ECONOMIC ANNALS-XXI
ISSN 1728-6239 (Online)
ISSN 1728-6220 (Print)
https://doi.org/10.21003/ea
http://www.soskin.info/ea/

Volume 177 Issue (5-6)'2019

Citation information:
Tikhonova, A., Telegina, Zh., Babanskaya, A., & Grudneva, A. (2019). Evaluation of the optimal ratio for consumption and income taxes with the use of econometric methods. Economic Annals-XXI, 177(5-6), 44-52. doi: https://doi.org/10.21003/ea.V177-04

UDC 336.22, 519.237

Anna Tikhonova
PhD (Economics), Associate Professor,
Department of Tax Policy and Customs Tariff Regulation,
Federal State-Funded Educational Institution of Higher Education
«Financial University under the Government of the Russian Federation»;
Associate Professor of the Department of Statistics and Econometrics,
Federal State Budgetary Educational Institution of Higher Education
«Russian Timiryazev State Agrarian University»
49 Leningradsky Ave., Moscow, 125993, Russia
AVTihonova@fa.ru
ORCID ID: https://orcid.org/0000-0001-8295-8113

Zhanna Telegina
D.Sc. (Economics), Associate Professor, Professor of the Russian Academy of Sciences,
Department of Production Management,
Federal State Budgetary Educational Institution of Higher Education
«Russian Timiryazev State Agrarian University»
49 Timiryazevskaya Str., Moscow, 127550, Russia
zhatelegina@rgau-msha.ru
ORCID ID: https://orcid.org/0000-0001-5003-707X

Anastasia Babanskaya
PhD (Economics), Associate Professor,
Department of Economic Security, Analysis and Audit,
Federal State Budgetary Educational Institution of Higher Education
«Russian Timiryazev State Agrarian University»;
49 Timiryazevskaya Str., Moscow, 127550, Russia
banasti@rgau-msha.ru
ORCID ID: https://orcid.org/0000-0002-4695-1587

Alla Grudneva
PhD (Economics), Associate Professor,
Department of Taxation and Financial Law,
Federal State Budgetary Educational Institution of Higher Education
«Russian Timiryazev State Agrarian University»;
49 Timiryazevskaya Str., Moscow, 127550, Russia
kokotko@list.ru
ORCID ID: https://orcid.org/0000-0001-6865-4498

Evaluation of the optimal ratio for consumption and income taxes with the use of econometric methods

Abstract. The authors examines the dependence of tax rates by direct and indirect taxes. The research methodology is based on the authors' approach based on the construction of scatter diagrams, as well as the use of correlation and regression analysis. To calculate regression indices, data of 2007-2018 was sampled from 87 countries (10 indicators), including countries of different types (third world, developing and developed). The authors analyse the structure of tax revenues by type of taxes in the EU, depending on the socio-economic development of the country.

The results of the analysis show no clear dependence between VAT and corporate tax rates. However, there is correlation between the rate of VAT and personal income tax. Mostly it is due to the level of socio-economic development of the countries. Economically developed EU countries replenish the state budget revenues mostly by direct taxes. However, if indirect tax rates are high, their share in the national GDP is still quite remarkable (for example, in Denmark and Sweden). Meanwhile, in developing countries there is a clear predominance of consumption taxes in GDP (Croatia, Hungary).

At the same time, there is a significant impact of political factors that are not amenable to mathematical evaluation. This, however, explains the results obtained by the authors. It has been noted that tax revenues from direct taxes prevail in developed countries, whereas developing countries prefer indirect taxes.

Keywords: Consumption Taxes; Corporate Tax; Income Tax; Tax Rate; Tax Revenue Structure; Dispersion Matrix; Correlation; Homoscedasticity; Tax Rate Elasticity

JEL Classification: H23; C15; C51

Acknowledgements and Funding: This article was prepared with the support of the Russian Foundation for Basic Research (RFBR), project No. 18-010-00527 (2019).

Contribution: The authors contributed equally to this work.

DOI: https://doi.org/10.21003/ea.V177-04

Тихонова А. В.
кандидат економічних наук, доцент,
департамент податкової політики і митно-тарифного регулювання, Федеральний державний бюджетний заклад вищої освіти «Фінансовий університет при Уряді Російської Федерації»,
доцент, кафедра статистики та економетрики,
Федеральний державний бюджетний заклад вищої освіти
«Російський державний аграрний університет – МСГА ім. К. А.Тімірязєва», Москва, Росія
Тєлєгіна Ж. А.
доктор економічних наук, доцент, професор РАН, професор, кафедра організації виробництва,
Федеральний державний бюджетний заклад вищої освіти
«Російський державний аграрний університет – МСГА ім. К. А. Тімірязєва», Москва, Росія
Бабанська А. С.
кандидат економічних наук, доцент, кафедра економічної безпеки, аналізу та аудиту,
Федеральний державний бюджетний заклад вищої освіти
«Російський державний аграрний університет – МСГА ім. К. А. Тімірязєва», Москва, Росія
Груднєва А. О.
кандидат економічних наук, доцент, кафедра оподаткування та фінансового права,
Федеральний державний бюджетний заклад вищої освіти
«Російський державний аграрний університет – МСГА ім. К. А. Тімірязєва», Москва, Росія

Оцінка оптимального співвідношення податків на споживання й доходи з використанням економетричних методів

