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Адрес редакции
620002, г. Екатеринбург, ул. Мира, 19, а/я 10
Тел. +7 (343) 375-97-20
E-mail: 5symposium@mail.ru
WEB-SITE: jtr.urfu.ru

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Contact information
19 Mira St., 620002, Yekaterinburg, Russian Federation
Phone +7 (343) 375-97-20
E-mail: 5symposium@mail.ru
WEB-SITE: jtr.urfu.ru

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Редакционная политика

Цели:

- создание информационной площадки для обнародования результатов исследований социально-экономических и иных последствий налоговых реформ и анализ ожидаемых эффектов от преобразований налоговых систем;
- приращение научно-теоретических знаний в области публичных финансов и налогообложения как науки, направленной на поиск новых конструктивных решений в сфере налогообложения;
- разработка комплекса мер практического, организационно-экономического, информационного характера, для повышения эффективности и справедливости налогообложения и налоговых преобразований;
- международное сотрудничество представителей научного сообщества, общественности, бизнеса и государственных органов по совершенствованию налоговых систем.

Стратегические задачи:

- всесторонний анализ международного и отечественного опыта реформирования налоговых систем;
- разработка мер профилактики уклонения от уплаты налогов;
- поддержка междисциплинарного подхода к изучению налогообложения и налоговых реформ;
- взаимодействие ученых различных наук (экономики, математики, социологии и психологии) и практиков с целью совершенствования национальных налоговых систем.

Editorial policy

Objectives:

- creation of an information platform to make public the results of studying socio-economic and other consequences of tax reforms and analysis of the effects of transformations of tax systems;
- growth of scientific and theoretical knowledge in the fields of public finance and taxation as a science aimed at searching new constructive solutions in the taxation sphere;
- development of practical, economic and organizational measures for increasing the efficiency and justness of taxation and tax reforms;
- international cooperation of representatives of the scientific community, the public, the business sector and government agencies in the improving the tax system.

Strategic tasks:

- comprehensive analysis of the national and the international experience in reforming tax systems;
- development of measures to prevent tax evasion;
- support of the inter-disciplinary approach to studying taxation and tax reforms;
- cooperation of scholars of various sciences (economics, mathematics, sociology and psychology) with the aim of improving taxation and tax systems.

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СОДЕРЖАНИЕ

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Journal of Tax Reform

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CONTENTS

DOI 10.15826/jtr.2020.6.3.082 *Original Paper*

Fiscal Effects of Labour Income Tax Changes in Russia

S.G. Belev[1], **N.S. Moguchev**[2], **K.V. Vekerle**[1]
[1] *Russian Presidential Academy of National Economy and Public Administration, Moscow, Russian Federation*
[2] *Gaidar Institute for Economic Policy, Moscow, Russian Federation*
✉ *belev@iep.ru*

ABSTRACT
The purpose of this article is to evaluate the fiscal effects of changes in social contribution rates in Russia for the period 2010–2014, which was marked by significant changes in tax legislation. The consequences of these changes for both the budget system and the labor market still have not been thoroughly studied. As the empirical and theoretical research shows, taxation could influence the labor market in two ways: through the intensive and extensive margin. This study tests the hypothesis about the two kinds of effects of taxation for Russia by using the data of the Russian Longitudinal Monitoring Survey. It is demonstrated that an increase in the social contribution rate causes a decline in labor participation both for women and men. Moreover, an increase in the social contribution rate causes a reduction in the net-of-tax wage level for women and men. The state has already exhausted the opportunities for raising social contributions and pushing the reforms further would mean jeopardizing budget revenues and fiscal sustainability. Generally, an increase in social contributions has had a negative impact on the government's revenues from social contributions and the personal income tax. It can be concluded that in general, the fiscal effects of the reforms were negative rather than positive. We would recommend the government to reconsider the current social contribution rates. Since the labour market is highly sensitive, it is possible to raise tax revenue through other means, thus avoiding adverse effects on public welfare.

KEYWORDS
fiscal effects, labor particapation, tax legislation, tax revenues, labor income taxation, nonlinearity of the tax scale, Heckman procedure, social contributions

JEL H24, H31, J22

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Оценка эффектов изменения налогообложения трудовых доходов в России

С.Г. Белёв[1], **Н.С. Могучев**[2], **К.В. Векерле**[1]
[1] *Российская академия народного хозяйства и государственной службы, Москва, Россия*
[2] *Институт экономической политики имени Е. Т. Гайдара, Москва, Россия*
✉ *belev@iep.ru*

АННОТАЦИЯ
Целью статьи является количественная оценка бюджетных эффектов от изменения ставок страховых взносов за период 2010–2014 гг., который отметился значительными изменениями в налоговом законодательстве. Последствия этих изменений, как для бюджетной системы, так и рынка труда в России до сих пор слабо изучены, в частности, как изменения ставок по страховым взносам повлияли на налогооблагаемую базу. Согласно эмпирическим и теоретическим работам, имеют место два канала влияния налогообложения на рынок

труда: интенсивность труда и участие в рабочей силе. В работе тестируются гипотезы о наличии этих двух каналов. Оценка производится на основе базы данных Российского мониторинга экономического положения и здоровья населения. Получены следующие результаты. При увеличении ставки по страховым взносам участие в трудовой деятельности снижается как для женщин, так и для мужчин. Также при увеличении ставки по страховым взносам чистая заработная плата также уменьшается для женщин и мужчин. В текущих экономических условиях налоговое бремя по страховым взносам уже избыточно, а возможности для повышения ставок страховых взносов не просто исчерпаны, а несут риски для пополнения бюджета и для бюджетной устойчивости. В целом повышение страховых взносов негативно сказалось на поступлениях страховых взносов и налога на доходы физических лиц. Бюджетные эффекты от проведённых реформ следует признать отрицательными. В качестве рекомендации следовало бы пересмотреть величину ставок по страховым взносам. В условиях высокой чувствительности рынка труда возможно обеспечить большую пополняемость бюджета без создания негативных эффектов на уровень общественного благосостояния.

КЛЮЧЕВЫЕ СЛОВА
бюджетные эффекты, участие на рынке труда, налоговое законодательство, налоговые поступления, налогообложение труда, нелинейность налоговой шкалы, процедура Хекмана, страховые взносы

1. Introduction

Even though employer is the formal taxpayer of social contributions from the perspective of tax legislation, a part of the tax burden could be shifted to employees. It happens when the net wage (earned by an employee) becomes smaller because of a new tax is introduced or the rate of the existing tax is raised. Social security contributions are deducted from the gross wage when calculating the net wage, which is why social contributions used to be viewed as a private case of labor taxation [1–6]. Moreover, in OECD reports on tax statistics[1], social contributions are considered when calculating the "tax wedge" indicator. Between 2010 and 2014, there were some serious changes in the rates of social contributions in Russia. These reforms were primarily driven by the government's desire to boost its fiscal revenues and therefore to have the source for financing a pension increase. For example, in 2010 the basic social contribution rate was raised from 26% to 34% in 2011. Afterwards, in 2012 it was lowered to 30% and at the same time the rate after the threshold was increased to 10%. These changes seem to be inconsistent, as if the Russian government by trial and error was trying to find the optimal social contribution schedule. However, the consequences of these changes for both the budget system and the labor market in Russia are still poorly understood. It is still not quite clear how the changes in social contributions rates affected the tax base.

The purpose of this study is to develop approaches that can help assess the fiscal effects caused by changes in social contributions rates in Russia. On one hand, the fiscal revenues from social contributions were growing in 2010–2014 (from 5.3% of GDP in 2010 to 6,3% of GDP in 2014). On the other hand, the shortage of fiscal revenues from the personal income tax (measured as a share of GDP) in 2011–2012[2] could be probably connected with the growth in social contribution tax rates due to the common tax base (labor income). To test this hypo-thesis, one should isolate the effect of the changing rates from other factors.

Thus, there are several hypotheses which will be accepted or rejected depending on the results of this study:

– the above-mentioned increase in social contribution rates in 2010–2014 caused (*ceteris paribus*) the decline in fiscal re-

[1] OECD Tax Database: Explanatory Annex, Part 3: Social Security Contributions; 2019.

[2] The period of the most dramatic increase in labor income tax burden of 2010–2014.

venues from the personal income tax and social contributions;

– this decline was a result of the elastic (to tax rates) tax base;

– the shrinking tax base occurred due to the drop in labor particapation and the cutback of net-of-tax wages

If these hypotheses are not rejected, it means that the main goal of these tax reforms had not been achieved. Moreover, it brings us to the discussion of what more effective changes in labor income tax schedule could be.

The structure of this paper is as follows. Our literature review deals with the theoretical literature in order to identify the channels of influence of income taxation on the labor market and with empirical works in order to determine possible methods for quantitative assessment of the effects of labour income taxation.

The section "Data and Methodology" describes the main changes in the collection of social contributions in Russia in 2010–2014. Based on the constructed theoretical model, we derived the specification of the econometric equation for assessing the elasticity of the labor supply at the rate of social contributions. Our estimates rely on the data from the Russian Longitude Monitoring Survey (RLMS).

The following sections present our econometric assessment of the effects and interpretation of the results of analysis.

2. Literature review

The peculiarity of social contributions in Russia lies in the fact that there is a rather weak connection between social contributions and social benefits that an employee or a self-employed person is entitled to if an insurance case occurs. Therefore, it is expedient to consider social contributions as a form of tax, in fact, it is important to highlight the gratuitous nature of these payments. Thus, social contributions, along with the personal income tax, are taxes on labor income.

The development of the scholarly interest in labor taxation began precisely with the effects related to the intensity of labor (e.g. high-income tax rates create incentives to work and earn less). In particular, the key point of interest is the elasticity of the labor income tax base [7]. Early studies focused on tax rate changes such as the factor of labor supply and demand [8; 9]. The estimation of labor supply and demand, however, poses several problems. The first one appears because the use of microdata still demonstrates little variation in hours of work[3], which is why studies based on microdata (like this paper) estimate the elasticity of labor income but not that of labor supply (or demand) measured in hours of work, as in [10]. According to this approach, the variation in efforts of an employer with fixed working time corresponds to the variation in wages [11].

However, dealing with the studies examining the effects of labor taxation, we should keep in mind that the decision about whether to work or not can also be endogenous with respect to changing tax rates. This problem has received little attention, because the early studies [7–9] considered the supply of labor of men who were supposed to have a low elasticity of participation, which is why the literature often neglected the effects associated with labor participation [12]. The main problem in analyzing the effects of labor force participation is that it is necessary to consider individuals who are not currently working [13; 14]. Consequently, it is impossible to determine the characteristics that are important for the analysis, for example, the level of labor income [15]. At the same time, the exclusion of those people who do not work can lead to the problem of non-random selection, which leads to a significant bias in the estimates of elasticities [16]. In the academic literature, this econometric problem could be solved by using non-random selection models (censored regression). This approach is widely used in labor market studies (for example, in [16–18]). The pioneering work in this respect was [19], which for the first time investigated selection bias as the authors proposed a censored regression methodology. Subsequently, this approach was

[3] Little variation in hours of work is the story typical of microdata, but not microdata.

implemented many times to obtain unbiased estimates of elasticities.

Another problem is the nonlinearity of the tax scale (for example, progressive or regressive personal income taxes). In this case, the estimates of elasticity would be biased due to the two-sided connection between tax rate and labor income. For example, the more income one has, the higher marginal tax rate will be applied in the case of progressive tax schedule. It means that not only does labor income depend on the tax rate, but the tax rate depends on labor income [20; 21]. In [11], it was proposed to add to the equation a variable characterizing the displacement of the budget constraint (so-called virtual income).

The last but not least is the problem of heterogeneity of elasticity among different sociodemographic groups (differences due to gender [22], to age and level of education [23], to marital status and number of children [24], to distribution of income [25]). The solution is to use sociodemographic characteristics as control variables or to cluster the sample according to some of them. The effect is usually the most heterogeneous due to gender [18; 22].

Summing up, the estimation of the effects of the labor income tax rate on the tax base should be divided into two components:

1) The magnitude in labor intensity (intensive margin) associated with how much more / less individuals began to work.

2) The magnitude of participation in the labor force (extensive margin) associated with an individual's decision to work or not.

3. Data and methodology

As a point of departure for our analysis, we are going to use the model from [15] and add social contributions. This model is a modification of the classical problem of the choice between the level of leisure and consumption. Modification of this model consists primarily in the fact that one of the parameters of the utility function is not the number of hours worked but the labor income. Thus, the individual's utility function is defined as follows:

$U = U_{(C;\, LI)}$ is the utility of an individual, and

$$\frac{\partial U}{\partial C} > 0;$$

C is the level of consumption of an individual;

LI is the labor income of an individual.

