concentration that are mapped up in small segments. These segments are based on geographical, administrative set-up or a combination of streets to form a block. However, the informal sector is still not scheduled to adopt this system since business registration of informal practitioners is low. The system has also been proved to be one sided in usage as it helps tax authority only to trace taxpayer.

2.3. Challenges facing Tax Administration to MBs

Micro Business are still not fully included in the TRA tax targets net, this is attributed to a number of challenges that prevent the accommodation of these firms into the tax system. These challenges include most tax regulations do not accommodate MBs, lack of accuracy MBs' information, and lack of proper records from MBs from Elly [16] and Haji [22].

A study by Fjeldstad and Heggstad [4] revealed that local government taxation is faced with a challenge that limits the inclusion of MBs to TRA tax net. Multiple, unstructured, and excessive levies such as taxes, fines, or fees cause a huge burden to MBs. These levies were found to be charged astronomically irrespectively of the size, type, and level of earning of a particular business making it difficult for MBs to graduate to the next level of their growth. Moreover, Coleman and Evans [12] found that most MBs were not satisfied with tax practices of local authorities. Most MBs commented that tax procedures are not well organized, and this affect the amount taxable from an individual MBs. Poor tax administration was cited as a discouraging factor for many to pay taxes. Sometimes there is overestimation of

taxes that end up demoralizing taxpayers Freedman & Crawford [19].

Moreover, Nakiwala [26] revealed that despite that, tax administration to MBs is an important, TRA tax practices presume to be uneconomic. The presumption of uneconomical tax administration to MBs based on the facts like it requires high cost of monitoring, controlling, and collecting. In addition, geographical diversity of MBs causes constraints to tax administrators. It also evident that, the costs incurred in tax administration of informal practitioners in most cases outweighs the revenues generated Haji [22]. A study by Elly [16], found that it was difficult for the tax authority to administer tax from informal operations such as MBs.

Furthermore, lack of information from MBs to tax authorities has been identified as another impediment to include MBs in the tax net. The study by Slemrod and Yitzhaki [27] conducted in Ghana found that information offered by MBs was not sufficient to support revenue authority in tax administration. For example, MBs lack record keeping skills and thus depended on personal memory of their daily operations from Gomera [5]. MBs operations are informal and have very limited ability to generate information, which therefore affects the link between revenue authorities and MBs.

Another challenge is the complication of tax regulations or elimination of MBs in tax regulations. The complexity of tax laws frightens MBs in the aspect of tax compliance burden, which is presumed to follow suit after being registered by Coleman & Evans [12]. Many studies have proposed the need of strengthening the tax base by accommodating MSMEs in the TRA's tax net, as this might lead to rationalizing turnover of tax regime. The initiative may also help in pulling practitioners of the informal and semi-informal sectors into formal and hence expanding TRA tax base from Elly [16].

As for the MBs, their inclusion in the tax net may help them transform from informal to the formal sector. This transformation is envisaged to be

advantageous to MBs in terms of accessing credit, accessing formal and export markets, involvement in government procurement, and enjoying attractive business opportunities available in Government's Nakiwala [26]. Studies undertaken realised that the MBs are not included in the TRA tax net, due to most tax regulations do not accommodate MBs, lack of accuracy MBs' information, and lack of proper records from MBs (Elly [16], Haji [22], Fjeldstad & Heggstad [4], Freedman & Crawford [19]). In addition, TRA presume tax administration to MBs to be uneconomic due to high cost of monitoring, controlling, and collecting Haji [22], Freedman & Crawford [19], Ahmad et al. [15]. This attracted the following study to focus more on exploring the potentials of technology to enhance the inclusion on MBs in TRA's tax net.

With this regard, the conceptual framework focused on aspects that made connecting the three research questions addressed in this study was inevitable. The aspects considered in this study are the current tax administration practices to MBs, challenges impede TRA in administering tax to MBs and potentials technological solutions for tax administration to MBs. The conceptual framework depicted in Fig. 1 was developed from the literature review that focused on tax practices to informal sectors, challenges of tax administration to informal sector and potential of digital technology in administrating tax to informal sector.

The MBs are required to pay taxes because they generate income from their daily undertakings. However, the current tax administration to MBs as for other small businesses in Tanzania is not curtained and lack structured framework. The study by Haji [22] observes that MBs faces multitudes of levy, which are charged by different authorities. This high tax burden creates difficulties of administering tax to informal practitioners, including MBs by Haji [22].

Tax burden minimizes the exact portion of total personal/business income as large portion is charged by the government. The multiple taxes, fines, various payments leave the MBs with less expendable capital to business owners.

In Tanzania, the digital technology has stipulated to be a potential asset to both TRA and business community by improving tax compliance and reduce administration and compliance costs from Dube [28] and Lubua [29]. Despite the adoption of technology, in several aspects, it was noticed that still a good number MBs were left out of the tax net. This motivated the current study into exploring
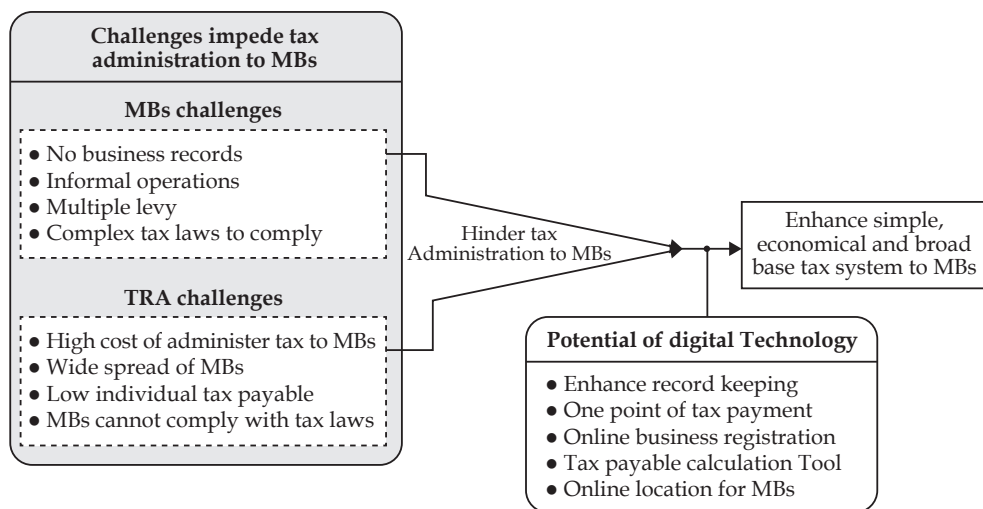

Fig. 1. **Conceptual framework of the study**

the possibility of using mobile technology to include MBs in the country's tax net and adoption of GPS and GIS/Remote sensing in the informal business locations as additional remake to technology aspect.

3. Research design

The study adopted a mixed method research design by Creswell [30] in exploring the status of TRA in tax administration to MBs. The specific type of mixed method used is convergent parallel mixed method from Creswell [30] whereby data analysis was done simultaneously. The usage of convergent parallel mixed method was based on the fact that both qualitative and quantitative approaches provided information from participants and generated the results that answer the research questions. Under mixed approach, two types of data collection namely qualitative and quantitative were obtained through questionnaire and interview Kothari [31].

3.1. Data collection methods

The data collection tools included a series of questions about tax, TRA, and MB, which are derived from the theories outlined in section 2. Data collection tools were questionnaire for quantitative and interview guide for qualitative. These tools were used to collect both qualitative and quantitative data in a parallel approach (at the same time) using the same variables. Variables used in data collection were tax administration, challenges impeding tax administration to MBs, and the potentials of digital technology to tax administration as depicted in Fig. 1 in section two of this article. Qualitative data was collected through semi-structured interviews. This was conducted in Dar Es Salaam City, which is the head office of TRA and the economic hub of Tanzania. 24 TRA officers were interviewed, and 137 Micro Business candidates s were provided with questionnaire to collect quantitative data. The informants from TRA were obtained based on friendship, professional collegiate and willingness to provide their personal views and experience on the practical experience of tax administration towards MBs. The MBs participants were purposefully chosen based on (1) the kind of business and (2) willingness to participate in the study. Therefore, all together 161 participants from Dar Es Salaam City from various business sectors participated in the study. Because the study is of explorative nature that required more detailed and overview information from practitioners, the sample size considered satisfactory from Bryman [5].