Анотація. У статті досліджуються питання залежності податкових ставок за прямими й непрямими податками. Автори аналізують структуру оподатковуваних доходів за типами податків у ЄС залежно від рівня соціально-економічного розвитку країни. Основу методології дослідження складає авторський підхід, заснований на побудові діаграм розсіювання, а також застосуванні кореляційно-регресійного аналізу. Для розрахунку показників регресії будо взято вибірку з 87 країн (10 показників), у які увійшли країни різних типів (країни третього світу; країни, що розвиваються; розвинені країни). Результати проведеного аналізу свідчать про відсутність чіткої залежності між ставками ПДВ і ставками корпоративного податку з громадян. Разом із цим існує кореляція прямої спрямованості між ставкою ПДВ і ставкою корпоративного податку з громадян. Вона, багато в чому, пояснюється рівнем соціально-економічного розвитку держав. При цьому наголошується на істотному впливові політичних чинників, які не підлягають математичній оцінці, проте деякою мірою пояснюють результати дослідження. Авторами зроблено висновок, що в розвинених країнах переважають доходи, отримані від застосування прямих податків, у той час як у країнах, що розвиваються основними є надходження від непрямих податків.
Ключові слова: податки на споживання; корпоративний податок; податок на прибуток; податкова ставка; структура доходів від податків; матриця розсіювання; кореляція; гомоскедастичність; еластичність податкових ставок.

Тихонова А. В.
кандидат экономических наук, доцент,
Департамент налоговой политики и таможенно-тарифного регулирования,
Федеральное государственное образовательное бюджетное учреждение высшего образования «Финансовый университет при Правительстве Российской Федерации»,
доцент кафедры статистики и эконометрики,
Федеральное государственное бюджетное образовательное учреждение высшего образования «Российский государственный аграрный университет – МСХА имени К. А. Тимирязева», Москва, Россия
Телегина Ж. А.
доктор экономических наук, доцент, профессор РАН, профессор кафедры организации производства,
Федеральное государственное бюджетное образовательное учреждение высшего образования «Российский государственный аграрный университет – МСХА имени К.А. Тимирязева», Москва, Россия
Бабанская А. С.
кандидат экономических наук, доцент, кафедра экономической безопасности, анализа и аудита,
Федеральное государственное бюджетное образовательное учреждение высшего образования «Российский государственный аграрный университет – МСХА имени К. А. Тимирязева», Москва, Россия
Груднева А. А.
кандидат экономических наук, доцент, кафедра налогообложения и финансового права,
Федеральное государственное бюджетное образовательное учреждение высшего образования «Российский государственный аграрный университет – МСХА имени К. А. Тимирязева», Москва, Россия

Оценка оптимального соотношения налогов на потребление и доходы с использованием эконометрических методов

Аннотация. В статье исследуются вопросы зависимости размера налоговых ставок по прямым и косвенным налогам. Авторы анализируют структуру налоговых доходов по типам налогов в ЕС в зависимости от уровня социально-экономического развития страны. В качестве методологии исследования использован авторский подход, основанный на построении диаграмм рассеяния, а также применении корреляционно-регрессионного анализа. Для расчета показателей регрессии

осуществлена выборка данных по 87 странам (10 показателей), в которую вошли страны разных типов (третьего мира, развивающиеся и развитые). Результаты проведенного анализа говорят об отсутствии четкой зависимости между ставками НДС и корпоративного налога. Однако присутствует корреляция прямой направленности между ставкой НДС и подоходного налога с граждан. Она, во многом, объясняется уровнем социально-экономического развития государств. При этом отмечается существенное влияние политических факторов, которые не поддаются математической оценке, но в некоторой степени объясняют полученные автором результаты. Отмечено, что в развитых странах преобладают налоговых доходы от прямых налогов, в то время как в развивающихся – косвенных.
Ключевые слова: налоги на потребление; корпоративный налог; подоходный налог; налоговая ставка; структура налоговых доходов; матрица рассеяния; корреляция; гомоскедастичность; эластичность налоговых ставок.

1. Introduction

Tax system is the most important economic regulator in any country of the world. In this regard, it is important to note that modern tax systems are characterised by complexity and heterogeneity of structures (by type of tax), as well as varying degrees of differentiation (by which the authors understand the amount of fiscal payments). Thus, one of the fundamental tools for managing the tax system and the economy as a whole is the optimal ratio and combination of taxes, in particular a combination of federal, regional and local taxes; direct and indirect taxes; taxes levied on individuals and legal entities.

In the framework of this research, the issues of the consumption and income taxes optimal ratio are studied from the standpoint of their functions. The regulatory function of the above mentioned taxes is most clearly appeared in the following aspects:

1) the redistribution of national wealth in relation to the population;
2) economic and production business efficiency;
3) the formation of tax revenues of the country and the impact on the growth / reduction of the illegal sector of the economy.

As a rule, taxes on income and consumption form the overwhelming majority of fiscal revenues in the economies of the world. At the same time, the choice of priorities in budgeting by direct and indirect tax revenues is greatly determined by the level of the country's socio-economic development. In particular, indirect taxes dominate the incomes of developing countries, whereas direct taxes form the basis of state revenues in economically developed countries.