Since $LI = w \cdot l$, where is the hourly wage and l the number of working hours, this individual's utility function is not monotonic in variable LI.

Now let us formulate an optimization problem for an individual who would like to conceal some of their income to pay less taxes. The individual maximizes his utility in accordance with the budget constraint, which implies the possibility of tax evasion. Moreover, it is important to note that concealment occurs simultaneously – the invidivual evades social security contributions and income tax (1).

$$\begin{cases} U_{(C;\, LI)} \to \max\left(C;\, LI\right) \\ C = NLI + LI + \\ + \underbrace{\left[T^{inc}_{(LI)} - T^{inc}_{(LI^{rep})}\right]}_{\substack{\text{benefits from personal} \\ \text{income tax evasion}}} + \underbrace{\left[T^{soc}_{(LI)} - T^{soc}_{(LI^{rep})}\right]}_{\substack{\text{benefits from social} \\ \text{contributions evasion}}} \end{cases} \quad (1)$$

NLI is the individual's nonlabor income;

$T^{inc}_{(X)}$, $T^{soc}_{(X)}$ are social functions of taxation of labor income in the amount of X for personal income tax and social benefits, respectively;

LI^{rep} is the declared labor income, where $LI^{rep} \le LI$.

In this formulation of the model, it is obvious that with a constant (actual) gross wage, all the benefits from evasion are received by the employee. In this case, the welfare of the employer does not decrease, since, by understating the base, the employee actually does not work less than in the situation without evasion, and the employer does not care who will receive the payments: the state (in the case of non-evasion) or the employee (in the case of evasion). However, with a decrease in actual net wages, the benefits will be distributed between the employee and the employer.

It is important to note that parameter LI^{rep} is not fully endogenous, since the possibility of evasion is largely determined by the existing system of institutions, the specifics of the industry and the enterprise where an individual works. We are going to provide empirical evidence to support this premise further in this paper. Let us take the public sector as an example. As much as a public sector employee wants to evade taxes, he is unable to do so. In addition, evasion is often not an individual's deliberate choice, but a condition of recruitment. This situation is especially typical of the cases when the labor market is not entirely competitive. Therefore, in this model, parameter LI^{rep} will be considered exogenous with respect to the individual's decision.

The solution to this optimization problem is equivalent to maximizing the following function (2):

$$\mathcal{L}_{(C;\,LI;\,\lambda)} = U_{(C;\,LI)} + \\ +\lambda\left\{\begin{array}{c} C - NLI - LI - \\ -\left[T^{inc}_{(LI)} - T^{inc}_{(LI^{rep})}\right] - \left[T^{soc}_{(LI)} - T^{soc}_{(LI^{rep})}\right] \end{array}\right\} \rightarrow (2) \\ \rightarrow max(C;\,LI;\,\lambda).$$

The system of equations (3) follows from the necessary condition for an extremum:

$$\left\{\begin{array}{l} \dfrac{\partial\mathcal{L}}{\partial C} = \dfrac{\partial U}{\partial C} + \lambda = 0 \\ \dfrac{\partial\mathcal{L}}{\partial LI} = \dfrac{\partial U}{\partial LI} + \lambda\left\{-1 - \tau^{inc}_{(LI)} - \tau^{soc}_{(LI)}\right\} = 0 \\ \dfrac{\partial\mathcal{L}}{\partial\lambda} = C - \underbrace{\left\{\begin{array}{c} NLI + LI + \\ +\left[T^{inc}_{(LI)} - T^{inc}_{(LI^{rep})}\right] + \\ +\left[T^{soc}_{(LI)} - T^{soc}_{(LI^{rep})}\right] \end{array}\right\}}_{TI} = 0 \end{array}\right. , \quad (3)$$

TI is the total income of an individual.

Equation (4) follows from the solution of the system of equations (3):

$$MRS_{LI.C} = \frac{MU_{LI}}{MU_C} = \frac{\partial U \diagup \partial LI}{\partial U \diagup \partial C} = \\ = -1 - \tau^{inc}_{(LI)} - \tau^{soc}_{(LI)}, \quad (4)$$

$MRS_{LI.C}$ is the marginal rate of replacement of labor income by consumption;

$$\tau^{inc}_{(LI)} = \frac{\partial T^{inc}_{(LI)}}{\partial LI}$$

is the marginal income tax rate;

$$\tau^{soc}_{(LI)} = \frac{\partial T^{soc}_{(LI)}}{\partial LI}$$

is the marginal rate of social contributions.

Thus, the equilibrium level of labor income is an implicit function of the marginal rates of income tax, social contributions and total income: $LI^* = LI^*_{(1+\tau^{inc}_{(LI)}+\tau^{soc}_{(LI)};\,TI)}$. Since between 2010 and 2014 in Russia only the system of social contributions was reformed, the differential of function $LI^*_{(1+\tau^{inc}_{(LI)}+\tau^{soc}_{(LI)};\,TI)}$ will look the following way (5):

$$dLI^* = \frac{\partial LI^*}{\partial(1+\tau^{soc})} \cdot d\tau^{soc} + \frac{\partial LI^*}{\partial TI} \cdot dTI. \quad (5)$$

To transform this equation so that it can be interpreted in terms of elasticities, we are going to divide both of its sides by LI^*, multiply each term on the right-hand side and divide by the corresponding variable of the numerator's differentia. The result is the following equation (6):

$$\frac{dLI^*}{LI^*} = \zeta^I \cdot \frac{d\tau^{soc}}{(1+\tau^{soc})} + \eta^I \cdot \frac{dTI}{TI}, \quad (6)$$

$$\zeta^I = \frac{1+\tau^{soc}}{LI^*} \cdot \frac{\partial LI^*}{\partial(1+\tau^{soc})}$$

is the elasticity of labor income (before personal income tax is withheld) to the marginal rate of social taxation;

$$\eta^I = \frac{TI}{LI^*} \cdot \frac{\partial LI^*}{\partial TI}$$

is the elasticity of total labor income to the total income of an individual.

I index in the designation of elasticities means that these elasticities refer to estimates of the effects of labor intensity (intensive margin). The value of elasticity ζ^I will reflect the effect of replacing labor with leisure. From equation (6), the following specification for econometric model (7) may be obtained:

$$\ln LI = \alpha^I + \zeta^I \cdot \ln(1+\tau^{soc}) + \\ + \eta^I \cdot \ln TI + \epsilon^I. \quad (7)$$

It is important to note that this approach is consistent with the analysis of the impact of taxation in the case of a non-

linear scale, since there is a marginal rate in the regression equation, which depends on the amount of labor income.

Now let's look at the effects on labor force participation. When deciding whether to work at all, an individual is also guided by labor income taxation, more specifically, he makes a conditional comparison of utility in the case when he has a job and when he doesn't. If we formalize this comparison mathematically and use the optimal solution LI^* obtained above, the comparison is carried out between the following expressions (8):

$$U\left(\underbrace{NLI+LI^*+\left[T^{inc}_{(LI^*)}-T^{inc}_{(LI^{rep})}\right]+\left[T^{soc}_{(LI^*)}-T^{soc}_{(LI^{rep})}\right]}_{TI=C^*};\ LI^*\right) \sim U\left(\underbrace{NLI}_{TI^0};\ 0\right), \quad (8)$$

TI^0 is the total income of a non-working individual.

Thus, the decision to participate in labor force is an implicit function of total income and optimal labor income, excluding personal income tax deduction. In [15], the decision to participate in labor force also depended on nonlabor income since in the theoretical model in this article, nonlabor income was taxed on an equal basis with labor income. Due to the specifics of social contributions, nonlabor income is not included in the tax base. Therefore, it is enough to restrict ourselves to the use of total income, which coincides with the nonlabor income for non-working individuals. In addition, the presence of total income and labor income means indirect inclusion of nonlabor income in the model. In turn, the optimal labor income from the previous analysis is $LI^* = LI^*_{(1+\tau^{soc}_{(LI)};\ TI)}$. Consequently, an individual's decision to participate in labor force can be represented as follows (9):

$$W = W_{(TI:LI^*)} = \\ = W_{(TI;\ LI^*_{(1+\tau^{soc}_{(LI)};\ TI)})} = W_{(TI:1+\tau^{soc}_{(LI)})}, \quad (9)$$

$$W = \begin{cases} 1, & \textit{if the individual is working} \\ 0, & \textit{if the individual is not working} \end{cases}.$$

Since our goal is to estimate the probability of labor participation, expression (9) can be reduced to the following form (10):

$$P_{(W=1)} = \mathcal{F}_{\left\{TI:1+\tau^{soc}_{(LI)}\right\}}, \quad (10)$$

$P_{(W=1)}$ is the probability that the individual will work;

$\mathcal{F}$ the probability distribution function.

Depending on the choice of function $\mathcal{F}$, the logit and / or probit of the binary choice model will be built. There is an econometric procedure for adjusting estimates for possible non-random selection error.

The change in working status can be divided into two terms. Let us write out the differential of function (11):

$$d\mathcal{F} = \frac{\partial \mathcal{F}}{\partial(1+\tau^{soc})} \cdot d\tau^{soc} + \frac{\partial \mathcal{F}}{\partial TI} \cdot dTI. \quad (11)$$

Now we will carry out the same mathematical transformations as with equation (5) to interpret the equation in terms of elasticities. As a result, we get the following expression:

$$\frac{d\mathcal{F}}{\mathcal{F}} = \zeta^E \cdot \frac{d\tau^{soc}}{(1+\tau^{soc})} + \eta^E \cdot \frac{dTI}{TI}, \quad (12)$$

$$\zeta^E = \frac{1+\tau^{soc}}{\mathcal{F}} \cdot \frac{\partial \mathcal{F}}{\partial(1+\tau^{soc})}$$

is the elasticity of the probability of a person's labor force participation at the marginal rate of social contributions.

$$\eta^E = \frac{TI}{W} \cdot \frac{\partial W}{\partial TI}$$

is the elasticity of the probability of a person's labor force participation by his total income.

E index in the designation of elasticities means that these elasticities refer to estimates of the effects of labor force participation (extensive margin). The value of elasticity ζ^E will reflect the effect of substitution of labor for leisure in the limiting case. Since the explained variable is discrete (binary), it is necessary to use probabilistic discrete choice models to evaluate the effects.

The analysis will use the panel data from the Russia Longitudinal Monitoring Survey – Higher School of Economics for 2010–2014. There are two RLMS databases: individual survey results and household survey results. This structure is extremely important for the study, since, to assess the effects of labor income taxation, it will be necessary to supplement the data

on individuals with the characteristics of households.

From the model specification it follows that we need data on how much money an individual receives as wages. The RLMS questionnaire contains the question of how much money a person has received as a wage at the main place of work over the past 30 days, net of tax. Equation specification includes labor income, excluding personal income tax payments. But since the personal income tax rates have not changed over the period, this data can be used as the actual labor income, because the effect of the personal income tax will go into the constant of the equation. In addition, similar data are available for the second place of work. The main explanatory variable is the marginal social contribution (tax) rate. The tax base is the annual payroll.

The actual annual payroll was determined as follows:

$$\frac{Net\ sallary}{100\% - income\ tax\ rate} \cdot 12\ months.$$

According to the Russian tax legislation, social contribution rates depend on the industry in which an individual works. The RLMS database contains data on the industries of the first and second jobs. In accordance with the tax legislation, each industry was assigned its own tax schedule by using the RLMS codifier for each year. Thus, having determined the actual annual payroll and the industry where an individual works, each observation was assigned its own marginal tax rate.

Next, we need to decide on the variable of the aggregate income of an individual. Despite the fact that the theoretical model should use his total income by analogy with the empirical strategy, [15] used the total income of the household minus the labor income of the individual himself, since he is supported by the funds of the entire household. It is also advisable to include this variable in the model since the decision about how much to work may depend on whether other members of the household are employed or not. For example, all other things being equal, an individual's incentives to work are, on average, higher when other members of the household are not working or receive low wages, since more money is needed to support the family. If we include the total household income in the model, it will take into account this situation. This variable is contained in the RLMS for households. Thanks to the structure of the databases, it is possible to relate an individual to his/her household. In addition to the main explanatory variables, the model also needs to include control variables. These variables should reflect the characteristics of the individual himself, his household and the characteristics of the place of work. As a standard set of control variables characterizing an individual, we use gender, age, education, work experience, and marital status. As characteristics of the household, we will use the data on the total number of members, the number of dependents (it includes children under 18 as well as people of the retirement age and older).