The interview questions focused on tax administration, challenges facing tax administration to MBs and the potential of technological solution to the identified challenges. These themes were built based on the research questions, practical aspects of tax administration, and tax theories. The interviews were designed as natural dialogues around the identified themes. The interviews lasted for 15 to 25 minutes. The researcher made extensive notes on the discussions based on the prior prepared form in each theme. The TRA interviews were conducted in English while MBs interviews were conducted in Kiswahili.

After the interview, the specific aspects in each theme were further grouped in different aspects. Researchers designed the quantitative data collection tools from the aspects obtained from qualitative information. The questionnaires were divided into three themes with a number of statements most of which were identified in the prior conducted interview.

3.2. Analysis

Both quantitative and qualitative data were analyzed side-by-side approach form Creswell [30]. Whereas quantitative information was analyzed by themes and compared with qualitative information. This means the data from quantitative and qualitative approaches were analyzed separately, and then the results from each method were compared. Under the qualitative approach, content analysis from Bryman [32] was used.

The content analysis involved coding process. The coding approach involve grouping of collected data into three

themes. The themes were current tax practices to MBs, challenges hindering tax administration to MBs, and potential technology for tax administration to MBs. After having three groups of data, used to derive meanings, the relevant information of presented data was generated. For the quantitative data, descriptive statistics was used to analyse quantitative data through SPPS. In qualitative approach, content data were broken down into small groups, which were categorized into three main themes of this study. The themes were designed to establish tax administration to small business owners, the challenges of tax administration, and the potential areas where mobile technology could be used to tackle the challenges.

4. Results

This section presents the findings on the general information of the study participants, practical aspects of tax ad-ministration to MBs, challenges thereon, and the potential of digital technology in enhancing tax administration to MBs.

4.1. General information

The primary participants of the study were 86 Micro Business owners in Dar Es Salaam City. With the expansion of scale, the total number of 137 Micro Business owners filled out and returned the questionnaire. Table 1 shows information on gender, age, education level, the kind of business and business location of MB owners participated in the study. Secondary participants in the study were 24 TRA officers who participated through the interview format. They provided their personal views on the practical experience of tax administration towards MBs. Therefore, all together 161 participants (MB**s** owners and TRA officers) in Dar Es Salaam City from various business sectors provided information for this study as presented in Table 1.

Table 1

General information of MBs participated in the study

Categories of respondents' information		Frequency	Percent	Cumulative Percent
Gender	Female	59	43.1	43.1
	Male	78	56.9	100.0
	Total	**137**	**100.0**	
Age of MBs	18–30	48	35.0	35.0
	31–45	70	51.1	86.1
	46–60	19	13.9	100.0
	Total	**137**	**100.0**	
MBs Education level	Primary education	54	39.4	39.4
	Secondary Education	61	44.5	83.9
	Diploma Level	15	10.9	94.9
	Bachelor	7	5.1	100.0
	Total	**137**	**100.0**	
Type of MBs Business	Food Venders	18	13.1	13.1
	Garments	16	11.7	24.8
	Fruits Venders	17	12.4	37.2
	Cosmetics	23	16.8	54.0
	Mobile money Services	22	16.1	70.1
	Electrical utilities	28	20.4	90.5
	Hardware	7	5.1	95.6
	Mixed business	6	4.4	100.0
	Total	**137**	**100.0**	
MBs business location	Local Markets	21	15.3	15.3
	Bus stop areas	55	40.1	55.5
	Road junctions	52	38.0	93.4
	Other areas	9	6.6	100.0
	Total	**137**	**100.0**	

4.2. Activities performed in Tax Administration to MBs

Through the interviews with TRA officers, we revealed that the current practices of tax administration to MBs are weak and in near to nonexistence. The respondents confirmed that local authorities conduct most of the tax practices from MBs. However, in some cases TRA apply presumptive tax system to MBs. Regarding current tax administration practices to MBs, the interviewees revealed a number of issues. We are currently having weak direct communication with MBs concerning tax payment, since very few MBs are paying taxes to TRA. Moreover, we have found that MBs are paying multiple taxes, levy, and fines to different authorities like local authorities, market authorities, and cleaning agents. This gives them a negative perception towards taxation due to high levy burden. Most MBs are willing to pay tax, however the payment system for MBs is complex and costly that does neither motivate tax authority nor taxpayers.

The TRA confirmed the existence of presumptive tax departments, which mostly deal with MBs, however the departments seem to fail reach most of MBs through tax campaign and training. Moreover, there is no full record for this group of taxpayers, therefore there is a failure to recognize their direct contribution to nation income and public revenue generation. The department has no continuous measure and system to meet the taxpayers, also most of MBs have specifically decided to remain at the bracket of presumptive tax and assume not to grow and graduate to another level. Participants revealed that TRA have no direct contact to MBs for either training or tax collection. Some TRA officers confirmed to provide training through radio, television and visiting some of MBs. "We are not providing active and continuous training to all kind of MBs; rather selecting few for training and follow-up. They added that selection of MBs to training depend on their nature and business environment.

In addition, from the interviews it was revealed that, the business registration process is considered very complex resulting to having too few MBs willing to register their business. Moreover, the Government (TRA) was found to be aware of the working environment and the type of MBs' businesses although not to a large extent. Therefore, confirming that tax administration to MBs is not active.

On top of qualitative information, the quantitative data of this study revealed that, MBs have no proper system for direct tax payment and have unrecognized businesses, which are surrounded by business uncertainties. Additionally, it was established that MBs face multiple tax liabilities from different authorities. However, MBs are willing to contribute to the national development. In order, to eliminate multiple taxes to MBs, participants advised that TRA should be the only authority of collecting and administering levy or tax to all taxpayers. Moreover, participants insisted that there should be a mechanism of introducing active tax system to informal practitioners in the country.

The quantitative findings, as summarized in Table 2, present the information of the current tax administration as ranked by MBs. These resulted from the Likert scale questionnaire contain number of statements as depicted in the Table 2 below with their relative values.

From the data depicted in Table 2, observations were made that there were some items confirmed to have low mean value and high value of standard deviation. TRA do not provide training to MBs (mean 2.77, std 1.742). MBs registered their business with local authorities (mean 2.88std, 1.620). MBs have no proper system for direct tax payment (mean 3.05, std 1.716). The low mean and the high standard deviation were confirmed to be affected by the business type as presented in the original individual respondents. This confirmed the claim made by TRA officers that nature of the business of those MBs can affect simplicity of administrating tax. It was also observed that food venders, fruit venders and garment MBs are not tax friendly when compared to cosmetics, electricity supplier, hardware and mobile money services.

Aspects of current practices of tax administration to MBs

S/N	Aspects reveal current Tax Administration to MBs	Minimum	Maximum	Mean	Std. Deviation
1	TRA do not provide training to MBs	1	5	2.77	1.742
2	MBs registered their business with local authorities	1	5	2.88	1.620
3	MBs have proper communication with authorities at business places	1	5	3.94	0.811
4	MBs' business types and locations are recognized by the Government	1	5	4.17	0.871
5	MBs have no proper system for direct tax payment	1	5	3.05	1.716
6	There is poor relationship between TRA and MBs	3	5	4.8	0.541
7	MBs face multiple tax payment to different authorities	1	5	4.47	0.718
8	MBs prefer TRA as only tax authority	1	5	4.26	0.970
9	Informal operation of MBs lead to exclusion from direct involvement of national development	1	5	4.28	0.897
10	MBs are willing to contribute in national development	2	5	4.46	0.630
11	MBs advised to have active tax system	3	5	4.35	0.671

4.3. Challenges

The study found that TRA does not charge tax to MBs directly due to difficulties associated with administering tax to small taxpayers. The data collected revealed that there are challenges regarding complex tax laws and regulations above the level of understanding of MBs and thus hindering compliance. In addition, TRA confirmed that most of the MBs are operating informally without any business records or business registration. Moreover, there is lack of proper tax administration mechanism to MBs whereas there is no single authority, which is liable to collect levy from MBs, this discourages MBs from complying with tax payment procedures. Another identified challenge is lack of information flow from authorities to MBs.