The second approach is economically more equitable, since it is based on the formation of real financial results of the business and the public. However, it requires highly developed tax control and discipline. In addition, tax revenues from direct individual taxes are most susceptible to the impact of financial crises, which creates significant fiscal risks for countries with developing economies. Countries with low business profitability, low incomes of the population and the absence of an effective tax administration system, are not able to ensure receipt of income taxes to the budget (Mawejje & Sebudde, 2019) [1]. For example, there is a number of European countries that raised VAT (indirect tax) rates in order to prevent a decline of income during the 2008 and 2011 crises (but in some countries standard rates were reduced) (Lykova, 2015) [2].

2. Brief Literature Review

The optimal structure of the tax system is a topic that has always been attracting theoretical economists, practitioners and politicians (Vishnevsky, Goncharenko, & Gurnak, 2016) [3]. Despite the fact, that all developed countries levy indirect taxes on a broad basis, along with direct taxes, a relatively small amount of research is devoted to explaining the optimal structure and ratio of direct and indirect taxes (Boadway, Marchand, & Pestieau, 1994) [4]. Moreover, research in this area considers problems not only within a whole country, but also within territories of the country.

In particular, Joy Eleniewski, Doug Nagode and James P. Trebby search for the optimal ratio of taxes on consumption and income in various US states in their study «Current Trends in State Taxation: Consumption Tax Versus Income Tax». They conclude that there is no single optimal structure for a tax system that could be implemented in every state. The combination of direct and indirect taxes should be built on the basis of specific economic conditions while minimizing the negative effects on the financial condition of the business and the public. The authors prove that states with a volatile economy can use sales tax, while more economically stable states should apply more aggressive tax policy, levying income taxes (Eleniewski, Nagode, & Trebby, 2014) [5]. Thus, the authors considered consumption and income taxes in the context of their fiscal tasks.

At the same time, a number of studies compare the influence of direct and indirect taxes on the redistributive function. In particular, Robin Boadway and Zhen Song, using the Atkinson-Stiglitz theorem, proved that if consumer preferences are poorly separable, the regulatory function of indirect taxes is not effective when the optimal scale of non-linear income tax is applied at the same time. And in this case redistributive goals can be achieved with the help of income tax only, even if consumed goods differ significantly in income elasticity of demand (Boadway & Song, 2016) [6].

Emmanuel Saez comes up with a similar conclusion in his research. According to the author, from the standpoint of national wealth redistribution indirect taxation is not optimal. In' his opinion, national wealth redistribution should be carried out through direct income taxation. However, these results are fair only with fixed tax rate of goods and progressive income tax. In a situation where labour taxation is based on income only and where there is a substitution of different types of labour, these patterns do not work. Indirect taxation, as a tool for redistribution, is effective in short terms only. In the long run, direct taxation should be preferred to increase national income and redistribute wealth (Saez, 2004) [7].

Often, when assessing the redistributive function of direct and indirect taxes, researchers also consider the political factor, the effect of which leads to opposite results than those presented by the authors discussed above (Mayburov & Kireenko, 2018; Fairfield, 2013) [8-9]. For example, Hector Sala analyses the evolution of the ratio between direct taxation (characterised by progressive rates) and indirect taxes (characterised by fixed rates), as well as the consequences of tax burden distribution for three groups of population, carrying out lower 50% of income, average 40% and high 10% of income in the United States. The author notes that fluctuations in the distribution of the tax burden have coincided with the election cycles in the United States since the 1960s. The periods when this ratio increases, coincide with the periods when the Democrats govern the Government, and there is a greater redistribution from the rich (10% of the best) to the rest of the population. Conversely, the periods when this ratio falls and the Republicans have the power are characterised by a decrease in this ratio and a smaller redistribution from the rich to the rest of the population. The authors conclude that the wealthiest citizens, being more informed economic agents, are able to protect themselves from toughening of fiscal conditions, thereby reducing the redistributive effects of establishing the income tax progression (Sala, 2019) [10]. Mexican authors come up to a similar conclusion, saying that Mexico had the lightest tax burden in Latin America during the last years.

Their article states that the main reason for this phenomenon is the resistance of the politically mobilized economic elite (Ondetti, 2017) [11].

We have noted above that the excessive use of indirect taxes is economically unfair with respect to end-users who act as tax carriers. The opinion that consumption taxation is inherently unfairly confirmed by early empirical data that suggest a high regressive component of VAT. However, this point of view is not supported by all scientists (Alizadeh & Motallabi, 2016) [12]. In particular, Milojko Arsić, Nikola Altiparmakov analyse the tax system of Serbia, as one of the representatives of the European Union developing countries. In their study, they showed that a significant part of the assumed VAT regressivity was due to the tendency of under-reported income inherent in sample household surveys. The authors proceeded from the assumption that household expenditure is a more significant indicator of well-being than recorded income. In many developing European countries, including Serbia, the significant presence of small-scale agricultural food production is an important factor in the progressivity of VAT, rather than in developed European countries. Micro-model analysis of expenditures in Serbia showed that common beliefs about the inequity of indirect taxation are greatly exaggerated and poorly substantiated in the economic reality of developing European countries, where VAT can be considered moderately progressive (Arsić & Altiparmakov, 2013) [13].