In addition, the intensive margin is influenced by the factors associated with regional differentiation and the specifics of work. Therefore, it is worth including into the model the characteristics of the place of work and residence as control variables. First, it is worth adding a dummy variable indicating the type of settlement – city or village. In the RLMS there is a more detailed differentiation – a regional center, city, urban-type settlement, and village. In order not to overload the model with dummy variables, this parameter was transformed: a regional center was taken as a city, and an urban-type settlement as a village. Also, in the RLMS database there are data on the number of employees of a firm or enterprise where an individual works. This variable is interpreted as the size of a firm. In order to include it in the model, we have matched the codes of industries from the RLMS with those from the All-Russian Classifier of Types of Economic Activity (RCEAP) database (Appendix 1). All variables measured in rubles are converted into real terms (in prices of 2014).

It is worth noting that, if the declared income is included in the model as a dependent variable, it will allow us to esti-

mate the effect of labor intensity, taking into account possible tax evasion.

We chose the period of 2010–2014 because this was the time of the most significant changes in tax legislation in terms of social contributions. Figure 1 shows the dynamics of changes in the marginal rates of social contributions corresponding to the general tax regime. In addition to the general regime, tax legislation provides preferential treatment for employees in specific industries. In the given period, these mostly were workers in agriculture, IT and mass media. Thus, additional variation in the explanatory variable is provided by a person's transition from one industry to another.

As you can see (Fig. 1), the largest increase in tax rates was recorded in 2010–2011. In addition, changes in tax legislation also affected the thresholds. The dynamics of the thresholds, starting from the changes in the marginal rate, is presented below (Fig. 2).

Thus, we can observe a relatively high variation in social contributions' rates, which will allow us to obtain more accurate estimates of the elasticity of the labor supply. Our assessment of the elasticity of labor will help us determine to what extent the dynamics of revenue from social contributions is explained by the reforms in the field of labor taxation, namely, by changes in social contributions.

The non-linearity of the taxation scale creates additional difficulties in evaluating equation (7). In this case, it is not enough to use only the marginal rate as a regressor, since for individuals whose labor income is above the threshold of the main rate of social contributions the marginal rate could remain the same but the budget constraint will change its form because this individual would have to pay more

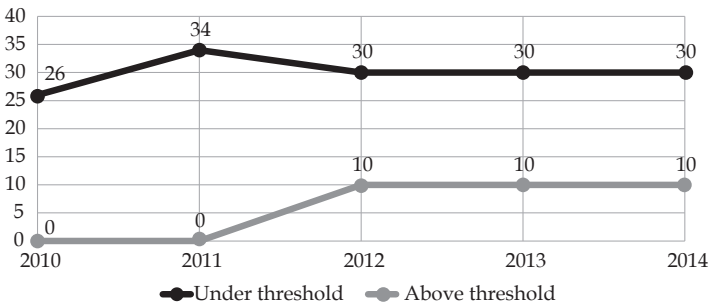

Fig. 1. **Changes in marginal social contribution rates**

Source: compiled by the authors based on the information from the Tax Code of the Russian Federation as amended for the corresponding year

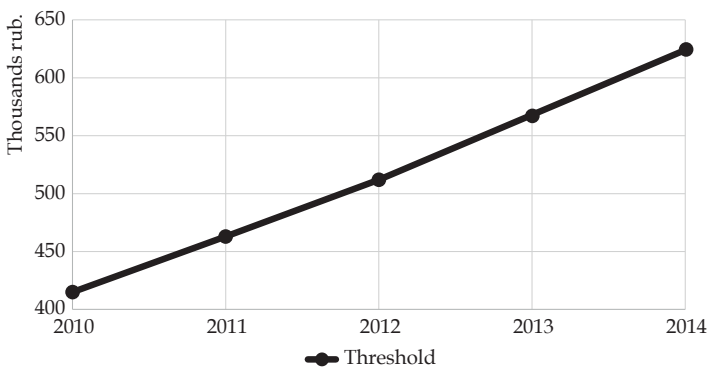

Fig. 2. **Changes in thresholds for determining the marginal social contribution rate**

Source: compiled by the authors based on the information from the Tax Code of the Russian Federation as amended for the corresponding year

because of the rise in the main rate. In this paper, we have included virtual income in the variable of total household income.

4. Results

Let us proceed to assessing the effects of labor force participation in the elasticity of the tax base resulting from the changes in labor taxation (extensive margin and intensive margin, respectively). We also need to take into account the possible problem of non-random selection caused by the unobserved characteristics of the potential place of work for non-working individuals.

Considering the econometric estimation of the probability of an individual entering and/or staying in the labor market, we must make certain assumptions concerning unobservable characteristics of his potential place of work. Salary is a key parameter in our analysis since the marginal rate of social contributions depends on its size. Taking into account the distribution of workers by wage (for a significant part of workers the amount of their wages will be below the first threshold), it is advisable to assume that the amount that workers who are going to enter the labor market will earn is below the first threshold, all other things being equal (their preferences are biased towards leisure). As a substantiation of this premise, we can cite the data on the median wages calculated by using the Rosstat data (Fig. 3). The figure below reflects the significant difference between these values. This means that at least a half of the workforce receives net wages below the given threshold. It is important to note that this gap is quite large, therefore, much less than a half of these workers receive salaries that exceed the threshold values. Since non-working individuals, on average, other things being equal, have lower earning abilities and / or a relatively higher opportunity cost of leisure time. Therefore, we assign to non-working individuals a tax rate that corresponds to incomes below the threshold. Thus, the dependent variable is the probability of an individual entering the labor market, and the variable of interest is the marginal rate of social contributions.

Heckman's procedure [19] assumes at the first step an assessment of the probability of going to work depending on the marginal tax rate on social contributions. The table below (Table 1) presents the results of evaluating the effect of labor force participation. As can be seen from the estimates, the probability of going to work is statistically significantly influenced (negatively) by the marginal rate of social contributions. This result is consistent with theoretical concepts. Even though formally the employer is the taxpayer, the actual tax burden is redistributed between the employer and the employee.

As a result, with an increase in the rate of social contributions by 1%, the probability of going to work decreases by 3.14% for women and by 2.98% for men.

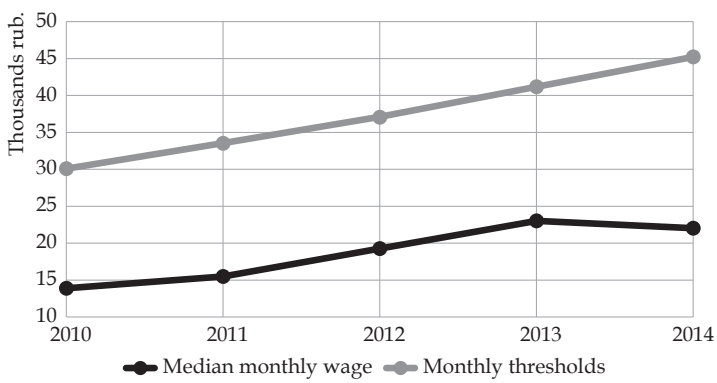

Fig. 3. **Comparison of the median wage and monthly thresholds of the social contribution tax scale**

Source: compiled by the authors based on the information from the Tax Code of the Russian Federation as amended for the corresponding year

It should be noted that women are more sensitive to an increase in tax rates, which is also consistent with the results of many studies discussed earlier. This result can be explained from the point of view of the theory of opportunity costs. Women tend to do most of the housework and they also take a more active part in caring for children, so the opportunity costs of going to work are much higher for them. Thus, this result is consistent with the differentiation of social roles by gender. Moreover, there is a difference in the signs of the coefficients with a variable marital status.

In addition, one should pay attention to the fact that it is not the regression coefficients themselves to be interpreted, but the slope coefficients which show the marginal effect for an average person in the sample. The signs for the control variables are also consistent with the previous theoretical and empirical research. The share of correctly predicted observations serves as an indicator of the quality of the model. In general, we can see that the binary choice models are built with a fairly high percentage of correctly predicted observations.

Table 1

Assessment of "the first step" in Heckman procedure (evaluating the probability of an individual entering the labor market)

Dependent variable: the individual participates/doesn't participate in labor force				
Regressors	**Women (18 and over)**		**Men (18 and over)**	
	Estimates	**Average Slope**	**Estimates**	**Average Slope**
Constant	−3.510*** (0.109)		−1.901 *** (0.126)	
Log. 1 + marginal social contribution rate	−3.135 *** (0.153)	−1.114	−2.982 *** (0.156)	−1.169
Log. the total household income excluding the individual's labor income	−0.073 *** (0.006)	−0.025	−0.083 *** (0.007)	−0.032
Education level, years	0.131 *** (0.005)	0.047	0.081 *** (0.006)	0.032
Family status	−0.167 *** (0.016)	−0.060	0.492 ** (0.023)	0.193
Work experience, years	0.003 ** (0.001)	0.001	0.002 *** (0.0008)	0.001
Disability	−1.043 *** (0.039)	−0.288	−1.434 *** (0.043)	−0.498
The individual is retired/not retired	−0.333 *** (0.031)	−0.118	−0.600 *** (0.041)	−0.236
Number of dependents, people	−0.163 *** (0.011)	−0.059	−0.034 (0.013)	0.013
Number of family members, people	0.006 (0.007)	0.002	0.015 * (0.009)	0.006
Accommodation in the city	0.127 *** (0.017)	0.045	0.284 *** (0.045)	0.112
Age, years	0.207 *** (0.004)	0.074	0.155 *** (0.045)	0.061
Age2 / 100	−0.244 *** (0.005)	−0.087	−0.192 *** (0.005)	−0.075
Number of observations	39357		24693	
Percentage of correctly predicted observations	78.2%		80.8%	

Source: compiled by the authors based on the information from the Tax Code of the Russian Federation as amended for the corresponding year.

Note – Designations in Table 1: * – significance at 10%; **, at 5%; ***, at 1%. The values in parentheses below the coefficients are standard errors.

After discussing the results of the evaluation of the equation for participation, one can proceed to the estimates of the elasticity of the tax base (Table 2). The dependent variable corresponds to the monthly wage in real terms (2014 was chosen as the base year) received by an employee. We deflated all wages according to regional inflation rates. Rosstat provided the regional data using 2014 as a base year. The specification of the equation includes an individual's labor income, net of personal income tax payments. Since the personal income tax did not change during the period under consideration, these data can be used as the actual labor income, since the effect of the personal income tax will go into the constant of the equation. Our assessment of the regression leads us to the following conclusion: an increase in the rate of social contributions by 1% results in a decrease in net wages by approximately 4.49% and by 4.30% for women and men, respectively. It means that an increase in the social contribution rates causes a decline in the

Table 2

Assessment of "the second step" in Heckman procedure (evaluating the elasticity of net-of-tax wage)

Dependent Variable: Declared monthly wages		
Regressors	**Women (18 and over)**	**Men (18 and over)**
	Estimates	**Estimates**
Constant	7.681 *** (0.074)	8.800 *** (0.078)
Log. 1 + marginal premium rate	−4.486 *** (0.080)	−4.302 *** (0.069)
Log. the total household income excluding the individual's earned income and including virtual income	−0.003 (0.002)	−0.006 *** (0.002)
Education level, years	0.111 *** (0.003)	0.060 *** (0.003)
Family status	−0.058 *** (0.010)	0.152 *** (0.012)
Work experience, years	0.001 (0.001)	0.001 *** (0.000)
Disability	−0.241 *** (0.036)	−0.358 *** (0.044)
The individual is retired/not retired	0.027 (0.019)	0.029 (0.026)
Number of dependents, people	−0.036 *** (0.001)	−0.013 * (0.007)
Number of family members, people	0.028 *** (0.005)	0.034 *** (0.005)
Accommodation in the city	0.183 *** (0.011)	0.217 *** (0.012)
Age, years	0.052 *** (0.003)	0.041 *** (0.003)
Age 2 / 100	−0.067 *** (0.004)	−0.060 *** (0.004)
Log. The size of the enterprise in which the individual works	0.071 *** (0.003)	0.074 *** (0.002)
λ – Heckman	0.076 *** (0.008)	0.021 *** (0.007)
Number of observations	39357	24693
Standard model error	0.625	0.629

Source: compiled by the authors based on the information from the Tax Code of the Russian Federation as amended for the corresponding year.

Note – Designations in Table 1: * – significance at 10%; **, at 5%; ***, at 1%. The values in parentheses below the coefficients are standard errors.

tax base. The signs at the control variables are also consistent with the previous emprirical results. The significance of the λ – Heckman variable should be highlightedt, since it indicates the statistical significance of the bias because of the non-random selection and, therefore, the expediency and necessity of using a censored regression (Heckman's procedure).