Additionally, the respondents revealed that currently TRA does not use technology in tax administration to MBs. This is due to lack of updated skills among their staff on technology and absence of software that can effectively connect MBs and TRA. It revealed that the incapability

of designing and operating the software application for taxing different groups of taxpayers may affect the tax administration initiative to MBs. Some interview respondents revealed that "We have not the technological incubation for software and system development. This may affect technological capacity of the institution. Additionally, TRA to involve MBs in the form of presumptive tax because these firms have poor information system, have no permanent address, leading to high tax administration costs.

Besides, the quantitative data revealed that there are challenges that hinder tax administration to MBs. These are affecting both sides MBs and TRA. The statements in the Likert scale questionnaire were analysed to retrieve quantitative information derived from descriptive statistics as presented in Table 3. Specifically, the MBs owners felt that there was no proper tax bracket, which relate to the income level of MBs (mean 4.04, std 0.969). Moreover, MBs were not aware of revenue collection channels (mean 4.50, std 0.708). Additionally, the, presence of multiple taxes dis-

couraged MBs from paying taxes (mean 4.50, std 0.620)

The factors hindering tax administration include wide spread of MBs, informal operations of MBs, and poor understanding of tax procedures. In addition, MBs owners indicated that, MBs fail to pay proper taxes due to lack of record keeping (mean 4.26, std 0.825). Others include MBs lacking knowledge on record keeping (mean 4.45, std 0.727). MBs lacking knowledge on Tax payment procedures under TRA (mean 3.23, std 1.693)

The MB owners were not able to access business services from local authorities due to informal operating (mean 3.21, std 1.738) and sometimes lack of specific locations for MBs business operations (mean 3.15, std 1.643). Additionally, MBs operate in difficult environments (4.56, std 0.513) and their businesses were found not to continue for the foreseeable future (to lack going concern aspect) (mean 3.09, std 1.680). The findings show that, there are challenges in taxing this informal sector, ranging from underreporting of taxable income, lack of authority and mechanisms of monitoring activities of the informal sector, and businesses in the informal sector are not registered and do not abide by taxation ethics.

The findings of this study have identified a number of challenges impeding the inclusion of MBs into direct tax systems. These challenges include lack of proper recording for MBs, high cost of tax administration, lack of official records concerning MBs, wide dispersion of MBs and their informal nature of operations.

However, from the data depicted in Table 3, it was confirmed that there were some responses with low mean value and high standard deviation. The responses like; MBs have no knowledge on Tax payment procedures under TRA (mean 3.23, std 1.693), MBs fail to access the services from authorities due to informal operation (mean 3.21, std 1.738), No specific locations for MBs business operations (mean 3.15, std 1.643), and MBs businesses are not concerned (mean 3.09, std 1.680), found to differ among respondents.

The low mean and the high standard deviation were confirmed to be affected by the business type as presented in the original individual respondents capture. This confirms that, there challenges affecting all MBs regardless of type and nature of the business. However, the impact of some challenges depends on the nature and type of business. Table 3 above shows that food venders, fruit

Table 3

Quantitative findings on challenges affecting tax administration to MBs

S/N	Aspects reveal challenges affect tax administration to MBs	Minimum	Maximum	Mean	Std. Deviation
1	No proper tax bracket relate to level of MBs income	1	5	4.04	0.969
2	MBs fail to pay proper tax due to lack record keeping	1	5	4.26	0.825
3	MBs have no knowledge on Tax payment procedures under TRA	1	5	3.23	1.693
4	MBs fail to access of services from authorities due to informal operation	1	5	3.21	1.738
5	MBs are not sure of revenue collection channels	1	6	4.50	0.708
6	No specific locations for MBs business operations	1	5	3.15	1.643
7	MBs are operating in difficult environment	3	5	4.56	0.513
8	MBs have no knowledge on record keeping	1	5	4.45	0.727
9	Multiple taxes demotivate MBs to pay tax	1	5	4.50	0.620
10	MBs businesses are not going concern	1	6	3.09	1.680

venders and garments revealed to be more affected by; knowledge on Tax payment procedures, lack of access of services from authorities lack specific locations for MBs business operations lack of business continuity (businesses are not going concern) when compared to cosmetics, electricity supplier, hardware and mobile money services.

Moreover, the quantitative data of this study revealed that, some of the identified challenges impede tax administration to MBs correlate with poor TRA relationship mechanisms to MBs. The data revealed the significant relationship between absence of tax bracket, lack of record keeping, lack of knowledge on tax payment procedures, unknown tax collection channels, and multiple taxes on one side with poor TRA relationship mechanisms to MBs on the other side. The correlation of the challenges impedes tax administration to MBs with poor relationship between TRA and MBs were established based on critical criteria presented in Table 4.

4.4. Potentiality of Technology

Based on the challenges aforementioned in section 4.3 above, researchers confirmed the potential solutions of addressing them. These potential solutions include the use of good number of mobile phones. However, the widely cited

solution to most of the practical challenges is the application of mobile technology. Participants revealed that despite that the current tax administration practices are faced by the various identified challenges. However, almost all MBs had mobile phones that can facilitate their operation and enhance direct involvement in the national development.

The usage of digital technology was proposed as a way of enhancing tax administration process. Digital technology was mentioned in an interview as a potential area for tackling tax administration challenges among MBs. From the findings, the study participants also revealed the available potentials on the usage of digital technology in carrying out different activities in responding to tax challenges. This paves the way of enhancing the usage of mobile tax administration for MBs.

Additionally, the respondents advised that TRA have to set strategic training plans to equip employees with the use and ability of designing technological solution to address the challenges. This might include in house training and short courses, which staff can attend to upgrade their skills as per the emerging technologies. Respondents advised that TAX institute, practitioners and other higher leaning institutions in the country

Table 4

Correlation between challenges affecting tax administration and poor tax administration MBs

Challenges Impede Tax Administration to MBs	Poor relationship between TRA and MBs	
	N = 137	
	Pearson Correlation	Sig. (2-tailed)
Absence of proper tax bracket relate to level of MBs income	0.725	0.008
Lack of tax record keeping to MBs	0.564	0.015
Lack of knowledge on Tax payment procedures for MBs	0.852	0.007
MBs fail to access services from authorities due to informal operation	0.005	0.955
MBs are not sure of revenue collection channels	0.671	0.012
No specific locations for MBs business operations	0.115	0.179
MBs are operating in difficult environment	0.027	0.755
MBs have no knowledge on record keeping	0.017	0.846
Multiple taxes demotivate MBs to pay tax	0.733	0.009
MBs businesses are not going concern	0.021	0.812

could also be part of building specific software and skills for TRA in adopting current technology for practical challenges facing tax administration.

Moreover, from quantitative data, MBs proposed the usage of digital technology for business registration (mean 4.41, std 0.692). With reference to the mobile money service, the mobile phone was recommended to be used to make direct digital payment by MBs to TRA (mean 4.57, std 0.566). In addition, participants proposed the usage of mobile record keeping system that may help them to generate information for tax purposes (mean 4.50, std 0.698). Basing on tax administration, participants re-commended that local authorities should deal with creating conducive business environment only leaving the collection of tax levy to TRA (mean 4.36, std 0.674). Moreover, they recommended that digital technology system and mobile training application services should be used to enhance tax compliance (mean 4.50, std 0.708) and having a training application to MBs (mean 4.50, std 0.698). However, having a user friendly and simple mobile tax application was among the concerns of the study participants (mean 4.49, std 0.687). The technological potentials on tax administration to MBs as presented in Table 5 indicate that TRA has opportunity of using technology to increase the tab base.

5. Discussion

From our findings, the explorative mechanism of enhancing tax administration to MBs through digital technology can be held under three themes: the current practical aspect of tax administration to MBs, challenges thereon and the potential of digital solution to the existing challenges. Therefore, this section provides answers to the research questions that contributed to the achievement of the study objectives.