It is important to note that VAT implementing to increase government revenues, raise economic efficiency and reduce inequality is a serious problem for developing countries. The issue of the distributive effect of VAT has received much attention in literature (Chugunov & Zhukevych, 2014) [14]. The disadvantage of the works described above is the fact that scientists are considering the regulatory impact of tax mainly on households. However, VAT is not neutral for business, as some researchers believe (Litvintseva, 2012) [15]. It becomes the final expense for manufacturers who cannot accept it for deduction or are the final consumers of goods, works, and services. Thus, Céline de Quatrebarbes, Dorothée Boccanfuso, Luc Savard, using a two-stage modelling procedure - general

balance followed by micro-modelling - illustrate the importance of taking into account the features of the VAT structure for measuring its distribution and economic impact (Quatrebarbes, Boccanfuso, & Savard, 2016) [16]. A differentiated VAT rate is more cost effective than a single flat rate. A high VAT rate with tax exemption of basic food products has the greatest potential for poverty reduction. In terms of a tax deductions system, such VAT structure contributes to the development of business and the fulfilment of state budget revenues.

The presented analysis of the scientific literature allows us to determine the vector of the study. It will assess the principles of establishing tax rates for direct and indirect taxes, depending on the level of development of the national economy and the structure of tax payments. This will determine either the presence or the absence of the optimal ratio of consumption and income taxes.

3. Research Methodology

To identify the relationship between the system of income and indirect taxation, the following analysis methods and techniques have been used as methodology.

1) The scattering matrix of countries (the study examined 87 states). A graphical representation of the compliance between income tax rates (corporate tax and income tax levied on individuals) and consumption allows countries to be segmented by the type of tax rate ratio.
2) Matrix of pair correlation coefficients. This method is used to identify the dependence degree of the VAT tax rate (x1), corporate (x9) and income tax (x10) with regard to the general level of the national economy development, business condition and the welfare of the population. According to the authors' methodology, the following indicators are selected to characterise the level of economic development:
   - the annual inflation rate, % (x2);
   - the trade balance, billion US dollars (x3);
   - public debt in % of GDP (x4);
   - GDP per capita, US dollars (x5);
   - the index of ease of doing business (x6);
   - the unemployment rate, % (x7);
   - the food inflation rate, % (x8).
3) Correlation and regression analysis. The CRA is used to determine the degree of elasticity of consumption tax rates relative to income tax rates. In this case, regression allows us to find the equation of rate dependence in which the coefficient for an independent variable will be an indicator of elasticity. We make a reservation that, in order to interpret the parameters of the regression equation, a preliminary assessment of the equation for residues heteroskedasticity is carried out using the residual graph and the Goldfeld-Quandt criterion (1):

$$F = \frac{\sum_{i=1}^{m} e_i^2}{\sum_{n-m-1}^{n} e_i^2} > F_{\alpha;\nu_{n-p};\nu_{n-p}} \,. \quad (1)$$

The need to evaluate the model for heteroskedasticity is confirmed by the fact that the analysis uses a heterogeneous set of objects (countries of the 3rd world, developed and developing states).

4. Results

In order to assess the dependence of established consumption and income tax rates, two dispersion matrices were developed. Figure 1 shows the scatter graph for income tax and the VAT rates of the 87 countries with data as of 01.06.2019.

As there is a progressive income tax scale in most of the analysed countries, the following data were used in the study:

1) the basic tax rate was used in countries with fixed rates;
2) the average effective tax rate was used in countries with progressive taxation.

Only the main rate for consumption taxes (VAT, sales tax and other consumption taxes) was included in the analysis.

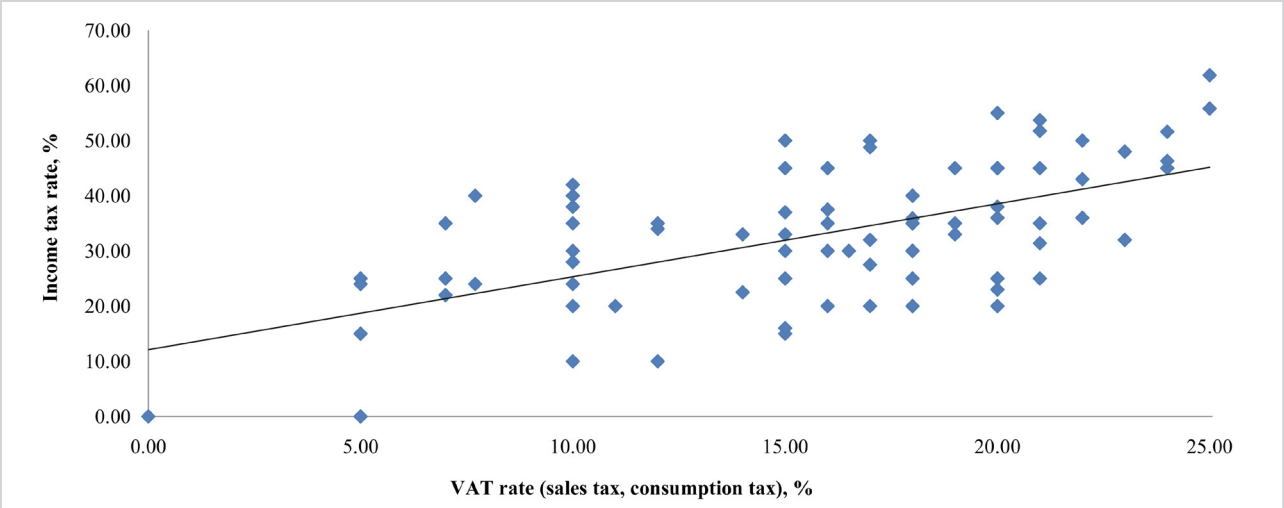

Figure 1:
Graph of dependence between the income tax rate and VAT rate in 87 countries
Source: Compiled by the authors

The scatter chart showed a direct dependence between the rates of direct and indirect taxes, and therefore a correlation and regression analysis was conducted between the rates of the above mentioned taxes at the next stage of the study, (Table 1).