These estimates take into account the problem of non-random selection and thus enable us to assess the fiscal effects of the changes in social contribution rates, net of other factors. Special attention should be paid to the significance of the overwhelming number of variables, which also indirectly indicates the relatively good quality of the econometric models.

5. Discussion

In this study we assessed the impact of tax reforms on the economic behavior of individuals in relation to labor activity in Russia for the period 2010–2014. We distinguished between two effects, which, in their turn, reflect three possible reactions of workers to changes in labor income taxation.

The effect of labor intensity shows to what extent the equilibrium value of monthly wages has changed in response to changes in social contribution rates. In general, an increase in the rate of social contributions by 1% led to a reduction in wages by 4.49% for women and by 4.30% for men.

The tables below show the fiscal effects that were calculated on the basis of elasticities (coefficients in regressions at a variable rate of social contributions), namely, increases in tax revenue resulting from reforms of social contributions (Tables 3 and 4). Even though the reforms of labor income taxation 2010–2014 related exclusively to the collection of social contributions, they also influenced the revenue from the personal income tax, since labour income taxation and social contributions share the same taxable base.

Table 3

The growth of budget revenues in current prices (at the beginning of the period) raised from employees of the private sector, %

Period	Social contributions				Income tax			
	1	2	3	4	1	2	3	4
2010–2011	–8.1	–3.3	–6.1	**–17.5**	–3.2	–0.1	–1.4	**–4.6**
2011–2012	2.5	0.8	–21.3	**–18.0**	1.0	0	–5.8	**–4.8**
2012–2013	–0.1	–0.1	11.2	**11.0**	0	0	4.6	**4.6**
2013–2014	–0.1	0	8.3	**8.2**	0	0	1.2	**1.2**

Calculated by using the data from the RLMS and Tables 1 and 2.

Note – Explanation of notation: 1 – increase in tax revenues raised from people who earned less than the threshold value (intensive margin); 2 – increase in tax revenues raised from people who entered the labor market (extensive); 3 – increase in tax revenues raised from people with wages above the threshold; 4 – the sum of the first three: the total increase in tax revenues.

Table 4

The growth of budget revenues in current prices (at the beginning of the period) raised from employees of the state sector, %

Period	Social contributions				Income tax			
	1	2	3	4	1	2	3	4
2010–2011	–3.6	–0.1	–1.6	**–5.3**	–6.7	–0.1	–0.5	**–7.2**
2011–2012	1.2	0	–6.9	**–5.8**	2.1	0	-4.8	**–2.7**
2012–2013	0	0	11.2	**5.8**	0	0	1.5	**1.5**
2013–2014	0	0	1.4	**1.3**	–0.1	0	0.4	**0.3**

Calculated by using the data from the RLMS NRU-HSE and Tables 1 and 2.

Note – Explanation of notation: 1 – increase in tax revenues raised from people who earned less than the threshold value (intensive margin); 2 – an increase in tax revenues raised from people who entered the labor market (extensive); 3 – increase in tax revenues raised from people with wages above the threshold; 4 – the sum of the first three: the total increase in tax revenues.

In the current institutional environment, the burden from social contributions is already excessive. In other words, the state has already exhausted the opportunities for increasing social contributions and pushing the reforms further would mean jeopardizing budget revenues and fiscal sustainability. The growth in the revenue from social contributions is determined bythe growth in the revenue from public sector institutions, which means, in essence, transferring funds from "one budgetary pocket" to another. Moreover, there may be other factors at play here, unrelated to changes in the schedule of social contributions.

To this it should be added that the increase of social contributions had a negative impact on revenues from the personal income tax, which means that in general, the fiscal effects of the reforms were negative rather than positive.

6. Conclusion

Our hypothesis about the two effects of labour income taxes was confirmed: a 1%-increase in the social contribution rate leads to a 3.0% and 3.1% average decrease in labour participation for men and women, respectively. Moreover, a 1%-increase in the social contribution rate causes a 4.3% and 4.5% average decrease in net-of-tax wages for men and women, respectively.

These results mean that an increase in the social contribution rate has negatively affected the fiscal revenues from social contributions and the personal income tax. The fiscal effects of the reforms appear to be negative rather than positive. Thus, we would recommend the government to revise the social contribution rates. Since the labour market is highly sensitive, it is possible to raise tax revenue through other means thus avoiding adverse effects on public welfare.

The high elasticity of labor participation to the rate of social contributions suggests that it is advisable to reduce the rate of social contributions for low income levels. However, this requires a separate calculation since any decrease in rates for lower levels of income can have a strong effect on income (the so-called mechanical effect of changes in tax rates). At the same time, the more individuals there are in the population with low sensitivity of wages to tax rates on labor income, the higher is the risk that the fiscal effect of this measure will be insignificant.

A decrease in the basic rate of social contributions carries even greater risks of a negative mechanical effect. However, it may be worthwhile to consider a scenario where a reduction in one tax rate will be compensated by an increase in another rate for different groups of taxpayers.

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Information about the authors

Sergei G. Belev – Candidate of Sciences (Economics), Senior Researcher, Gaidar Institute for Economic Policy (3-5, building 1 Gazetny lane, Moscow, 125993, Russian Federation); ORCID: 0000-0003-3962-7428; e-mail: belev@iep.ru

Nikita S. Moguchev – Researcher, Gaidar Institute for Economic Policy (3-5, building 1, Gazetny lane, Moscow, 125993, Russian Federation); ORCID: 0000-0002-2727-6192; e-mail: moguchev@iep.ru

Konstantin V. Vekerle – Junior Researcher, Russian Presidential Academy of National Economy and Public Administration (84 Vernadsky Prospekt, Moscow, 119571, Russian Federation); ORCID: 0000-0002-6828-5802; e-mail: vekerle-kv@ranepa.ru

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Информация об авторах

Белев Сергей Геннадьевич – кандидат экономических наук, старший научный сотрудник Института экономической политики имени Е. Т. Гайдара (125993, Россия, Москва, Газетный пер., д. 3-5, стр. 1); SPIN-код: 8978-7881; ORCID: 0000-0003-3962-7428; e-mail: belev@iep.ru

Могучев Никита Сергеевич – научный сотрудник Института экономической политики имени Е. Т. Гайдара (125993, Россия, Москва, Газетный пер., д. 3-5, стр. 1); SPIN-код: 5073-6578; ORCID: 0000-0002-2727-6192; e-mail: moguchev@iep.ru

Векерле Константин Владимирович – младший научный сотрудник Российской академии народного хозяйства и государственной службы (119571, Россия, Москва, проспект Вернадского, 84); SPIN-код: 5408-9576; ORCID: 0000-0002-6828-5802; e-mail: vekerle-kv@ranepa.ru

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Anti-Crisis Fiscal Measures in the European Union during the COVID-19 Pandemic and their Impact on GDP

V.V. Karpova[1], **V.F. Tischenko**[1], **V.N. Ostapenko**[1], **Yu.B. Ivanov**[2]
[1] *Simon Kuznets Kharkiv National University of Economics, Kharkiv, Ukraine*
[2] *Research Centre for Industrial Problems of Development of the National Academy of Sciences of Ukraine, Kharkiv, Ukraine*
✉ *vladavika@gmail.com*

ABSTRACT
The aim of this study is to analyze the connection between anti-crisis fiscal measures adopted by EU governments in response to the COVID-19 pandemic and these countries' GDP growth. The study relies on methods of statistical analysis, including cluster analysis, to examine the challenges of forecasting tax revenue collections during the COVID-19 pandemic. It is possible to make preliminary conclusions regarding the relationship between fiscal anti-crisis measures in EU countries and these countries' GDP growth even in the absence of the actual data. The study has revealed variations in forecast GDP growth caused by a higher than usual degree of uncertainty. The best way to minimize such variations is to constantly monitor the situation and adjust the forecast estimates depending on the changes in the relevant factors. The variations in forecast estimates can also stem from adjustments for the changes in tax revenues of EU countries implementing fiscal anti-crisis measures. Most EU countries resorted to such instruments as deferral of certain tax payments, temporary tax breaks, reduction of tax rates, tax loss carryforwards, cancellation or reductions of social contributions. The European leaders in terms of anti-crisis fiscal measures are the Czech Republic and Ireland – these countries used four out of five instruments and were followed by Austria, Hungary and the UK, which used three instruments. We also analyzed the coefficient of tax elasticity for European countries and demonstrated that tax reliefs (tax preferences) influence the level of tax revenue. The hypothesis that there is an indirect connection between the anti-crisis fiscal measures and GDP growth was confirmed. It is shown that clusters of EU countries grouped depending on their anti-crisis fiscal measures do not coincide with the clusters of countries grouped depending on their GDP growth estimates. Thus, a tentative forecast can be made that the fiscal anti-crisis measures taken by EU countries will not have a direct impact on their GDP growth.

KEYWORDS
fiscal anti-crisis measures, tax relief, tax preferences, tax revenue, GDP, coefficient of tax elasticity

JEL H12, H20, H21, H22, H68

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Фискальные антикризисные меры в Европейском Союзе в условиях распространения COVID-19: оценки влияния на ВВП

В.В. Карпова[1], **В.Ф. Тищенко**[1], **В.Н. Остапенко**[1], **Ю.Б. Иванов**[2]
[1] *Харьковский национальный экономический университет им. С. Кузнеца, Харьков, Украина*
[2] *Научно-исследовательский центр индустриальных проблем развития Национальной академии наук Украины, Харьков, Украина*
✉ *vladavika@gmail.com*

АННОТАЦИЯ
Цель исследования – провести анализ взаимосвязи принятых в условиях распространения COVID-19 фискальных антикризисных мер и показателя валового

внутреннего продукта в странах Евросоюза. В исследовании применяются методы статистического анализа, в том числе кластерного анализа, и рассматривается вопрос: в чем сложность прогнозирования налоговых поступлений в условиях пандемии COVID-19? Результаты исследования показали, что до получения фактических данных возможно сделать предварительные выводы относительно взаимосвязи принятых в странах ЕС фискальных антикризисных мер в ответ на COVID-19 на показатель ВВП. Были выявлены отклонения в прогнозах показателей ВВП, обусловленные факторами неопределенности, наилучшей мерой нивелирования которых является постоянный мониторинг и пересмотр прогнозных показателей в зависимости от влияния изменяющихся факторов. На отклонения в прогнозах могли повлиять в том числе корректировки, вызванные изменениями показателей налоговых поступлений, обусловленные предпринятыми странами Евросоюза фискальными антикризисными мерами. Среди этих мер чаще всего использовались такие инструменты как отсрочка уплаты налогов, временные налоговые льготы, снижение ставок налогов, перенос убытков, отмена/снижение социальных взносов. Было выявлено, что лидером среди стран по принятию антикризисных фискальных мер являются Чехия и Ирландия, которыми задействованы 4 инструмента антикризисных мер из пяти рассматриваемых. Австрия, Венгрия и Великобритания использовали 3 инструмента. Проведен анализ коэффициента эластичности налогов в разрезе стран Евросоюза. Показано, что на показатель налоговых поступлений оказывают влияние налоговые льготы (преференции). Подтверждена гипотеза о существовании косвенной связи между принятыми антикризисными фискальными мерами и показателем ВВП. В то же время показано, что кластеры стран Евросоюза, сгруппированных по признаку принятых антикризисных фискальных мер не совпадают с кластерами стран ЕС, сгруппированных по изменению прогнозов ВВП. Сделан предварительный прогноз, что фискальные антикризисные меры, предпринятые в странах Евросоюза, не окажут прямого влияния на изменение показателей ВВП.

КЛЮЧЕВЫЕ СЛОВА
фискальные антикризисные меры, налоговые льготы, налоговые преференции, налоговые поступления, валовый внутренний продукт, коэффициент эластичности налогов

1. Introduction

The COVID-19 pandemic has changed the world in many ways and severely disrupted the global economy. The leading experts are unanimous in their predictions that the pandemic will have a negative impact on national economies, the only thing that differs is the scale of this negative impact.

What complicates the situation even more is the lack of reliable information in the key parameters that can be used to estimate the impact of the pandemic on national economies and on the global economy in general. First of all, it is difficult to predict the duration of the pandemic since after a short-term decline in the number of cases, a new resurgence has started again and the governments have to adapt flexibly to these constantly changing conditions. Moreover, we do not have the reliable data on the efficacy of Covid-19 vaccines yet, which means that vaccination is by no means certain to become a panacea for the spread of coronavirus. New COVID-19 flare-ups create difficulties for predicting accurately when the pandemic will have run its course.