Research question RQ1 asked: "What are the current tax administration practices performed by TRA to MBs?" The results revealed a number of aspects in tax administration to MBs. Several important points were revealed. Our findings revealed that the current tax practices to MBs are in the form of presumptive tax system. As identified by Ahmad [15] the presumptive tax resulted from the application of indirect methods due to number of reasons. These include simplification in terms of the taxpayers' compliance burden and tax collectors' administrative burden. The burden is through the requirements of indicators of accurately presuming the actual income of the taxpayer in order to combat tax evasion, high demand of encouraging taxpayers to keep proper records and accounts. However, through findings, we revealed that not all MBs are included in

Table 5

Quantitative findings on technological potentials on tax administration to MBs

S/N	Aspects reveal technological potentials on tax administration to MBs	Minimum	Maximum	Mean	Std. Deviation
1	MBs prefer using digital registration for business registration	1	5	4.41	0.692
2	MBs recommend presence of Direct Digital Payment system	3	5	4.57	0.566
3	MBs recommend local authorities to deal with creating conducive business environment only	3	5	4.36	0.674
4	MBs inspired to have mobile record keeping system	1	5	4.50	0.698
5	MBs inspired to have digital technology system for tax compliance	1	5	4.50	0.708
6	MBs prefer to use mobile training application	1	5	4.50	0.698
7	MBs prefer friendly and simple mobile tax application	2	5	4.49	0.687

the presumptive tax net of TRA therefore local authorities through levy and fines handle the rest.

The importance of local authority ensuring tax to MBs is due to fact that these businesses are a very significant group of income generation; however, they are expensive to administer when it comes to taxation. Therefore, local taxes and informal income collection were found to be more preferable than formal taxation collected by TRA because of the difficulty of administering a number of MBs into adhering to tax laws.

The finding revealed that MBs wishes that as the TRA has set up Large Taxpayer Offices (or units) to manage tax affairs of the large taxpayers due to its importance; then, there is a need of establishing unit to manage Micro Small and Medium Enterprise (MSMEs) due to its wide tax base. This would help different enterprises to graduate from informal to formal status and assume the brighter future of having a larger base of collecting revenue from the country as recommended by Fjeldstad & Heggstad [4].

The study confirms that, MBs are willing to be incorporated into the tax net which has the potential of enlarging tax base, increasing tax revenue, and creating a responsible society leading to sustainable source of national tax revenue. This concurs with the study of Chatama [33] which revealed that taxing the informal sector increases tax revenue and reduces tax gap. Tax administration to MBs should focus on the minimal compliance requirements, simple and straightforward administration regulations to suit MBs skills, business environment incentives, and low interactive procedures with tax authorities. The digital technology should be considered to minimize administrative costs of dealing with MBs. Thus, administrative techniques should focus on connecting the compliance aspect with the benefits of being formal.

This particular study's findings confirmed that inclusion of MBs in the tax net is a very complicated move. However, TRA have to accept that most of the citizens are of MBs nature. Thus,

they have to devise a suitable mechanism of implementing simple, administer-able, and effective tax system to MBs. Moreover, as the type and nature of MB businesses confirmed to affect some administrative aspect (refer table 3 in section 4 of this paper), the specific actions should be taken to make sure that most of these businesses are efficiently included in tax net.

The formal inclusion of MBs to tax administration should be taken care in such a way that will results in effectiveness and efficiency. The first aspect being the cost of administering small taxpayers should not outweigh the revenues raised. However, the importance of considering long benefit of tax administration to MBs is inevitable. These benefits may include long-term revenue increase from wider tax base, growth potential of MBs (effects of formalization), responsible society and economy implications (fiscal social contract).

Research question RQ2: "What are the challenges impede TRA in the administration of taxes to MBs?" The results revealed a number of important factors that affect tax administration to MBs. These challenges are categorized under different themes namely, Informal operations of MBs, which were found to be, the most significant challenge for TRA tax administration.

Lack of assurance of Government policies concerning their practitioners and area of their investment was among them. Most of the respondents argued that the current government is the only regime that potential opportunities from MBs practices are being realized. However, they were not sure whether other polices in the future would be in favor of their operations. Additionally, many informal participants lacked basic knowledge on tax education as whole. They kept on relying on taboos believing that, paying taxes to the government is an option since it has does not benefit their business, rather it kills it.

The study also revealed that participants proposed that MBs should be included in the direct tax system. However, it was observed that direct tax system

requires the keeping of appropriate books and records leading to high compliance burden in the form of costs, skill, and the required capacity. Not all these are in favour of most of micro businesses as they lack the ability of practice them as confirmed by the findings of Engelschalk [11]. The TRA also advised to consider general and specific challenges towards inclusion of MBs into the tax net. This is due to large deviation of information that can be found from different MBs because of the differences in type and nature.

Additionally, the challenges of tax administration to MBs have the root causes on characteristics of MBs. These characteristics are in relation to tax administration impracticability. The Tanzanian MBs are characterised by non-registered for tax purposes, not keeping proper records hence impossible for accuracy tax ascertainment and have no room and knowledge for filing tax returns. This is a call to attention to TRA, academician, practitioners and software engineers to come together and to address this challenge.

However, due to the need of large tax base and importance of business growth in Tanzanian economy, the researcher calls the stakeholders to think beyond the practices of presumptive taxation to MBs. Especially given that the presumptive taxation 'involves the use of indirect means to ascertain tax liability. The presumption therefore replaces an entire tax base or at least a large portion of the base'. In other words, where the revenue authority cannot ascertain a taxpayer's income, or cannot verify the accuracy thereof, presumptive regimes allow them to presume the amount of income based on alternative observable indicators, i.e., an alternative base determined by the revenue authority. This may attract the need for MBs not to grow hence remain stagnant and reduce the tax base.

The findings revealed that the challenges like absence of tax bracket, lack of record keeping, lack of knowledge on tax payment procedures, unknown tax collection channels, and multiple taxes can be tackled through establishment of the strong relationship mechanisms between TRA and MBs. The existence of significant correlation between the aforementioned challenges and poor relationship between TRA and MBs confirm that the revenue authority can tackle the tax challenges to MBs through strengthening the relationship mechanisms.

Research question RQ3: "What are the potentials technological solution to tax administration challenges that suit the MBs operations?" The study confirmed that the inclusion of micro business in direct tax net is considered to be in line with a simple application that can tackle the challenges to tax administration. The aforementioned challenges can be tackled.

Moreover, this study confirmed that, the application of mobile tax administration to micro businesses is based on tax principles of fairness, efficiency, administrative capacity, and simplicity, just to mention a few. Basing on the simplification of the tax structure with regards to administrative and compliance costs, the study confirmed that with mobile technology, the MBs registration, record keeping, and inbuilt tax computation within the tool can enhance administrative capacity. The administrative issues include registration, payment, information access, assessment, audit, litigation and the appeal system, sanctions, and penalties.

The initial cost of establishing digital system for tax administration to MBs may be regarded as high but, once the system is in full operation, the cost of future administrative activities would be reduced significantly. As the system, focus on managing large numbers of MBs it may also reduce the number of administrators and hence, reducing the costs such as transportation and other operating expenses. Additionally, this also can assist MBs in record keeping not only for tax purposes but also for other business transactions.

This study, among other things, confirmed that through taxing the MBs, TRA has the opportunity of transforming their informal operations into formal economy. The inclusion of MBs in direct tax net may

result into initiating formalization operations in their informal undertakings. Through technology, transformation is simplified, making it easier to master tax process, and motivating MBs into joining the tax net. Despite the aforementioned challenges, the simplicity approach may be useful to other many informal practitioners as well.

Innovation in tax system is necessary in making tax administration to MBs possible as can support massive sharing of information at low cost Dube [20] and James [34]. Apart from a change of perceptions of both authority and taxpayers, the technological movement is important. The digital technology should focus on outreach, and integration that create trust between MBs and TRA. The effective application of digital taxation, among other things, is presumed to enhance TRA outreach to micro business, creates transparency and a two-way communication in case of payable tax and tax incentives.

As it argued that a good tax system should be simple for a taxpayer to comply from Tanzi [35], then it is recommended that TRA should think of a mobile application, which would have a very simple user interface that can calculate tax and determine taxable amount. The study established that high economic and developmental expectations are often loaded with information generation by keeping and sharing it. Through technologies, the developing countries can outperform and reach their citizens at all levels of development. The study confirmed that the mobile technology could be one of the potential areas to invest in in the transformation of informal to formal practitioners. This finding is consistent with various initiatives which have been in Tanzania on mobile technologies for small-scale practitioners such as farmers from Misaki [36], street vendors Mramba [37], MBs finance Gomera & Oreku [1], and women entrepreneurs Kapinga [6]. This opens up the way for different authorities in seeing the potentials of using technology-based innovations to formalize the informal practitioners and enable them

benefit from the initiative. Moreover, other technological projects in healthcare, agriculture, education, governance, and business have shown great potential and the importance of inclusion in development through technology. Based on the results of this study, the following technological solutions are suggested:

• Technological base that can enhance the relationship between TRA and MBs.