Table 1:
The results of consumption tax rates (y) and income tax (x) regression

Regression Model Indicators	Value
Multiple R	0.591
R-squared	0.349
Value F	0.000
Value of parameter a in the equation[1]	0.000
Value of parameter b in the equation	0.000
Equation	y=7.22+0.264x

Source: Calculated by the authors

Using the residual graph, the regression model was tested for heteroskedasticity of residues (Figure 2) and the Goldfeld-Quant criterion in order to determine the value of the considered factors (Formula 2).

$$F = \frac{\sum_{i=1}^{m} e_i^2}{\sum_{n-m-1}^{n} e_i^2} = \frac{712.5}{356.5} = 2.0 \ . \qquad (2)$$

The actual value of criterion (2.0) did not exceed its critical value (2.12). Thus, we accept the null hypothesis about the homoskedasticity of the residuals of the paired linear regression in the general population. Therefore, the third premise of the regression analysis is fulfilled, and the parameters of the equation can be estimated using the conventional least squares method.

The results of the study showed that the rate of consumption taxes correlates with the income tax rate, but the income tax is not one of the fundamental factors in establishing the VAT scale. 34.9% of the VAT rate variation is explained by the variability of the tax rate, while the remaining 65.1% is due to other factors. This does not allow us to state that there is a significant relationship between the income taxation of citizens and taxation of consumption. The analysis of the tax rates elasticity showed that with an increase of 1% in the tax rate, the average VAT rate for the analysed 87 countries increases by 0.264%. This does not correspond directly to the statement above about the predominant choice of taxes of one or another type by the countries. This discrepancy might be due to the fact that countries with high tax rates have a developed socio-economic system, and are characterised by high profitability of business and citizen incomes (Tikhonova, 2019;

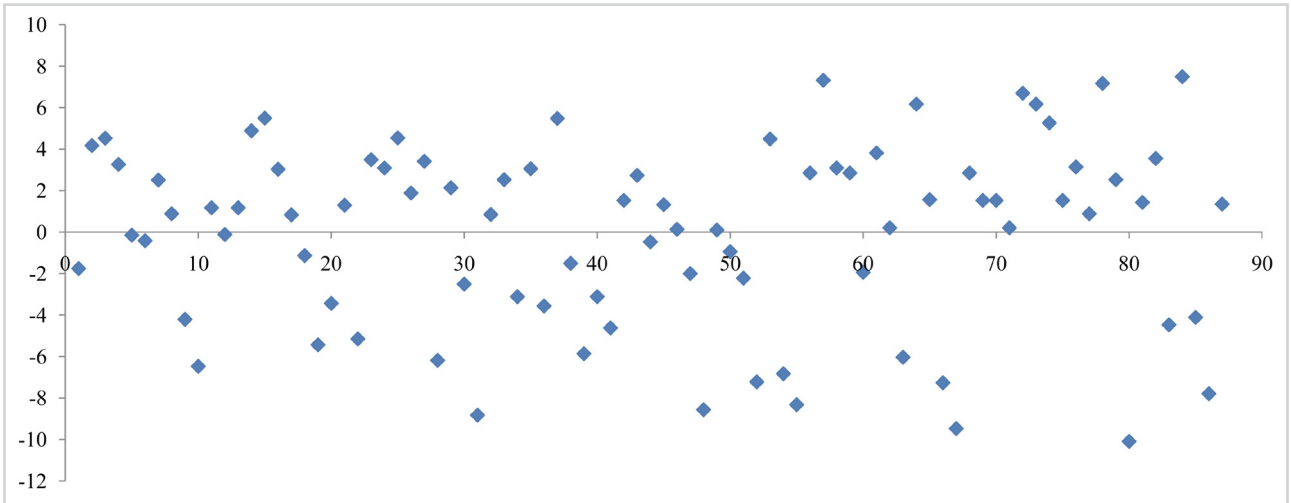

Figure 2:
Graph of the residuals of the regression equation
Source: Developed by the authors

Goncharenko, Tikhonova, Melnikova, & Malkova, 2018) [17-18]. On the contrary, a number of states with low tax rates are countries with a traditional eastern type of taxation system, where national and religious features play an important part (Oman, Yemen, and UAE).

To identify the dependence in the structure of tax revenues and the level of economic development, we consider the EU countries more attentively. The analysis showed that countries with high VAT and income tax rates included representatives of Scandinavia (Finland, Denmark, and Sweden), Belgium and the Netherlands. At the same time, the revenues from taxes levied on the incomes of organisations and citizens prevail in the budget revenues of these states even though they have high rates of direct and indirect taxes (Table 2).