Therefore, the pandemic creates a higher-than-usual degree of uncertainty around economic forecasting. In order to minimize the difference between the predicted and actual data, analysts use multiple scenarios, which can differ considerably from each other.

The European Union (EU) took vigorous action to tackle the negative effects of the pandemic in such spheres as health care, economy, research, border mobility, etc. The documents regulating these policies are available on the official EU website[1].

[1] List of key documents. Available at: https://eur-lex.europa.eu/content/news/index.html.

The European Commission monitors the economic indicators affected by these measures and adjusts the initial forecasts accordingly, which allows us to make some preliminary estimates of the impact that European countries' anti-crisis measures had on their GDP. A key role in this respect is played by fiscal anti-crisis measures, which can have short-term as well as long-term economic effects.

These effects are quite complex and can be found in different spheres, which is why they can be difficult to evaluate. It would be appropriate to use the amount of tax revenues (both short- and long-term) as the key indicator for our analysis. However, the first data on collections for specific types of taxes will be available only after the tax revenue data for 2020 are processed, which will happen later than usual due to delayed tax filing deadlines.

Nevertheless, it is already possible to make the first preliminary estimates by using the available data from interim reports, which leads us to chose GDP growth in EU countries as the main indicator.

The aim of this study is to analyze the connection between the anti-crisis fiscal measures adopted by EU governments in response to the COVID-19 pandemic and these countries' GDP growth.

We have formulated two opposite hypotheses:

Hypothesis 1. The fiscal anti-crisis measures taken by EU countries have a direct or indirect influence on indicators of GDP.

Hypothesis 2. The fiscal anti-crisis measures taken by EU countries have no influence on indicators of GDP.

The paper is structured as follows. The second section reviews the research literature on the effects of fiscal policies on macro-economic indicators. The third section describes our research methodology and hypotheses. The fourth section contains our calculations and analysis of the coefficients of tax elasticity for EU countries. The fifth section analyzes the problems of forecasting the changes in the economic indicators during the pandemic by focusing on the case of GDP. The sixth section presents a statistical analysis of fiscal measures used by EU countries to tackle the pandemic-induced crisis. The seventh section describes the results of clustering of EU countries according to their anti-crisis measures and the projections of GDP growth. The final section contains our conclusions and outlines the avenues for future research.

2. Literature review

There is a vast body of research on the relationship between fiscal policies and macro-economic indicators. For example, I. Loukianova et al. [1] proposed and confirmed the hypothesis that the fiscal and monetary policies working together can have a synergistic effect on economic growth and that at certain stages one of these policies prevails over the other.

Fundamental studies of various economic, social, political and philosophical problems, including those related to the sphere of taxation, were conducted by F. Knight [2]. J. Mirrlees [3] conducted research in the domain of welfare economics, taxation theory, government spending, contract theory, theories of growth and development economics.

W. Niskanen [4] analyzed the effects of voting rules, progressive taxation and the length of the fiscal horizon of democratic governments.

A. Philippopoulos [5] conducted an empirical study of the role and efficiency of the public sector, public policy regulating labour relations and wages, privatization, fiscal policy and financial stability.

V. Vishnevsky and A. Polovyan [6] considered the difficulties of substantiation of fiscal and monetary measures used to regulate an emergent economy with the help of evolutionary modelling methods. The results of their computational experiments have shown that the success of economic regulation depends on the initial state of the institutional environment. From the perspective of evolutionary economics, a fiscal policy applied in emerging markets retains its regulatory capacity, and therefore requires further reforms in the context of the 'new reality' based on the global value chains.

P. Nijkamp and J. Poot [7] used a sample of 93 published studies, yielding 123 meta-observations, to examine the robustness of the evidence regarding the effect of fiscal policy on economic growth and found that the evidence for a positive effect of conventional fiscal policy on growth is rather weak.

N. Gemmell et al. [8] suggest that previously estimated 'long-run' growth effects of fiscal policy are typically achieved quickly, consistent with results from short-run models. In principle, these short-run effects 'persist' while in practice, regular fiscal policy changes in OECD countries mean that persistent increases or decreases in growth rates are rare.

Ch. Erceg et al. [9] presented a systematic analysis of the short-run effects of trade policies that are equivalent in a frictionless economy, namely a uniform increase in import tariffs and export subsidies, an increase in value-added taxes accompanied by a payroll tax deduction, and a border adjustment of corporate taxation. The authors concluded that an increase in import tariffs and export subsidies is likely to elicit a much smaller response of the exchange rate than required for "full insulation" to hold, so that expenditure-switching effects show through to higher output. This output stimulus is largely driven by the export subsidy whereas tariffs tend to have a negligible or even contractionary effect on output [9, p. 37].

R. Boadway [10] charts the evolution of optimal tax analysis and discusses the lessons it holds for tax policy. He describes the theoretical challenges posed by recent findings in such fields as behavioral economics and social choice and considers how optimal tax analysis might adapt to these new paradigms.

Sh. Anwar showed that tax decentralization is a pre-requisite for sub-national credit market access. In countries with highly centralized tax bases, unrestrained credit market access by subnational governments poses a risk for macro stabilization policies of the national government as the private sector anticipates a higher level government bailout in the event of default and does not discount the risks of such lending properly [11, p. 40].

C. Romer and D. Romer investigated the causes and consequences of changes in the level of taxation in the postwar United States and concluded that despite the complexity of the legislative process, most significant tax changes have a dominant motivation that fits fairly clearly into one of four categories: counteracting other influences on the economy, paying for increases in government spending (or lowering taxes in response to reductions in spending), addressing an inherited budget deficit, and promoting long-run growth. The last two motivations are essentially unrelated to other factors influencing output, and so policy actions taken because of them can be used to estimate the effects of tax changes on output [12, p. 799].

S. Folster and M. Henrekson conducted an econometric panel study on a sample of rich countries covering the 1970–1995 period and concluded that when the rich country sample is extended to non-OECD countries, both government expenditure and taxation are negatively associated with economic growth [13, p. 15].

S. James et al. [14] analyze a range of manifestations of simplification in taxation, including tax systems, tax law, taxpayer communications and tax administration. A. Laffer et al. [15] have demonstrated that elimination or lowering of excessive tax burden on the level of individual states in the USA boosts economic growth and prosperity.

There is a number of seminal works devoted to tax reforms in a time of crisis: for example, R. De Mooij, G. Nicodème analyze the impact of bank levies or the financial activities tax (FAT) imposed on the financial sector, whose introduction was considered as a possible response to the financial crisis by the European Commission and IMF [16].

J. Alworth and G. Arachi [17] analyze the strengths and weaknesses of various fiscal initiatives, including limitations on the tax advantages to debt financing, special taxes on the financial sector and financial transactions taxes.

E. Engen and J. Skinner [18] found evidence of modest effects, on the order of 0.2 to 0.3 percentage point differences in growth rates in response to a major tax reform. Nevertheless, according to these authors, even such small effects can have a large cumulative impact on living standards.

M. Piqué and J. Martín [19] provide evidence of delayed adverse effects of the fiscal policy in Spain on the rate of growth of public spending and on the growth rate of GDP. The authors demonstrate that the delayed effects of the rate of decline in public investment have a negative impact on economic growth.

Z. Yang [20] analyzed the heterogeneous responses to the changes in the policy of budget decentralization introduced as a part of the 1994 tax reform in China and showed the non-linearity of these responses. The impact of decentralization of revenues and expenditures on economic growth was different across the three key sectors. Interestingly, this measures had the biggest influence on the secondary sector. The author also demonstrated that there is an inverted U-shaped dependency relationship between the degree of decentralization of revenues and expenditures and the growth in the secondary sector.

A. Alesina and F. Giavazzi [21] analyze how fiscal policy after a financial crisis focuses on the effects of fiscal stimuli and increased government spending. They also discuss the merits of alternate means of debt reduction through decreased government spending or increased taxes and investigate how the short-term political forces driving fiscal policy might be balanced with aspects of the long-term planning that governs monetary policy.

C. Cottarelli et al. [22] examine the fiscal vulnerabilities before a financial crisis, the composition of fiscal stimulus packages in countries with developed and developing economies.

J. Shemrod [23] analyzes the fiscal policy during the period of economic downtown of 2008–2009, concluding that public finance economists need to better integrate the economic analysis of taxation with the concerns and expertise of macroeconomists, finance economists, and accountants.

J. Brondolo [24] investigates different aspects of businesses declaring tax losses during an economic crisis to find that tax losses present a growing compliance risk and that tax authorities should give greater attention to verifying doubtful claims.

O. Blanchard and D. Leigh [25] analyzed questions of forecasting tax revenues such as the relationship between growth forecast errors and planned fiscal consolidation during the period of crisis. They found that in advanced economies, stronger planned fiscal consolidation has been associated with lower growth than expected, with the relation being particularly strong, both statistically and economically, early in the crisis. Fiscal multipliers turned out to be substantially higher than implicitly assumed by forecasters.

A. Alesina et al. [26] considered the largest cases of fiscal adjustments in the last 25 years in Western Europe and their political consequences. The authors concluded that it is possible for fiscally responsible governments to engage in large fiscal adjustments and survive politically. Fiscal adjustments based upon spending cuts are more successful, that is, they lead to more stable consolidations of the budget and cause less contraction of the economy than tax increases.

M. Hallerberg and C. Scartascini [27] showed that during banking crises, the need for fiscal reforms is generally higher. During electoral periods, increasing taxes becomes highly unlikely, even if the government is facing financing problems. What is more, Hallerberg and Scartaschini argue, politics seems to trump economics: banking crises do not affect the probability of having a reform during electoral times. The presence of an IMF program affects the tax instruments chosen: countries with a program increase the value-added tax, while those without it raise the personal income tax.

By using the case of the USA, J. Mikesell [28] has shown that the nature of changes of the state tax policy can be economically destabilizing: in certain years,

states are highly likely to raise taxes for a number of reasons unconnected to the national policy of aggregate demand. The budget and fiscal policy should be able to counteract this potentially destabilizing force which has nothing to do with the normal federal control.

R. Chirinko and D. Wilson [29] point out the importance of tax incentives and interstate capital flows, which are an essential element of tax competition. Own-state capital formation is substantially increased by tax-induced reductions in the own-state price of capital and is substantially decreased by tax-induced reductions in the price of capital in competitive-states.

G. Crespi et al. [30] investigated the effects of a tax credit scheme for promoting firm-level innovation investment in Argentina. Their results suggest that the intervention has been effective in increasing firms' innovation efforts. However, effects vary depending on the type of innovation investment being subsidized, industrial sector, and size of the firm.

A. Easson and E. Zolt [31] found that tax incentives can play a positive role in stimulation of domestic and foreign investsment. In particular they emphasize that incentive programs should be designed in such a way as to minimize the opportunities for corruption in the granting of incentive and for taxpayer abuse in exploiting the tax benefit.

T. Yefimenko [32] argues that a tax system as a strategic instrument of state regulation should include effective mechanisms of taxes and levies as well as tax incentives and preferences aligned with the key expenditure areas, transfers and subsidies.

M. Bonucchi et al. [33] concluded that the overall effects of reducing the corporate tax burden need to be assessed in a macroeconomic equilibrium context accounting for endogenous spillovers and feedback loops across various sectors of the economy. Over the years, temporary tax incentives have made an important contribution to boosting investment and economic activity during downturns. Reductions in tax rates have had a smaller, but permanent effect imposing a minimal burden on economic activity. Temporary fiscal incentives generate important positive economic effects, with long-lasting consequences for economic dynamics and welfare.

B. Kalaš and V. Mirovic [34] found a strong and positive relationship between tax revenue growth and corporate income tax, on the one hand, and the growth in gross domestic product, on the other hand. At the same time these authors argue that personal income tax and social security contributions are weakly related to gross domestic product growth.

A. Pogorleckij [35] demonstrates that the majority of tax regulation programs during the COVID-19 pandemic resemble those that were previously used during other pandemics. A new effect of the COVID-19 pandemic found by A. Porogrleckij for indirect taxation is the proposal of a unification of VAT and excise duties that was put on the international agenda and discussed by the corresponding international tax institutions.

Despite such substantial body of research, however, the connection between economic indicators and fiscal anti-crisis measures still remains a largely underexplored question.

3. Methodology

The study relies on qualitative and quantitative methods. Qualitative methods are applied to describe the essential elements of fiscal anti-crisis measures taken by EU countries in response to the pandemic and to highlight the key characteristics of tax relief.

Quantitative methods are applied to analyze fiscal anti-crisis measures and GDP growth during the pandemic in EU countries. The calculations were made with the help of Excel and Statistica software. The databases for computations were obtained from the EU[2] and IMF websites[3].