• Record keeping technologies for improved business performance indicators.

• Technologies that help in MBs registration and maintenance of database for their operations and geographical areas of operations (Business registration and monitoring technologies).

Technological base that can enhance the relationship between TRA and MBs.

Technologies for enhancing the relationship between TRA and MBs might have high importance for tax administration. The current mechanisms of physical tax administration have been identified in this study as weak and inappropriate. Therefore, through proper means of communication, record keeping, training on tax payment procedures, online channel of tax collection, and single authority for tax to MBs may improve the practices of revenue collection to MBs. This area of technology can lead to reliable information channels that could be used to check certain taxable amounts to be levied to an individual MB owner. In addition, the study suggests that there is a need of applying mobile technology in providing training to MBs to enable them to comply with taxation practices.

Moreover, the enabling factors for mobile technology usage to MBs have being revealed in various studies from Azom & Muying [38], Baguma [39] and Gomera [18]. Where, it was noticed that despite the MBs' low capital, most of them own smart mobile devices and are using them for business operation. This gives the opportunity to research community, practitioners, police makers and authorities to invest on formalize operations of different informal sectors. Record keeping technologies for improved business performance indicators.

From the findings, the study confirmed that both TRA and MBs would benefit from proper record keeping. The current modes of record keeping have several limitations, which include unsystematic record keeping, unclear record, and insufficient information for tax calculations, it has been shown that poor record keeping affect business performance, as nothing can be properly indicated to measure performance of MBs. The study confirms the need of record keeping as identified in the study of Gomera [5]. The usage of record keeping technology might be offered in different forms of application such as marketing, bookkeeping, or tax-based application.

Technologies for MBs registration and database for MBs operations and geographical areas of operations (business registration and monitoring technologies), the findings confirmed that, technological solution might be developed to help automate business registration process. The study results imply that when MBs make application for business license, they will have to do full registration online using an application whereby the same information will be connected to TRA and to the local authorities. This might provide a viable solution for MBs statistics and appropriate amount can be collected from them throughout the financial year. The registration will also locate the kind of business and business area, which might be formalized.

6. Conclusion

The importance of MBs in the generation of national income to developing countries cannot be undermined. The Tanzanian tax administration authority is advised to take a serious consideration of the widening tax base for its potential in the national development. However, as the tax administration theory indicates that using low costs in administering tax, the technological would provide a potential solution for the initiative.

The study appeals that exempting the MBs from tax laws and regulation do not give them room to grow instead it creates irresponsible society. The challenge of tax administration cost must be addressed effectively through digital technology whereby, tax laws and regulations, can be an inbuilt aspect.

Although, the study confirmed the presence of challenges in taxing MBs, including them in the tax net is paramount. This would include providing them with special places for business and enabling them to make online registration basing on areas of their business. In this regard, TRA is advised to consider MBs as the tax hub that may stimulate and improve both revenue collection and build a responsible society in the country.

Themes of the study are broad and can be considered as explorative in nature. Therefore, every identified issue such as tax administration of low-income earners, challenges, or potential technological solution call for in depth research in the area. The future research may be directed on action research or design research in order to find out practical solution to the identified practical challenges. This may involve designing, developing, and testing technological-based solutions for tax administration to low-income earners. Moreover, MBs is just a small part of the informal operations in Tanzania and other developing countries. As the players in the informal sector are crucial in the national development, the study recommends that future studies should consider other players in the informal operations.

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Political tax cycles: Cyclicality of the tax burden in election periods

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ABSTRACT

The article discusses changes in the tax burden in election and post-election years in countries with different levels of economic and political development. The study uses the data on 121 countries for the period between 1991 and 2019 to test two hypotheses: 1) in election years, governments tend to boost spending while in post-election years government expenditures decline, which determines a similar dynamic of the tax burden; 2) in election years the tax burden decreases and in post-election years it either increases or decreases at a slower rate than in election periods. Methodologically, the study relies on multi-factor regression analysis of panel data. As a result, the first hypothesis is confirmed for high-income countries where the governments increase their spending to ensure the incumbent's re-election and cut their expenditures after the election. In developed countries, in election years, the government's spending was 0.4% higher than in other periods. In developed countries, governments were motivated to raise rather than reduce the tax burden in order to compensate for their increased expenditures. No common pattern of declining tax burden in election periods was detected for all observed countries, for groups of countries by income level (high-income, middle- or low-income) or for groups of countries by political regime type (democratic and non-democratic – hybrid or authoritarian). However, the analysis of the annual data on taxes has shown that the decline in the tax burden can occur in countries with developing economic and political systems as was the case with Armenia, Russia and Ukraine in 1992–2019. In general, the findings demonstrate that the governments are more prone to using monetary and fiscal rather than tax instruments in election periods.

KEYWORDS

tax burden, tax policy, political business cycles, election, political economy

JEL H22, E32, O50, P16

Политические налоговые циклы: цикличность налоговой нагрузки в электоральные периоды

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АННОТАЦИЯ

Статья посвящена исследованию изменений налоговой нагрузки в электоральные периоды. Ее целью является подтверждение или опровержение существования политических налоговых циклов (то есть изменений налоговой нагрузки в годы выборов и после выборов) с выявлением специфики в группах стран

с разным уровнем экономического и политического развития. На примере 121 страны за период с 1991 по 2019 г. протестированы две гипотезы: 1) о росте бюджетных расходов в год выборов и их снижении в год после выборов, что служит стимулом для аналогичной динамики и налоговой нагрузки во избежание бюджетного дефицита; 2) о снижении налоговой нагрузки в электоральный год и ее повышении или снижении меньшим темпом в постэлекторальный год. С помощью многофакторного регрессионного анализа панельных данных была подтверждена первая гипотеза о наличии политического бюджетного цикла в группе стран с высоким уровнем экономического развития: власти этих стран в год выборов повышали бюджетные расходы, а в год после выборов снижали бюджетные расходы. В развитых странах рост бюджетных расходов в электоральный год был на 0,4% выше, чем в иные периоды. В развитых странах в электоральные годы у властей наблюдались стимулы повышения, а не снижение налоговой нагрузки для финансирования роста бюджетных расходов. Общего правила о снижении налоговой нагрузки в электоральные периоды выявлено не было как для всех рассматриваемых стран, так и для групп стран с высоким, невысоким (средним, низким) уровнями экономического развития, а также для групп стран с демократическими и недемократическими (гибридными, авторитарными) режимами. При этом отмечена возможность снижения налоговой нагрузки в рамках электоральных циклов в группах стран с развивающимися экономическими и политическими системами, что было подтверждено на годовых данных налоговой нагрузки в Армении, России и Украине за период с 1992 по 2019 г. В целом результаты демонстрируют предпочтения властей использовать преимущественно монетарные и бюджетные, а не налоговые инструменты в электоральные периоды.

КЛЮЧЕВЫЕ СЛОВА
Налоговая нагрузка, налоговая политика, политические циклы деловой активности, выборы, политическая экономия

1. Introduction

Elections are always a test for incumbent governments. To maximize their chances of successful re-election, policymakers want to appear competent in the eyes of the voters and employ a variety of instruments, including economic ones. After the election, this impulse recedes and the economic policy gets back to normal.

This article places a special accent on the observations in electoral and post-electoral years, because such observations are more likely to shed light on the phenomenon of political business cycles (PBCs). The latter are commonly understood as political processes shaping the economic policies of governments in electoral periods. Therefore, while focusing on this or that economic instrument, one should always remember that it plays a secondary role and keep an eye on the general political and economic context.

PBCs depend on the level of democratic development in a given country. In democratic countries, during election periods, economic instruments are mostly oriented towards winning the support of the electorate, and in non-democratic countries, towards the system of public administration. Thus, for democratic countries, there are significant differences between presidential and parliamentary elections. In presidential countries, government tends to employ economic instruments more actively when preparing for presidential elections than for parliamentary elections. In parliamentary republics, the situation is the opposite, and government focuses on parliamentary elections.