As demonstrated in Table 2, economically developed EU countries replenish the state budget revenues mostly by direct taxes. However, if indirect tax rates are high, their share in the national GDP is still quite remarkable (for example, in Denmark - 16.2%; Sweden - 22.5%). Meanwhile, in

Table 2:
Structure of production and import taxes on consumption (b) and taxes on income (a) in several countries, % of GDP

Year	2007		2008		2009		2010		2011		2012		2013		2014		2015		2016		2017		2018	
	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b	a	b
Countries with predominance of direct income taxes																								
Belgium	15.9	12.7	16.1	12.5	14.9	12.5	15.3	12.8	15.8	12.7	16.1	13.1	16.7	13.1	16.8	13	16.5	12.9	16.2	13	168	13	1.1	13.2
Denmark	28.6	17.5	27.9	16.5	28.3	16.3	28.5	16.2	28.4	16.3	29.2	16.3	30.2	16.4	33.2	16.2	30.6	16.3	29.8	16.2	30	16	29	16.2
Netherlands	11	11.5	10.7	11.3	10.8	11.1	11	11	10.5	10.8	10	10.6	9.9	10.9	10.5	11.3	11.3	11.1	11.5	11.5	12.7	11.5	12.5	11.7
Finland	17	12.7	16.8	12.4	15.5	12.9	15.4	12.9	15.9	13.8	15.6	14.1	16.2	14.4	16.4	14.4	16.6	14.1	16.5	14.4	16.6	14.1	16	14.2
Sweden	20.1	22	18.7	22.3	18.5	22.6	18.1	22.2	17.6	21.9	17.4	22.2	17.8	22.1	17.8	21.8	18.4	21.8	18.8	22.5	18.9	22.5	18.7	22.5
Switzerland	13.9	6.2	14.3	6.2	14.4	6.2	14	6.3	14.1	6.3	14.1	6.2	14.2	6.1	14.1	6.1	14.8	6	15	6	15.6	6.1	15.7	6
United Kingdom	15.5	11.6	15.2	11.2	14.7	10.8	14.8	12	14.7	12.6	14	12.5	13.9	12.6	13.5	12.7	13.7	12.7	14	1.8	14.2	13	14.3	13.1
Iceland	1.9	17.7	17.1	14.7	15.4	12.9	15.2	13.2	16.2	13.3	16.5	13.8	17.2	13.6	18.5	15.2	17.2	14.6	17.8	14	19	14.9	18.8	14.2
Norway	21	12.2	21.7	11	19.7	11.8	20.6	11.9	21.3	11.4	20.8	11.2	19	11.3	17.3	11.5	16	12	15.5	12.6	16	12.5	16.6	12.3
Countries with predominance of indirect taxes on production and imports																								
Bulgaria	7.2	16	5.8	16.7	5.3	14.3	4.8	14.1	4.6	13.7	4.7	14.8	5.1	15.4	5.4	14.7	5.4	15.4	5.4	15.4	5.8	15	5.9	14.8
Czechia	8.8	10.6	7.8	10.4	7.1	10.8	6.8	11.1	7	11.9	6.9	12.4	7.2	12.7	7.3	11.8	7.2	12.2	7.6	12.3	7.7	12.4	7.9	12.4
Estonia	7.4	13.3	7.7	12.1	7.4	14.5	6.6	13.7	6.3	13.4	6.6	13.8	7.2	13.3	7.4	13.7	7.8	14.2	7.5	14.6	7.2	14.2	7.5	13.9
Croatia	7.3	18.2	7.1	18	7.1	17.2	6.6	17.6	6.4	17.2	6.3	18.1	6.5	18.6	6.3	18.5	6.1	19.1	6.5	19.3	6.3	19.6	6.4	20.1
Latvia	8.3	12	9.1	10.8	7	11.2	7.4	12.3	7.3	12.2	7.7	12.6	7.7	13	7.8	13.3	7.9	13.6	8.4	14.2	8.5	13.9	7.3	14.1
Lithuania	9.1	11.6	9.2	11.6	5.9	11.6	4.6	11.8	4.3	11.6	4.8	11.2	5	11	5	11.2	5.4	11.6	5.6	11.7	5.4	11.6	5.7	11.6
Hungary	10	15.6	10.3	15.4	9.6	16.3	7.8	17.4	6.3	17.2	6.8	18.5	6.6	18.4	6.8	18.3	6.9	18.7	7.4	18.1	7.4	18	6.9	18.3
Poland	8.3	14.4	8.4	14.4	7.2	12.8	6.7	13.8	6.7	13.9	7	13	6.7	12.9	6.8	12.8	6.9	12.8	7.1	13.5	7.3	13.8	7.8	14.1
Slovenia	9	14.4	8.7	13.9	8.1	13.6	8	14.1	7.8	14	7.5	14.5	7	15	7.2	14.8	7.2	14.7	7.5	14.6	7.5	14.3	7.8	14.1
Slovakia	6.4	11	6.7	10.3	5.8	10.4	5.6	10	5.7	10.4	5.8	9.9	6.4	10.3	6.8	10.6	7.3	10.7	7.3	10.6	7.3	10.9	7.3	10.9

Source: Compiled by the authors based on
https://ec.europa.eu/eurostat/web/government-finance-statistics/data/database (as of 01.06.2019)

developing countries there is a clear predominance of consumption taxes in GDP (in Croatia - 6.4% versus 20.1%; Hungary - 6.9% against 18.3%).