[2] European Economic Forecast. Summer 2020 (Interim). Available at: https://ec.europa.eu/info/sites/info/files/economy-finance/summer_2020_economic_forecast_-_statistical_annex.pdf.

[3] International Monetary Fund. Policy responses to COVID-19. Policy Tracker. Available at: https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19#A.

At the first stage of our study, we calculated and analyzed coefficients of tax elasticity for different EU countries.

The coefficient of tax elasticity was calculated according to the following formula:

$$K_{TAX} = \frac{\Delta Tax}{Tax} : \frac{\Delta GDP}{GDP}, \quad (1)$$

where *Tax* is the indicator of total receipts from taxes and social contributions, euro; and *GDP* is gross domestic product, euro.

This indicator reflects the elasticity of tax revenue, showing its response to the changes in the key economic parame-ters such as GDP, per capita income, retail prices, etc. (https://economy-ru.info/info/3945; https://economy-ru.info/info/8070; https://economy-ru.info/info/41018).

Tax revenue can be considered elastic if its percent change causes a comparatively substantial (rapid) percent change in gross domestic product (in absolute terms). In other words, tax revenues are considered elastic provided that $K_{TAX} > 1$.

At the second stage, we analyzed challenges in forecasting economic indicators during the pandemic and focused on the case of gross domestic product.

At the third stage, we conducted a statistical analysis of the efficiency of EU countries' fiscal responses to the COVID-19 pandemic.

At the fourth stage, individual EU countries were clustered in accordance with their fiscal anti-crisis measures and GDP growth forecasts.

4. Analysis of coefficients of tax elasticity for EU countries

To draw preliminary conclusions concerning the relationship between GDP and the indicator "Total Receipts from Taxes and Social Contributions" (and thus to test Hypothesis 1), we calculated the coefficient of tax elasticity (K_{TAX}).

Our analysis of the coefficient of tax elasticity for different EU countries is summarized in Table 1.

Figure 1 provides a graphic illustration of the coefficient of tax elasticity in EU countries.

In almost all European countries, the coefficient of tax elasticity exceeds 1, which signifies the elasticity of tax receipts with respect to GDP growth (Nominal expenditure). However, we believe it is too early to make predictions as to whether this tendency will persist during the pandemic or not.

According to IMF analysts, 'the frequently-used method of forecasting revenue by applying an aggregate tax buoyancy to GDP forecasts is usually reasonably reliable, but often likely to overestimate revenue during the pandemic'. In our view, there is sense in this statement. "The buoyancy is the percent change in total tax revenue resulting from one percent change in GDP. The buoyancy thus reflects both structural features of the economy and tax system and policy measures taken over the cycle. In exceptional times, including in the current pandemic, it is unlikely that the historical relationship remains unchanged. Making projections based on such relationship can thus lead to – often but not always upward – biased projections"'[4].

However, even if we are very cautious in our predictions, the available data still point to the fact that there is a dependency between tax revenue and GDP growth. It could not, therefore, be said that there is no inverse relationship since the level of taxation in a country influences indirectly the consumption of resources. Thus, we can conclude that fiscal policy actions ta-ken in response to the COVID-19 pande-mic and resulting in a decline in tax collections also have an indirect effect on GDP.

5. Forecasts of GDP growth in Europe

As our review of the research literature has shown, the projections of the key economic indicators for the European Union and the world for 2020–2021 have been revised several times.

[4] Challenges in Forecasting Tax Revenue. Special Series on Fiscal Policies to Respond to COVID-19 Available at: https://www.imf.org/en/Publications/SPROLLs/covid19-special-notes.

Table 1

Computation of tax elasticity for EU countries in 2017–2018

Country	Total receipts from taxes and social contributions, Million euro			GDP (Nominal expenditure), Million euro			K_{TAX}
	2017	2018	Variation	2017	2018	Variation	
Austria	156303.70	164481.90	0.0523	370296	385712	0.0416	1.26
Belgium	206670.50	213452.30	0.0328	445957	459532	0.0304	1.08
Bulgaria	15315.60	16690.10	0.0897	52310	56087	0.0722	1.24
Croatia	18510.20	19864.40	0.0732	49094	51625	0.0516	1.42
Cyprus	6625.10	7100.50	0.0718	20040	21138	0.0548	1.31
Czechia	67523.30	74832.40	0.1082	191722	207570	0.0827	1.31
Denmark	136743.50	136191.30	–0.0040	292408	301341	0.0305	–0.13
Estonia	7776.50	8549.80	0.0994	23776	26036	0.0951	1.05
Finland	96990.00	99095.00	0.0217	225836	233619	0.0345	0.63
France	1104771.00	1133347.00	0.0259	2295063	2353090	0.0253	1.02
Germany	1322134.00	1380268.00	0.0440	3244990	3344370	0.0306	1.44
Greece	74467.00	76387.00	0.0258	180218	184714	0.0249	1.03
Hungary	48078.00	50070.10	0.0414	125603	133782	0.0651	0.64
Ireland	68313.00	74024.00	0.0836	297131	324038	0.0906	0.92
Italy	726707.00	739360.00	0.0174	1736593	1766168	0.0170	1.02
Latvia	8424.40	9084.30	0.0783	26798	29056	0.0843	0.93
Lithuania	12477.00	13671.60	0.0957	42269	45264	0.0709	1.35
Luxembourg	22100.80	24594.00	0.1128	56814	60053	0.0570	1.98
Malta	3693.40	4008.20	0.0852	11322	12403	0.0955	0.89
Netherlands	286084.00	300351.00	0.0499	738146	774039	0.0486	1.03
Poland	162895.20	178337.40	0.0948	467313	497590	0.0648	1.46
Portugal	71261.60	75472.20	0.0591	195947	204305	0.0427	1.39
Romania	48343.80	54895.10	0.1355	187773	204640	0.0898	1.51
Slovakia	28819.30	30638.30	0.0631	84521	89606	0.0602	1.05
Slovenia	16113.00	17270.60	0.0718	42987	45755	0.0644	1.12
Spain	400152.00	423153.00	0.0575	1161878	1202193	0.0347	1.66
Sweden	213789.00	208653.10	–0.0240	480026	470673	–0.0195	1.23
United Kingdom	823775.20	845278.10	0.0261	2363109	2423737	0.0257	1.02

Source: compiled by the authors based on Eurostat data.

Purchasing power parities (PPPs), price level indices and real expenditures for ESA 2010 aggregates. Available at: https://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do; Main national accounts tax aggregates. Available at: https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=gov_10a_taxag&lang=en

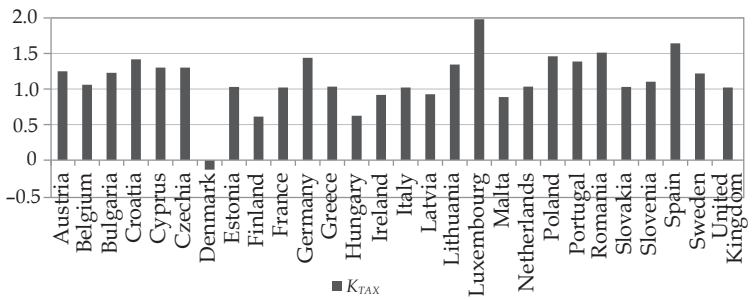

Fig. 1. **Tax elasticities in EU countries in 2017–2018**

Source: compiled by the authors based on Eurostat data

Purchasing power parities (PPPs), price level indices and real expenditures for ESA 2010 aggregates. Available at: https://appsso.eurostat.ec.europa.eu/nui/submitViewTableAction.do; Main national accounts tax aggregates. Available at: https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=gov_10a_taxag&lang=en

According to the IMF, global growth is projected at –4.9% in 2020, 1.9% below the April 2020 World Economic Outlook (WEO) forecast. The COVID-19 pandemic has had a more negative impact on activity in the first half of 2020 than anticipated, and the recovery is projected to be more gradual than previously forecast. In 2021 global growth is projected at 5.4%. Overall, this would leave 2021 GDP some 6.5% lower than in the pre-COVID-19 projections of January 2020[5].

Leading analysts are making cautious predictions concerning the impact of the pandemic on the future of individual countries and global economy in general. For instance, in her report, Isabel Schnabel, Member of the Executive Board of the ECB, pointed out that the revisions to inflation expectations for the coming years have been limited and that any mid-point forecast therefore needs to be taken with a grain of salt[6].

IMF analysts have published guidelines for preparing the 2021 budget by taking into account the pandemic situation[7]. In particular, it is emphasized that, with the 2020 budget execution diverging widely from its projected course amid high uncertainty, budgeting during the crisis becomes a continuous reactive process, placing strains on ministries of finance.

In addition to macroeconomic forecasts for the key economic indicators for 2020 and 2021, the European Commission publishes biannual reports. There are also interim reports with estimates adjusted to the changes in the factors that determine the economic situation.

Between 2019 and August 2020, GDP volume forecasts changed twice (see Table 2).

The indicator "Variation" in the Summer 2020 Forecast in comparison with the Autumn 2019 Forecast shows a considerable degree of variation. It means that in the calculations of GDP growth estimates for 2020 made in the summer of 2020, adjustments were made for a variety of factors, including tax revenues, which are also analyzed by Eurostat[8]. The calculations of tax revenues take into account tax relief offered by EU countries.

Thus, the calculations of forecast GDP growth for 2020 took into account the influence of anti-crisis fiscal measures in EU countries. This aspect can be used for preliminary analysis of the impact of anti-crisis fiscal measures on GDP growth.

Analysis of the variations shows that the most significant changes in the summer forecast in comparison with the autumn forecast were found in the estimates of GDP growth in the following countries: Croatia (–13.4%); Spain (–12.4%); Ireland (–12.0%), France (–11.9%). The smallest variation in predicted GDP values was observed for Sweden (–6.3%), Denmark (–6.7%), Germany (–7.3%), Finland (–7.4%). This fact can be considered as an indirect evidence pointing to the fact that the indicators of the first group of countries were more affected by the pandemic and these countries' response measures (including fiscal measures) than the corresponding indicators of the second group.

If we compare the Summer 2020 Forecast with the Spring 2020 Forecast, we can see that in the former case, the variations are less substantial. The countries that saw the biggest plunge in GDP growth are Portugal (–3.0%), France (–2.4%), and Slovakia (–2.3%).

[5] World Economic Outlook Update, June 2020. Available at: https://www.imf.org/en/Publications/WEO/Issues/2020/06/24/WEOUpdateJune2020.

[6] The ECB's response to the COVID-19 pandemic. Available at: https://www.ecb.europa.eu/press/key/date/2020/html/ecb.sp200416~4d6bd9b9c0.en.html.

[7] Teresa Curristine. Laura Doherty. Bruno Imbert. Fazeer Sheik Rahim. Vincent Tang and Claude Wendling. Budgeting in a Crisis: Guidance for Preparing the 2021 Budget. Special Series on COVID-19. June 29. 2020. Available at: https://www.imf.org/en/Publications/SPROLLs/covid19-special-notes.

[8] Tax revenue statistics. Available at: https://ec.europa.eu/eurostat/statistics-explained/index.php/Tax_revenue_statistics

In 2021, according to Eurostat, the negative impact of the pandemic on GDP will be mitigated and/or overcome and European countries will gradually improve their economic performance (Table 3).

The biggest positive variations in the Summer 2020 Forecast in comparison with the Autumn 2019 Forecast for GDP growth are observed for France (6.4%), Italy (6.4%), Spain (5.7%) and Belgium (5.5%); the smallest variations, for Finland (1.8%), Poland (1.0%), Romania (0.7%), and Sweden (1.7%).

The variations in the forecasts of GDP growth for the summer of 2020 made in spring can be characterized as insignificant. The biggest variations were found in the forecasts for Greece (–1.9%), Sweden (–1.2%), Slovenia (–0.6%) and Germany (–0.6%).