In non-democratic countries, governments are pursuing different goals, for example, they seek to maintain political stability, which is why, regardless of the type of political system, presidential and parliamentary elections are taken equally seriously. The research evidence indicates that elections are necessary for non-democratic countries to test their political systems, redistribute power within the

elites, collect information about the local problems [1], and test the loyalty of regional authorities [2; 3].

This research covers the countries with different political systems – presidential and parliamentary – and with different levels of democratic development (democratic and non-democratic countries with hybrid and authoritarian regimes).

PBCs are classified depending on the economic goals and instruments used in election periods. For example, the most general PBC is observed when governments are trying to manipulate macroeconomic indicators, such as economic growth, unemployment and the balance of payments [4]. For instance, governments may try to adjust the business cycle in order to stimulate economic growth and increase employment in the election year. Yet another example is the monetary cycle, which means that the government concentrates on inflation, the money supply, interest rate, volume of lending, and the exchange rate [5]. In this case, governments may lower the interest rate, increase lending by state-owned banks in order to raise wages in the state sector or use monetary instruments to curb inflation, and ensure exchange rate stability in the election year in order to boost real disposable income in the country.

The main focus of this study is made on political budget cycles, which means that fiscal instruments are used more actively than usual in election periods. This includes increased public spending, with some of the funds being targeted at specific voters' groups – people dependent on budget transfers (civil servants, students, pensioners, and the 'core electorate'). A political budget cycle may also be implemented in the form of tax cuts in election periods [6]. This aspect – the tax burden – will be considered further in more detail. The vision of a political tax cycle is the government using taxes more actively in the election year and less actively in the post-election period.

Specific characteristics of political tax cycles may be determined by the level of economic development in this or that country – its economic structure, the government's spending power, budget policy priorities and priorities of the economic policy in general, the level of the government's expertise, and the electoral effects of other economic instruments. There is a number of studies that demonstrates that the governments of high-income countries tend to rely on fiscal instruments more [6] while those of developing countries sometimes give preference to tax tools [7–9]. The study of former European communist countries has shown that after they entered the EU, their governments started actively using fiscal expansion instruments in election years [10].

This study of political tax cycles relies on the data for countries with different levels of economic development, including some emerging countries such as members of the Eurasian Economic Union (EAEU) and Ukraine. This paper aims to test the hypotheses about the existence of political tax cycles (changes in the tax burden in election and post-election years) and to shed light on the corresponding characteristics of countries with different levels of economic and political development.

This article comprises several sections. The first, introductory section is followed by a review of the research literature on PBCs and the role taxes play in these processes. In the third section, the hypotheses are formulated and the methodology for their testing is described. The hypotheses are tested on the data of 121 countries for the period of 1991–2019. The fourth section discusses the results of the analysis while the fifth section summarizes the key findings.

2. Literature review

The first highly cited seminal researches on PBCs were published in the 1970s [11]. These included the studies of Ray C. Fair, who analyzed the data on US presidential elections between 1916 and 1976 to show that successful economic performance influences voters' preferences – a 1% economic growth will bring the incumbent about 1% of extra votes [12].

The 1970s, which saw a surge of scholarly interest in PBCs, was a time when, after a long period of economic stability, the world entered the economic turmoil resulting from the 1973 oil price shock, the end of the gold-dollar standard and the switch to floating exchange rates and the resulting rise in inflation. Governments could no longer count on favorable conditions in raw materials markets and had to go to great lengths to show the results of their proactive economic policies to voters during election periods. Looking for ways to 'pump up' the economy and to show the electorates their efficiency in the short term, governments increased their debt levels, which led to a series of major debt crises in the 1980s and 1990s. In the 2000s and 2010s, politicians came to be perceived as meritocratic economists, they were expected to deliver specific economic targets (economic growth, low inflation and low unemployment) [4] rather than defend certain political values, pursue justice and fulfil their pre-election pledges [13]. In his recent book Michael Sandel describes the situation of the 'tyranny of merit', where the 'meritocratic hubris' of professional and political élites made them look down on their less fortunate fellow citizens and feel unaccountable to them [14]. As a result, electors start feeling cut off from any economic decision-making and experience enormous resentment against the elites, which leads them to vote for populist demagogues instead of liberal meritocrats. Economic populism has turned out to be simpler, more understandable and inspiring for voters. Importantly, more often than not, populists do not take the trouble of giving detailed accounts about the economic outcomes of their policies to voters in pre-election periods [15].

The studies on PBCs mainly describe the two types of economic tools used by governments: monetary and fiscal tools. The studies that focus on monetary instruments usually deal with the changes in the money supply and inflation [16], in the exchange rate [17], interest rate, volume of lending, especially by state-owned banks [18] or non-bank lending institutions [19]. The studies on fiscal instruments examine the changes in government spending and budget deficit [6], budget transfers and public consumption [20], and the external debt [21].

Supposedly, if a country's central bank is independent and in control of the monetary policy, monetary instruments become less accessible to the political government. Sometimes, however, governments of developed countries resort to monetary instruments although this does not always help them boost macroeconomic indicators for the elections. The study of a sample including 18 OECD countries did not find any evidence of enhanced economic growth in election periods, but it did detect an expansionary monetary policy in election years as well as an inflationary effect arising after the elections [5; 16].

A significant body of research focuses on taxes as one of the major instruments of fiscal policy in the context of PBCs [9; 20; 22–28]. Fines can also be considered as a kind of a tax instrument: as the case of Italian municipalities has shown, fines are also exhibiting cyclical behavior – less fines are handed out and less fines are collected in percentage of fines issued in election years in comparison with other periods [29]. Unfortunately, in the researches no consensus has been reached concerning the influence of electoral periods on fiscal policies, tax burden (nominal and real), tax rates, and tax legislation. There is evidence that in economically and politically developed countries, governments tend to increase public expenditure instead of lowering tax rates during the elections [26]. There is another study that used panel data for the post-war period and did not confirm that in election years governments reduced tax rates [30]. Similarly, no evidence was found for tax changes induced by elections in the EU between 1965 and 1997 [28] and in 13 Western European countries between 1985 and 2005 [31]. The study of political cycles in Italian municipalities (mayor elections) has shown the cyclicality of the personal income tax but failed to detect a similar impact of the electoral cycle on the

property tax rates [32]. Moreover, there is research evidence showing the existence of political tax cycles in some developing countries, for example, in Russia [9], Turkey [7; 33], and the Czech Republic [8].

To summarize this literature review, there are several major highlights that should be pointed out. First, the initial outburst of researches on the use of economic instruments in electoral periods was prompted by the reform of the global monetary system in the 1970s, high world inflation, including raw material prices, and voters' expectations concerning the governments' responses to these new economic challenges. In the public opinion, the politicians were regarded as economists advocating meritocracy. Economic populism gained ground in many countries and held it for recent decade.

Second, there is sufficient evidence showing that, in the run-up to elections, governments seek to deliver specific economic targets (economic growth, low inflation, and low unemployment) to gain voters support, which is achieved by manipulating monetary and fiscal tools. In developed countries, the use of these tools affects the growth in inflation and budget deficit in post-election years but does not always bring about economic growth or a decline in unemployment in election years.

Third, tax instruments are also used in election periods but this cannot be regarded as a common pattern and neither has the academic community reached any consensus about their effect. There are, however, cases of developed countries where tax tools were used in municipal elections and cases of governments in emerging countries doing the same.

3. Hypotheses and methodology

This paper is going to discuss and test two hypotheses about the cyclical behavior of governments' expenditures and tax burden in electoral periods.

*Hypothesis H*1: in election years, the government increases its expenditures and after the election, the expenditures either grow more slowly or start to decline. An increase in spending prompts

the government to raise the tax burden to restore the budget balance and prevent a budget deficit in the election year.

*Hypothesis H*2: in election years, the tax burden decreases and in post-election periods, it increases or decreases at a slower rate. This happens because in election years, governments tend to be more politically motivated to stimulate economic growth by reducing the tax burden and increasing it in the post-election year once their political priorities change.