A similar study was conducted to assess the relationship between corporate tax rates and consumption taxes (Figure 3).

The scatter chart showed a lack of correlation between established corporate tax rates and consumption taxes. A matrix of pair correlation coefficients is developed in order to assess the dependence between principle of tax rates establishment and the general level of countries' economic development (Table 3).

The matrix presented above showed a lack of connection between indicators of the economic development level and tax rates established. Such results substantiate the conclusion of Hector Sala about the significant influence of political factors on the tax system and the principles for establishing different elements of taxation. In addition, the tax rate is far from always an indicator of the tax burden in general. For example, a fairly high income tax rate in France does not demonstrate the actual effective tax burden on the population due to a system of significant tax deductions. This fact distorts to some extent the obtained analysis results.

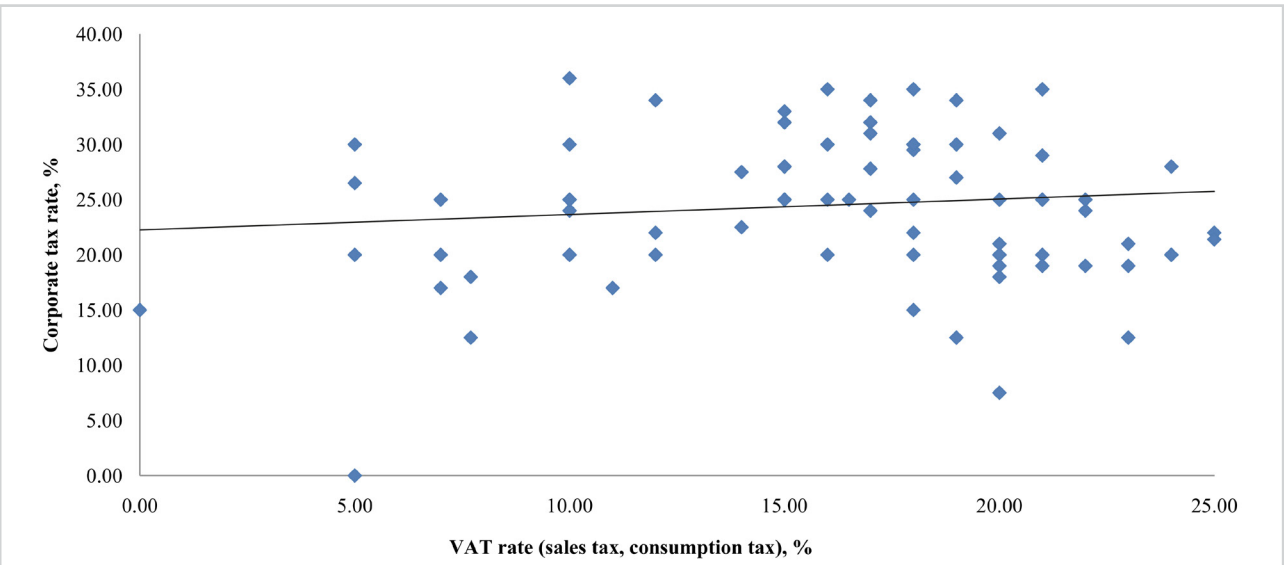

Figure 3:
Graph of corporate tax rate and VAT rate for 87 countries
Source: Developed by the authors

Table 3:
Matrix of paired correlation coefficients

	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9	x_{10}
x_1	1									
x_2	-0.03	1								
x_3	-0.22	-0.07	1							
x_4	0.20	0.04	-0.18	1						
x_5	0.21	-0.19	0.15	0.06	1					
x_6	-0.27	0.30	-0.20	0.05	-0.58	1				
x_7	0.05	-0,01	-0.14	0.11	-0.27	0.23	1			
x_8	-0.04	0.99	-0.04	0.04	-0.16	0.25	-0.01	1		
x_9	0.10	0.06	-0.41	0.02	-0.28	0.42	0.23	0.04	1	
x_{10}	0.59	0.09	-0.21	0.16	0.46	-0.23	-0.01	0.11	0.24	1

Source: Compiled by the authors

5. Conclusions

The study showed that the priority choice of the tax type, which forms the basis of state budget revenues, is mostly justified by the level of socio-economic development of countries, the quality of the tax administration system and tax discipline. An important part is also played by the political factor, which is difficult to be estimated by mathematical methods, and the influence of which is rather difficult to predict. No relationship was found between the level of tax rates of consumption

taxes and corporate income, which, however, does not mean that there is no correlation between the tax burden of direct and indirect taxes (this aspect requires additional independent research). However, there is a correlation between the individual income tax rates and VAT. It allows us to come to the following conclusions.

Firstly, the tax rate is not an indicator of the tax burden of a country. Secondly, developed economies set high rates for all types of taxes (direct and indirect), considering the purchasing power of the population and financial opportunities of business, as well as establishing a system of significant social benefits for the least protected layers.

In conclusion, it is worth saying that, taking into account the results obtained above, we must agree with the conclusions by American scientists Joy Eleniewski, Doug Nagode and James P. Trebby about the impossibility of determining the optimal ratio of taxes on consumption and income. At the same time, with the qualitative identification of factors affecting the architectonics of the tax system, it is possible to develop a mathematical model that allows one to determine specific parameters of the tax system under various conditions.