Table 2

Variation of gross domestic product, volume (percentage change in compared to the preceding year), 2020

Country	Autumn 2019 forecast	Spring 2020 forecast	Summer 2020 forecast	Variation Summer 2020 forecast / Autumn 2019 forecast	Variation Summer 2020 forecast / Spring 2020 forecast
1	2	3	4	5	6
Austria	1.4	–5.5	–7.1	–8.5	–1.6
Belgium	1.0	–7.2	–8.8	–9.8	–1.6
Bulgaria	3.0	–7.2	–7.1	–10.1	0.1
Croatia	2.6	–9.1	–10.8	–13.4	–1.7
Cyprus	2.6	–7.4	–7.7	–10.3	–0.3
Czechia	2.2	–6.2	–7.8	–10.0	–1.6
Denmark	1.5	–5.9	–5.2	–6.7	0.7
Estonia	2.1	–6.9	–7.7	–9.8	–0.8
Finland	1.1	–6.3	–6.3	–7.4	0
France	1.3	–8.2	–10.6	–11.9	–2.4
Germany	1.0	–6.5	–6.3	–7.3	0.2
Greece	2.3	–9.7	–9.0	–11.3	0.7
Hungary	2.8	–7.0	–7.0	–9.8	0
Ireland	3.5	–7.9	–8.5	–12.0	–0.6
Italy	0.4	–9.5	–11.2	–11.6	–1.7
Latvia	2.6	–7.0	–7.0	–9.6	0
Lithuania	2.4	–7.9	–7.1	–9.5	0.8
Luxembourg	2.6	–5.4	–6.2	–8.8	–0.8
Malta	4.2	–5.8	–6.0	–10.2	–0.2
Netherlands	1.3	–6.8	–6.8	–8.1	0
Poland	3.3	–4.3	–4.6	–7.9	–0.3
Portugal	1.7	–6.8	–9.8	–11.5	–3.0
Romania	3.6	–6.0	–6.0	–9.6	0
Slovakia	2.6	–6.7	–9.0	–11.6	–2.3
Slovenia	2.7	–7.0	–7.0	–9.7	0
Spain	1.5	–9.4	–10.9	–12.4	–1.5
Sweden	1.0	–6.1	–5.3	–6.3	0.8
United Kingdom	1.4	–8.3	–9.7	–11.1	–1.4

Source: compiled by the authors based on Eurostat data.

European Economic Forecast. Spring 2020. Institutional paper 125 | May 2020. Available at: https://www.politico.eu/wp-content/uploads/2020/05/Spring-2020-Economic-Forecast.pdf; European Economic Forecast. Summer 2020 (Interim). Available at: https://ec.europa.eu/info/sites/info/files/economy-finance/summer_2020_economic_forecast_-_statistical_annex.pdf

6. Analysis of fiscal responses of EU countries to the COVID-19 pandemic

In the majority of countries, tax revenues are crucial for the state budget. We cannot but agree with IMF specialists' opinion that the fiscal policy is at the forefront of the struggle against the pandemic[9]. Fiscal measures can help save lives, protect the most vulnerable social groups and companies from the economic consequences of the pandemic and prevent the countries experiencing health-care crisis from plunging into a deep and prolonged recession. Fiscal policy is going to be one of the primary means of stimulating economic recovery after the end of the lockdown and pandemic.

In this study, we are going to focus on the impact of fiscal anti-crisis measures in EU countries on their gross domestic product. The results of this analysis may prove useful to fiscal policy-makers in the future.

[9] Fiscal monitor reports. Fiscal monitor – April 2020. Reports International Monetary Fund. Available at: https://www.imf.org/en/publications/fm/issues/2020/04/06/fiscal-monitor-april-2020.

Table 3

Variation of gross domestic product, volume (percentage change compared to the preceding year), 2021

Country	Autumn 2019 forecast	Spring 2020 forecast	Summer 2020 forecast	Variation Summer 2020 forecast / Autumn 2019 forecast	Variation Summer 2020 forecast / Spring 2020 forecast
1	2	3	4	5	6
Austria	1.4	5.0	5.6	4.2	0.6
Belgium	1.0	6.7	6.5	5.5	–0.2
Bulgaria	2.9	6.0	5.3	2.4	–0.7
Croatia	2.4	7.5	7.5	5.1	0
Cyprus	0.7	6.1	5.3	4.6	–0.8
Czechia	2.1	5.0	4.5	2.4	–0.5
Denmark	1.6	5.1	4.3	2.7	–0.8
Estonia	2.4	5.9	6.2	3.8	0.3
Finland	1.0	3.7	2.8	1.8	–0.9
France	1.2	7.4	7.6	6.4	0.2
Germany	1.0	5.9	5.3	4.3	–0.6
Greece	2.0	7.9	6.0	4.0	–1.9
Hungary	2.8	6.0	6.0	3.2	0
Ireland	3.2	6.1	6.3	3.1	0.2
Italy	0.1	6.5	6.1	6.4	–0.4
Latvia	2.7	6.4	6.4	3.7	0
Lithuania	2.4	7.4	6.7	4.3	–0.7
Luxembourg	2.6	5.7	5.4	2.8	–0.3
Malta	3.8	6.0	6.3	2.5	0.3
Netherlands	1.3	5.0	4.6	3.3	–0.4
Poland	3.3	4.1	4.3	1.0	0.2
Portugal	1.7	5.8	6.0	4.3	0.2
Romania	3.3	4.2	4.0	0.7	–0.2
Slovakia	2.7	6.6	7.4	4.7	0.8
Slovenia	2.7	6.7	6.1	3.4	–0.6
Spain	1.4	7.0	7.1	5.7	0.1
Sweden	1.4	4.3	3.1	1.7	–1.2
United Kingdom	1.4	6.0	6.0	4.6	0

Source: compiled by the authors based on Eurostat data.

European Economic Forecast. Spring 2020. Institutional paper 125 | May 2020. Available at: https://www.politico.eu/wp-content/uploads/2020/05/Spring-2020-Economic-Forecast.pdf; European Economic Forecast. Summer 2020 (Interim). Available at: https://ec.europa.eu/info/sites/info/files/economy-finance/summer_2020_economic_forecast_-_statistical_annex.pdf

Due to the lack of statistical data, the effects of fiscal measures taken by EU countries in response to the pandemic have not been analyzed yet. However, the IMF has already published descriptive statistics[10] summarizing the key fiscal responses of EU countries (Table 4).

Figure 2 illustrates the fiscal measures undertaken by EU countries in response to the pandemic.

The Czech Republic and Ireland used most of the tax instruments – 4 out of 5. These countries are the leaders in terms of diversity of their anti-crisis fiscal measures. They are followed by Austria, Hungary and the UK (3 out of 5 instruments). The majority of countries resorted to 2 instruments – Belgium, Bulgaria, Cyprus, Finland, France, Greece, Italy, Malta, Poland, Romania, Slovakia, Slovenia, and Spain.

Some countries used only one – Croatia, Denmark, Estonia, Germany, Luxembourg, Netherlands, Portugal, Sweden, while some did not use any at all, for example, Latvia and Lithuania.

Our analysis of EU countries' fiscal policy responses to the COVID-19 pandemic is summarized by Figure 3.

[10] Policy responses to COVID-19. Policy Tracker. Available at: https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19#A.

Table 4

Fiscal responses of EU countries to the COVID-19 pandemic

Country	Deferral of taxes	Reduction of tax rates		Carry forward losses	Temporary tax breaks	Social security contributions (cancellation / reduction)
		VAT	income tax			
Austria	+	–	+	–	+	–
Belgium	+	–	–	+	–	–
Bulgaria	+	+	–	–	–	–
Croatia	+	–	–	–	–	–
Cyprus	+	+	–	–	–	–
Czechia	+	+	–	+	–	+
Denmark	+	–	–	–	–	–
Estonia	–	–	–	–	–	+
Finland	+	–	–	–	+	–
France	+	–	–	–	+	–
Germany	–	+	–	–	–	–
Greece	+	+	–	–	–	–
Hungary	+	–	–	–	+	+
Ireland	+	+	–	+	+	–
Italy	+	–	–	–	–	+
Latvia	–	–	–	–	–	–
Lithuania	–	–	–	–	–	–
Luxembourg	–	–	–	–	+	–
Malta	+	–	–	–	+	–
Netherlands	+	–	–	–	–	–
Poland	+	–	–	+	–	–
Portugal	+	–	–	–	–	–
Romania	+	–	–	–	+	–
Slovakia	+	–	–	+	–	–
Slovenia	+	–	–	–	+	–
Spain	+	+	–	–	–	–
Sweden	+	–	–	–	–	–
United Kingdom	+	+	–	–	+	–

Source: compiled by the authors based on IMF data.

Policy responses to COVID-19. Policy Tracker. Available at: https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19#A.

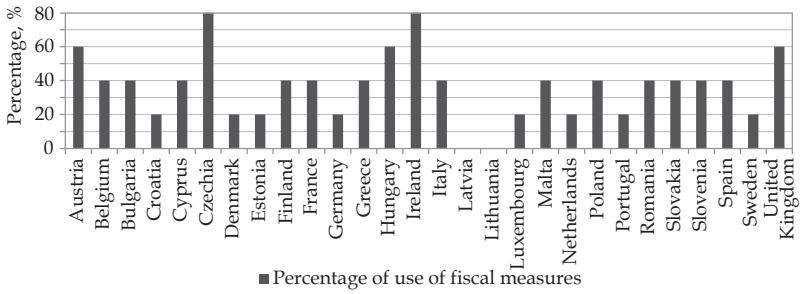

***Fig. 2.* Fiscal responses of EU countries to the COVID-19 pandemic**

Compiled by the authors based on on IMF data
Policy responses to COVID-19. Policy Tracker. Available at:
https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19#A

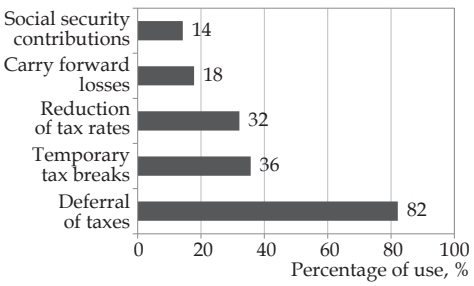

***Fig. 3.* Analysis of fiscal instruments used by EU countries in their policy responses to the pandemic**

Compiled by the authors based on IMF data
Policy responses to COVID-19. Policy Tracker. Available at: https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19#A

Most European countries (82%) resorted to deferral of taxes to cope with the consequences of the COVID-19 pandemic. Other instruments, such as temporary tax breaks (36%) and reduction of tax rates (32%), were used much less frequently. The third group of instruments includes tax loss carryforwards (18 %) and cancellation or reduction of social security contributions (14 %).

The anti-crisis fiscal measures taken by EU countries, including tax reliefs, will result in the decline of tax revenue to these countries' state budgets.

7. Clustering of EU countries depending on the efficiency of their fiscal anti-crisis measures and GDP forecasts

We used cluster analysis to show the connection between fiscal anti-crisis measures and GDP forecasts. Figure 4 illustrates clustering of EU countries depending on the direction of their fiscal policy responses.

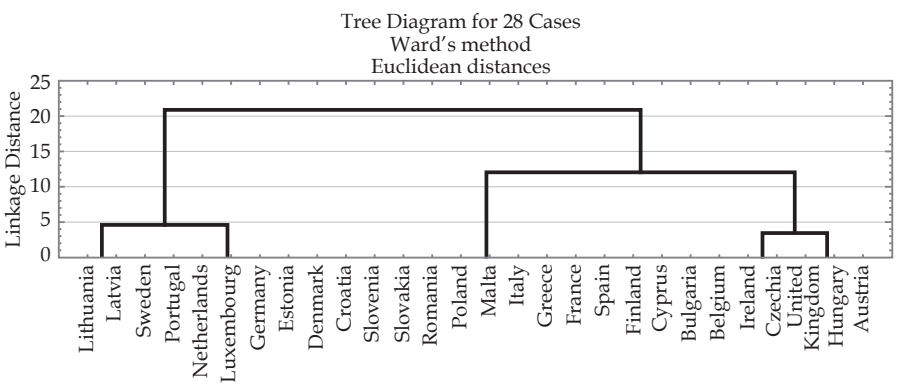

***Fig. 4.* Dendrogram of hierarchical clustering of EU countries depending on the direction of their fiscal policy responses**

Compiled by the authors based on IMF data
Policy responses to COVID-19. Policy Tracker. Available at:
https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19#A

Table 5 illustrates how EU countries were grouped into clusters depending on the direction of their fiscal anti-crisis measures.

Table 5

Grouping of EU countries depending on the direction of their fiscal anti-crisis measures

1	Croatia, Denmark, Estonia, Germany, Netherland, Luxembourg, Sweden, Portugal, Lithuania, Latvia	Min = 0; Max = 20
2	Cyprus, Greece, Malta, Bulgaria, Slovenia, Romania, Belgium, Slovakia, Italy, Spain, France, Poland, Finland	Min = 20; Max = 40
3	Austria, Hungary, United Kingdom, Czechia, Ireland	Min = 60; Max = 80

Source: compiled by the authors based on IMF data.

Policy responses to COVID-19. Policy Tracker. Available at: https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19#A.

It should be noted that, in addition to taxation, EU countries implemented active anti-crisis measures in other spheres. Remarkably, those countries that made the most active use of fiscal measures, such as the Czech Republic and Ireland, also implemented a wide range of other anti-crisis measures.