Political budget and tax cycles are expected to differ in countries with different levels of political and economic development.

This study tests the above-described hypotheses by using the data on 121 countries from 1991 to 2019. All the countries were divided into parliamentary and presidential, and the data were analyzed for election and post-election periods. For parliamentary countries, the dates of parliamentary elections were used and for presidential countries, the dates of presidential elections.

The data were analyzed by applying the methodology described in [34] for 1991–2017 [35] and 2018–2019[1]. To examine the cyclicality of the tax burden in different countries, the countries in the sample were divided into several groups. First, the countries were divided by the level of income into high-income countries (according to the classification of the World Bank in 2019, these are the countries with a gross national income per capita of US$12,300 or more, calculated using the Atlas method) and low- and middle-income countries (gross national income below US$12,300). In terms of their political development, the countries were divided into democracies (those whose EIU Democracy Index of 2019[2] was above 6)

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and hybrid and authoritarian regimes (the Democracy Index below 6).

The political indicators were adopted from the methodology of the Economist Intelligence Unit[3] and the economic indicators, from the World Bank's data[4]. Due to the lack of data, for the analysis of countries with different levels of democratic development, 12-year periods were used instead of 29-year periods, like for other groups of countries: 2006, 2008, 2010–2019.

This study follows the methodological approach adopted in other studies of PBCs [6; 36]: to test the hypotheses, the method of multi-factor linear regression analysis of panel data was used. The analysis was conducted with the help of SPSS Statistics software.

Two dependent variables were analyzed – government spending to GDP and the tax burden, that is, tax to GDP. In the analysis of the first dependent variable of government spending, the second (tax burden), in addition to other indicators, was used as an independent variable.

$$Y_{it} = \beta_0 + \beta_1 \cdot X_{1it} + \dots \beta_k \cdot X_{kit} + \varepsilon_{it}$$

$i = 1, \dots, 121$ for all countries;

$i = 1, \dots, 46$ for high-income countries;

$i = 1, \dots, 77$ for low- and middle-income countries ;

$i = 1, \dots, 66$ for democratic countries;

$i = 1, \dots, 40$ for countries with hybrid and authoritarian regimes;

$t = 1, \dots, 29$ (1991, 2019) for all countries with different levels of economic development;

$t = 1, \dots, 12$ (2006, 2008, 2010, 2019) for countries with different political regimes;

$k = 1, \dots, 7$;

Y_{1it} = Expens – government spending to GDP;

Y_{2it} = Tax – tax revenue to GDP ratio;

X_{1it} = log GDP per capita – the logarithm of GDP based on PPP per capita in current international dollars;

X_{2it} = Tr – sum of exports and imports as percentage of GDP;

X_{3it} = Pp15 – demographic indicator characterizing the ratio of under-15-year-olds to the working-age population (people aged 15–64);

X_{4it} = Pp65 – demographic indicator characterizing the ratio of the elderly population aged 65 and over to the working-age population (people aged 15–64);

X_{5it} = GDP_HP – cyclical component in the dynamics of real GDP calculated as the difference between the common logarithm of GDP based on PPP in current international dollars and the same indicator filtered through the Hodrick–Prescott filter;

X_{6it} = ElecY – Boolean variable assigned value 1 in the presidential election year in presidential countries and in the parliamentary election year in parliamentary countries, and value 0 in other years;

X_{7it} = Elec(Y + 1) – Boolean variable assigned value 1 in the year following the presidential election in presidential countries and the year following the parliamentary election in parliamentary countries, and value 0 in other years.

4. Results

Testing of Hypothesis 1. The multi-factor linear regression analysis of government spending, whose statistical model also included independent predictor *Tax* (tax revenue in percentage of GDP), has brought the following results (see Table 1).

For countries with hybrid and authoritarian regimes, the statistical results were insignificant with a low coefficient of determination (adjusted R^2). For other countries, a relatively high coefficient of determination was obtained, which was close to 0.7.

In general, it was found that the governments increased their spending in election years in comparison with other years. The same happened in post-election periods although to a lesser extent. It is remarkable that the governments in highly developed countries increased their expenditures more in election years than in post-election years while in low- and middle-income countries, on the

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   [3] Democracy Index 2019. A Year of Democratic Setbacks and Popular Protest. A Report by The Economist Intelligence Unit. 2020. Available at: https://www.in.gr/wp-content/uploads/2020/01/Democracy-Index-2019.pdf
   [4] WB. (2021). The World Bank Open Data. https://data.worldbank.org/

contrary, the governments spent more in post-election years than in election years. In the 12-year period of observation, governments in democratic countries spent less in election years.

The statistically significant results show that the maximum difference between the growth in government spending to GDP in election years and the growth in post-election years was characteristic of high-income countries. In these countries, in election years, the governments' expenditures grew almost 0.4% faster than in other years. If to compare these results with those of previous research based on similar statistical methods, it could be seen that this indicator increased over time. For example, Brender and Drazen used 1,638 observations in 68 countries over the period of 1960–2001 to show that governmental expenditures to GDP grew by 0.07% in election periods in comparison with other periods [6].

Thus, the hypothesis about the existence of political budget cycles was confirmed for all groups of countries (except for non-democratic ones), that is, government expenditures rose in election years and declined or grew more slowly after the elections. This might point to the fact that the governments were economically motivated to increase the tax burden to prevent a budget deficit in election years due to increased spending.

Testing of Hypothesis 2. The multi-factor regression analysis of dependent variable *Tax* (tax revenue in percentage of GDP)) has not brought any statistically significant results with a sufficiently high coefficient of determination of adjusted R^2 (see Table 2). The comparison of different groups of countries has shown that low- and middle-income countries and countries with hybrid and authoritarian regimes have the highest determination coefficient and correlation coefficients.

Table 1

Results of multi-factor regression analysis of the dependent variable of government spending

Expens[1]	All countries		High-income countries		Low- and middle-income countries		Democracies		Hybrid and authoritarian regimes	
	ElecY	**ElecY+1**	**ElecY***	**ElecY+1***	**ElecY**	**ElecY+1**	**ElecY***	**ElecY+1***	**ElecY***	**ElecY+1***
Coefficient B	0.243	0.157	0.396	0.076	0.077	0.202	–0.222	–0.288	1.092	1.193
T-statistic	0.704	0.453	0.674	1.3	0.193	0.502	–0.466	–0.601	1.357	1.456
Adjusted R^2	0.642	0.642	0.605	0.605	0.608	0.608	0.690	0.690	0.261	0.261
F-statistic	498.082	497.966	183.361	183.201	244.999	245.078	197.482	197.549	19.221	19.276
DW statistic	0.313	0.312	0.353	0.352	0.458	0.459	0.511	0.516	0.403	0.414
Number of countries	107	107	46	46	77	77	66	66	40	40
Number of observations	1945	1945	834	834	1101	1101	618	618	363	363
Observation period, years	29	29	29	29	29	29	12	12	12	12

Note: [1] *Expens* is a dependent variable; independent variables are *Tax, Lgdp_pc, Tr, Pp15, Pp65, GDP_HP, ElecY* (or *ElecY*+1).

* Significant at the level of 1%.

Source: author's calculations

Table 2

**Results of multi-factor regression analysis of the dependent variable
of the tax burden**

Tax[1]	All countries		High-income countries		Low and middle-income countries		Democracies		Hybrid and authoritarian regimes	
	ElecY*	ElecY+1*	ElecY*	ElecY+1*	ElecY*	ElecY+1*	ElecY*	ElecY+1*	ElecY*	ElecY+1*
Coefficient B	–0.274	–0.113	–0.438	–0.360	0.051	0.167	0.031	0.375	–0.114	–0.468
T-statistic	–0.850	–0.007	–0.747	–0.616	0.152	0.494	0.057	0.691	–0.197	–0.791
Adjusted R^2	0.299	0.298	0.238	0.237	0.310	0.310	0.237	0.238	0.354	0.355
F-statistic	141.492	141.348	44.538	44.499	85.495	85.549	33.231	33.336	34.480	34.634
DW statistic	0.182	0.182	0.219	0.219	0.378	0.378	0.456	0.459	0.424	0.429
Number of countries	108	108	47	47	83	83	61	61	44	44
Number of observations	1980	1980	839	839	1131	1131	622	622	367	367
Observation period, years	29	29	29	29	29	29	12	12	12	12

Note: [1] *Tax* is a dependent variable; independent variables are *Lgdp_pc, Tr, Pp15, Pp65, GDP_HP, ElecY* (or *ElecY* + 1).