References

1. Mawejje, J., & Sebudde, R. K. (2019). Tax revenue potential and effort: Worldwide estimates using a new dataset. *Economic Analysis and Policy, 63,* 119-129. doi: https://doi.org/10.1016/j.eap.2019.05.005
2. Lykova, L. N. (2015). Tax burden in the Russian Federation: a comparative analysis point of view. *Journal of Tax Reform, 1*(1), 76-89. doi: https://doi.org/10.15826/jtr.2015.1.1.005
3. Vishnevskyi, V. P., Goncharenko, L. I., & Gurnak, A. V. (2016). Evolution of tax institutes and transition towards economic growth. *Terra Economicus, 14*(4), 14-30. doi: https://doi.org/10.18522/2073-6606-2016-14-4-14-30 (in Russ.)
4. Boadway, R., Marchand, M., & Pestieau, P. (1994). Towards a theory of the direct-indirect tax mix. *Journal of Public Economics, 55*(1), 71-88. doi: https://doi.org/10.1016/0047-2727(94)90081-7
5. Eleniewski, J., Nagode, D., & Trebby, J. P. (2014). Current trends in state taxation: consumption tax versus income tax. *Journal of State Taxation, 33*(1), 25-34. Retrieved from https://www2.deloitte.com/us/en/pages/tax/articles/current-trends-in-state-taxation-consumption-tax-versus-income-tax.html
6. Boadway, R., & Song, Zh. (2016). Indirect taxes for redistribution: Should necessity goods be favored? *Research in Economics, 70*(1), 64-88. doi: https://doi.org/10.1016/j.rie.2015.06.002
7. Saez, E. (2004). Direct or indirect tax instruments for redistribution: short-run versus long-run. *Journal of Public Economics, 88*(3-4), 503-518. doi: https://doi.org/10.1016/S0047-2727(02)00222-0
8. Mayburov, I. A., & Kireenko, A. P. (2018). Tax reforms and elections in modern Russia. *Journal of Tax Reform, 4*(1), 73-94. doi: https://doi.org/10.15826/jtr.2018.4.1.046
9. Fairfield, T. (2013). Going where the money is: strategies for taxing economic elites in unequal democracies. *World Development, 47,* 42-57. doi: https://doi.org/10.1016/j.worlddev.2013.02.011
10. Sala, H. (2019). A fresh look at fiscal redistribution and inequality in the US across electoral cycles. *Journal of Behavioral and Experimental Economics, 81,* 195-206. doi: https://doi.org/10.1016/j.socec.2019.06.008
11. Ondetti, G. (2017). The power of preferences: economic elites and light taxation in Mexico. *Revista Mexicana de Ciencias Políticas y Sociales (Mexican Journal of Political and Social Sciences), 231*(62), 47-76. doi: https://doi.org/10.1016/S0185-1918(17)30038-7
12. Alizadeh, M., & Motallabi, M. (2016). Studying the effect of value added tax on the size of current government and construction government. *Procedia Economics and Finance, 36,* 336-344. doi: https://doi.org/10.1016/S2212-5671(16)30045-4
13. Arsić, M., & Altiparmakov, N. (2013). Equity aspects of VAT in emerging European countries: a case study of Serbia. *Economic Systems, 37*(2), 171-186. doi: https://doi.org/10.1016/j.ecosys.2012.12.003
14. Chugunov, I. Y., & Zhukevych, O. M. (2014). Indirect taxation in a system of economic regulation. *Economic Annals-XXI, 1-2*(1), 61-64. Retrieved from http://soskin.info/userfiles/file/2014/1-2_2014/1/Chugunov_Zhukevych.pdf (in Ukr.)
15. Litvintseva, T. V. (2012). Reform of value added tax in Russia as part of the development of the tax system as a social institution. *Mezhdunarodnyi bukhalterskii uchot (International Accounting), 230*(32), 41-55. Retrieved from https://cyberleninka.ru/article/v/reformirovanie-naloga-na-dobavlennuyu-stoimost-v-rossii-v-ramkah-razvitiya-nalogovoy-sistemy-kak-sotsialnogo-instituta-1 (in Russ.)
16. de Quatrebarbes, C., Boccanfuso, D., & Savard, L. (2016). Beyond representative households: The macro-micro impact analysis of VAT designs applied to Niger. *Economic Modelling, 57,* 76-92. doi: https://doi.org/10.1016/j.econmod.2016.03.018
17. Tikhonova, A. V. (2019). Mathematical simulation modeling of the income taxation system with the use of Tukey's Q-test. *Ekonomicheskie i sotsialnye peremeny: fakty, tendentsii, prognoz (Economic and Social Changes: Facts, Trends, Forecast), 12*(1), 138-152. doi: https://doi.org/10.15838/esc.2019.1.61.8
18. Goncharenko, L., Tikhonova, A., Melnikova, N., & Malkova, Yu. (2018). Assessment of the Influence of the Current National Economy Development State upon Personal Income Taxation System. *Positive organization - transformation of management culture and strategic management approach: proceedings of the 32nd international business information management association conference (IBIMA), November 15-16, 2018,* Seville, Spain, 2018 (pp. 7982-7989).

Received 25.07.2019
Received in revised form 30.07.2019
Accepted 2.08.2019
Available online 18.09.2019