* Significant at the level of 1%.

Source: author's calculations

Thus, the second hypothesis about the existence of political tax cycles has not been confirmed. These results in general correspond to the findings of previous studies, which present a somewhat ambivalent picture.

Hypothesis testing leads to the following conclusions.

First, the main tool used by governments in pre-election and post-election periods is increased spending, which makes them more economically motivated to raise more taxes to avoid a budget deficit. The political budget cycle is mostly typical of high-income countries. In election years, the expenditures of governments in these countries grew 0.4% faster than in other periods while in post-election years, this figure was 0.07%. Therefore, in high-income countries, in pre-election periods, the tax burden is more likely to rise than to fall, demonstrating the same pattern as governments' expenditures.

Second, the study detected no statistically significant patterns of the tax burden's decline in election periods or its increase after the elections.

Third, the cyclicality of the tax burden in election periods has the highest statistical significance in low- and middle-income countries and in countries with hybrid and authoritarian regimes.

Therefore, it makes sense to look for the existence of political tax cycles in countries with low levels of economic and political development, which is why the focus was made on EAEU countries and Ukraine in 1992–2019. As a result of the above described statistical modelling procedure performed with the help of SPSS Statistics, no statistically significant results were found and, therefore, the cyclicality of the tax burden in election periods in Belarus, Kazakhstan and Kyrgyzstan cannot be confirmed. Political tax cycles were detected in Armenia,

Russia and Ukraine. In Armenia, the tax to GDP ratio decreased in election years in comparison with other periods. This indicator grew faster in election than in post-election periods. After the elections the tax burden declined, but more slowly. The coefficient of determination (adjusted R^2) between the tax burden and election periods in Armenia was quite high – 0.965. In Russia and Ukraine, the tax burden decreased in election years in comparison with other periods and rose after the elections. This contrasts with the situation in Armenia, where in post-election years the tax burden declined but more slowly. Both Russia and Ukraine were found to have high determination coefficients (adjusted R^2) – 0.836 and 0.827 respectively. Thus, political tax cycles were detected in some of the countries with developing political and economic systems.

5. Discussion

To discover political tax cycles and shed light on the changes in the tax burden in election periods, two opposing hypotheses were formulated.

Hypothesis *H*1 stated that the main fiscal instrument used by governments in election periods is increased spending rather than tax revenue. This shapes the dynamics of the tax burden in election periods, that is, in election years, the tax burden was used to cover the cost of government spending, so in fact taxes played a role that was secondary to the government's expenditures and 'mirrored' them. Thus, according to this hypothesis, political tax cycles are associated with an increase in the tax burden in election years followed by its decline in post-election periods.

On the other hand, Hypothesis *H*2 stated that in order to stimulate economic growth and convince the electorate that their approach to economic management is effective, governments will reduce the tax burden in election years. In this case, the concept of political tax cycles implies a reduction in the tax burden in election years followed by its rise in post-election periods.

The first hypothesis was confirmed and the second refuted. In other words, the majority of political tax cycles are associated with increased tax burden in election years, rather than decreased one. In all likelihood, governments do not choose to reduce the tax burden because increased spending on social protection (pensions, disability benefits, etc.) and salaries has a more direct and tangible effect on the electorate in the short term.

This fact is supported by the available research evidence, especially from studies of developed countries where the main accent was placed on public spending and budget deficit rather than tax instruments [6]. Depending on the structure (the prevalence of business corporations among the taxpayers), an increase in the tax burden in election years to cover the government's overspending means that the government redistributes corporate financial resources via the state budget to gain voters loyalty. Moreover, as the tax burden increases in the election year, the government put more pressure on the economy, which in some cases impedes economic growth in the election period. The research evidence does not confirm the existence of PBCs related to economic growth in election periods [5; 15; 37].

However, the possibility of reduced tax burden in election years followed by its increase after the elections cannot be entirely excluded, even if this hypothesis was not confirmed for the observed groups of countries. Relatively significant statistical results were obtained for low- and middle-income countries as well as for countries with hybrid and authoritarian regimes. There is sufficient research evidence to show that in some developing countries the tax burden was in fact declining in election periods [7–9; 33]. Governments in developing countries may have different political and economic motivations to reduce the tax burden in election periods: in the case of authoritarian governments, these may include subjective preferences of certain tax instruments; low competence

of the economic governmental agencies and the use of a wide range of economic instruments, including those based on taxation, in the hope of not missing out opportunities; corporate lobby of taxpayers pushing to reduce the burden, and so on. Within the general picture, however, isolated cases of reduced tax burden in election periods appear to be more an exception than a rule. When political and economic systems emerge and start evolving, the tax burden in election periods may decrease but as the country develops politically and economically, the tax burden tends to grow in election years.

Regarding the role of the tax burden in PBCs, there is a number of studies showing that governments tend to prioritize monetary rather than fiscal tools [16–19] since the former produce faster and more visible short-term macro-economic results. To influence target electoral groups, preference should be given to fiscal instruments. In this matrix of political and economic instruments, those based on taxation play only a supporting role, providing funds to compensate for increased government spending.

Finally, it should be noted that in election periods, governments may use tax instruments that, as long as the same level of the tax burden is maintained, may contribute to the attainment of the government's political goals. These instruments may target not the electorate but the political opponents: the latter can be subjected to tax audits in search of the past or present non-compliance or to biased assessment of tax declarations and similar. Thus, in addition to their normal fiscal and stimulating functions, tax instruments start to be used to intimidate and harass members of the opposition.

6. Conclusions

*Hypothesis H*1 about the existence of political budget cycles was confirmed for all groups of countries (except for non-democracies). In election years, the governments of high-income countries often spent more and in post-election periods, on the contrary, made cuts

to their spending. This might signify that in election years, governments are economically motivated to increase the tax burden to compensate for their overspending and to avoid running a budget deficit. Thus, if the tax burden does change in the election period, it tends to grow in the election year and decrease afterwards, 'mirroring' the changes in government expenditures.

*Hypothesis H*2 about the existence of political tax cycles in groups of countries with different levels of political and economic development was refuted.

From the above, the following conclusions can be reasonably drawn:

No substantial evidence was found indicating the existence of political tax cycles in the last decades. Within PBCs, fiscal policies were rarely used by governments to demonstrate their efficiency to the electorate. This might be explained by the fact that, although governments strive to gain voters support and stimulate economic growth through various instruments, they generally appear unwilling to use tax instruments for this purpose due to the lack of confidence in their efficiency. Governments of high-income countries tend to use increased budget spending rather than tax revenue as part of political budget cycles.

Political tax cycles were only observed in some developing countries, where the governments reduced the tax burden in election years. No common pattern was detected among the countries sharing certain political and economic characteristics; however, some evidence was found that in Armenia, Russia, Turkey, Ukraine and the Czech Republic, the tax burden declined in election periods. Governments in these countries tended to reduce the tax burden for political reasons in election years and in post-election periods either to raise it or reduce it at a lower rate.

Political tax cycles usually occur in developing countries when other instruments fail to produce the desired effect. For example, the government may decide to stick to fiscal and tax instruments and exclude monetary ones, thus

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keeping the monetary policy independent of political pressures. Nevertheless, due to budget constraints, the high lending interest rates, shortage of resources in the domestic financial market, and budget deficit, the government may have nothing else to do but to manipulate the tax burden in the election period by adjusting its level or the tax rates, tax exemptions and tax base.

The practical implications of this study are as follows. In general, in election periods, governments tend to manipulate the tax burden as an auxiliary tool to compensate for their overspending. This can be explained by the fact that the use of the tax burden for short-term purposes (in preparation for elections) may fail to produce the desired effect and instead have a long-term structural effect on the economy (whether the government wants it or not). Therefore, in order to maintain the effect of the tax burden on the economic growth and to ensure the manageability of short- and long-term tax reforms, it is important that political tax cycles should be determined by economic rather than political reasons. In practical terms, it means that political tax cycles should be taken into consideration in economic policy-making rather than in political economy.

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