For example, the government of the Czech Republic introduced a fiscal package of CZK 249.3 billion (€9.4 billion, 4.5 percent of GDP)[11]. The Irish authorities announced a comprehensive fiscal package of €24.5 billion (about 14% of GDP), distributed over 2020 and 2021, which includes €20.5 billion in direct support and €4 billion in indirect support.

To analyze the effect of fiscal anti-crisis measures on GDP indicators, we conducted a hierarchical cluster analysis of EU countries by looking at their GDP growth in 2020 (Fig. 5).

[11] Policy responses to COVID-19. Policy Tracker. Czech Republic. Available at: https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19#A.

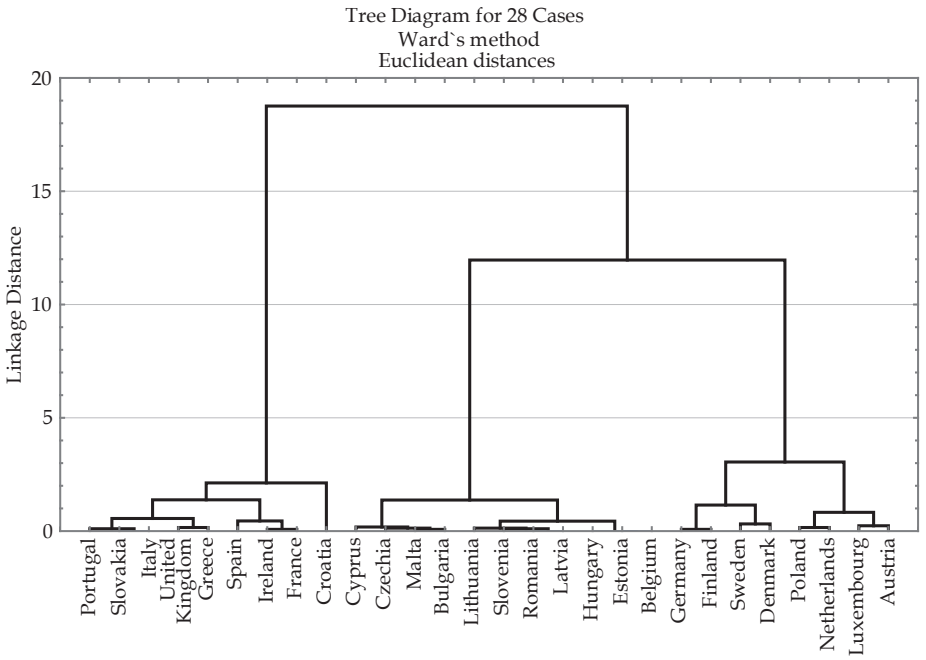

Fig. 5. **Dendrogram of hierarchical clustering of EU countries depending on their GDP growth in 2020**

Compiled by the authors based on IMF data

Policy responses to COVID-19. Policy Tracker. Available at: https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19#A

Table 6 illustrates the allocation of EU countries to clusters depending on their GDP growth in 2020.

Table 6

Grouping of EU countries into clusters depending on their GDP growth in 2020

Cluster	Country	Characteristic
1	Portugal, Slovakia, Italy, United Kingdom, Greece, Spain, Ireland, France, Croatia	Min = –13.4; Max = –11.1
2	Cyprus, Czechia, Malta, Bulgaria, Lithuania, Slovenia, Romania, Latvia, Hungary, Estonia, Belgium	Min = –10.3; Max = –9.5
3	Denmark, Finland, Germany, Sweden, Poland, Austria, Netherland, Luxembourg	Min = –8.8; Max = –6.3

Figure 6 illustrates the clustering of EU countries depending on their GDP growth in 2021.

Characteristics of the clusters are given in Tables 7 and 8.

Table 7

Grouping of EU countries into clusters depending on their GDP growth in 2021

Cluster	Country	Characteristic
1	Romania, Poland, Sweden, Finland	Min = 0.7; Max = 1.8
2	Ireland, Slovenia, Netherland, Hungary, Greece, Latvia, Estonia, Luxembourg, Denmark, Malta, Czechia, Bulgaria	Min = 2.4; Max = 4.0
3	Austria, United Kingdom, Cyprus, Belgium, Slovakia, Italy, Spain, France, Croatia, Germany, Portugal, Lithuania	Min = 4.2; Max = 6.4

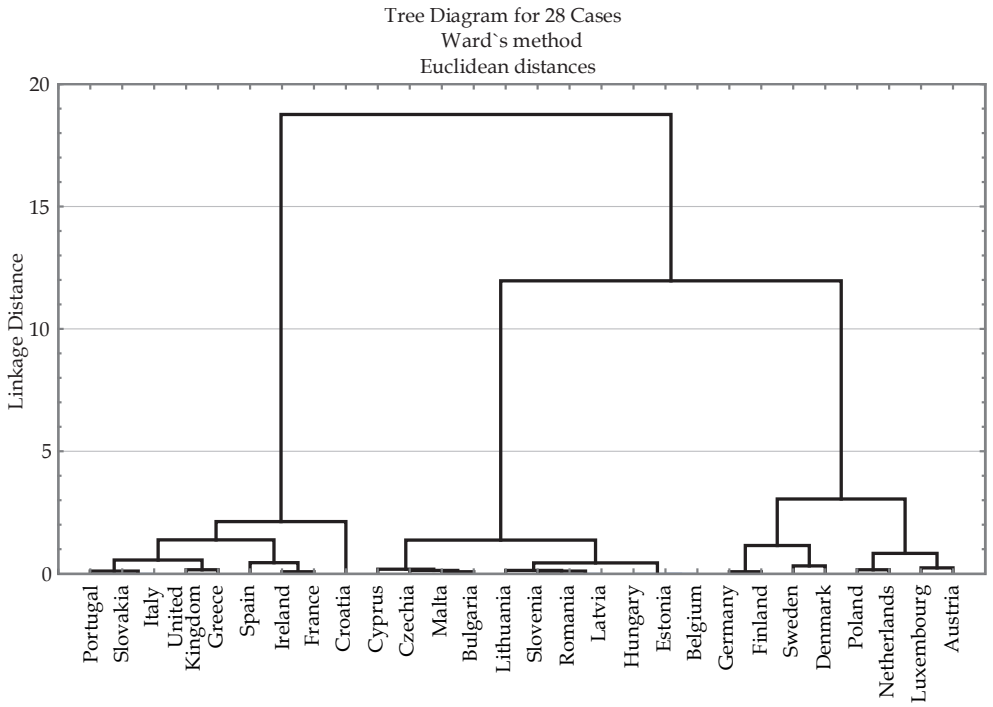

Fig. 6. **Dendrogram of hierarchical clustering of EU countries depending on their GDP growth in 2021**

Compiled by the authors based on IMF data

Policy responses to COVID-19. Policy Tracker. Available at: https://www.imf.org/en/Topics/imf-and-covid19/Policy-Responses-to-COVID-19#A

Table 8

Final results of the cluster analysis of EU countries depending on their fiscal anti-crisis measures and the impact of these measures on GDP growth in 2020–2021

Country	Cluster		
	direction of anti-crisis measures in fiscal policy	change in GDP for 2020	change in GDP for 2021
Austria	3	3	3
Belgium	2	2	3
Bulgaria	2	2	2
Croatia	1	1	3
Cyprus	2	2	3
Czechia	3	2	2
Denmark	1	3	2
Estonia	1	2	2
Finland	2	3	1
France	2	1	3
Germany	1	3	3
Greece	2	1	2
Hungary	3	2	2
Ireland	3	1	2
Italy	2	1	3
Latvia	1	2	2
Lithuania	1	2	3
Luxembourg	1	3	2
Malta	2	2	2
Netherlands	1	3	2
Poland	2	3	1
Portugal	1	1	3
Romania	2	2	1
Slovakia	2	1	3
Slovenia	2	2	2
Spain	2	1	3
Sweden	1	3	1
United Kingdom	3	1	3

Only in 4 countries out of 28 (Austria, Bulgaria, Malta, Slovenia), the results of clustering according to the type and number of anti-crisis fiscal measures coincide with clustering according to the changes in the level of GDP in 2020–2021. Interestingly, these four countries do not belong to the group of countries that implemented anti-crisis fiscal measures most actively.

In view of the above, a conclusion can be made that Hypothesis 1 regarding the direct connection between the anti-crisis fiscal packages implemented by the countries and a drop in economic growth was not confirmed since the results of country clustering have not shown a correlation between their fiscal policy responses and GDP growth.

8. Conclusions

Our study has brought to light challenges in forecasting tax revenue due to the uncertainty surrounding the COVID-19 pandemic. The best way to tackle the problem of variation in forecasts is to monitor the situation and adjust the estimates accordingly.

Our analysis of the coefficient of tax elasticity for EU countries in 2017–2020 has shown a high elasticity of taxes. Although elasticity cannot be considered a reliable indicator for tax revenue forecasts due to the higher-than-usual degree of uncertainty during the pandemic, we can still argue that there is an indirect relationship between fiscal anti-crisis measures in EU countries and GDP growth. Thus, Hy-

pothesis 1 about the indirect connection between fiscal anti-crisis measures and GDP growth is confirmed while Hypothesis 2 is refuted.

We analyzed the variations in GDP forecasts for 2020 and conducted a cluster analysis of European countries, which led us to identify the countries whose forecast estimates of GDP growth are most prone to variation – Croatia, Spain, Ireland and France.

Our analysis of anti-crisis fiscal measures and clustering showed that the countries which made the most active use of such measures were the Czech Republic and Ireland as these countries used 4 instruments out of 5. These are followed by Austria, Hungary and the UK (3 instruments).

Clusters of EU countries that took anti-crisis fiscal measures generally do not coincide with the clusters of countries grouped according to forecast estimates of their GDP growth. At the same time, since GDP forecasts take into account, among other things, changes in tax revenues, which to some extent result from anti-crisis fiscal measures, we could make a tentative evaluation of the relationship between these two indicators.

The countries that are actively implementing fiscal anti-crisis measures (leading to a reduction in tax revenues) are not among those with the most alarming GDP growth figures. Interestingly, the revised GDP projections for such countries do not significantly differ from base ones. This can be explained by the fact that GDP growth is also affected by other indicators, for example, national monetary policies. In our view, this confirms the hypothesis that fiscal anti-crisis measures adopted in EU countries do not have a direct impact on GDP indicators.

It takes time for anti-crisis fiscal measures to produce noticeable effects. However, the projections for those countries that have made the most active use of such measures already demonstrate positive dynamics. Thus, for European governments it would make sense to analyze the experience and achievements of the leading countries in this sphere (the Czech Republic, Ireland and the UK) and add the most efficient instruments to their own anti-crisis packages.

Our study has revealed a non-uniform impact of fiscal policy responses on economic indicators of individual EU countries since, on top of everything else, anti-crisis measures may affect gross national income and thereby EU budget's own resources used to finance different kinds of projects and programs, inclu-ding those aimed at countering the effects of the pandemic. As a result, the EU budget's own resources may decrease, which will inevitably hit national budgets of European countries affected by the pandemic.

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Information about the authors

Vlada V. Karpova – PhD, Associate Professor, Department of Custom and Taxation, Simon Kuznets Kharkin National University of Economics; (Kharkiv, 61166, Ukraine); ORCID: 0000-0003-3712-0391; e-mail: vladavika@gmail.com

Viktoriia F. Tyschenko – Doctor of Economic Sciences, Associate Professor, Head of the Department of Custom and Taxation, Simon Kusnets Kharkiv National University of Economics; Kharkiv, 61166, Ukraine); ORCID: 0000-0001-5924-2061; e-mail: vf_hneu@ukr.net

Viktoriia N. Ostapenko – PhD, Associate Professor, Department of Custom and Taxation, Simon Kuznets Kharkin National University of Economics; (Kharkiv, 61166, Ukraine); ORCID: 0000-0002-4077-5738; e-mail: viktoria.ostapenko@hneu.net

Yuriy B. Ivanov – Doctor of Economic Sciences, Professor, Director of Research Centre for Industrial Problems of Development of the National Academy of Sciences of Ukraine (Kharkiv, 61166, Ukraine); ORCID: 0000-0002-5309-400X; e-mail: yuriy.ivanov.ua@gmail.com

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Информация об авторах

Карпова Влада Викторовна – кандидат экономических наук, доцент кафедры таможенного дела и налогообложения, Харьковский национальный экономический университет имени Семена Кузнеца (61166, Украина, г. Харьков); ORCID: 0000-0003-3712-0391; e-mail: vladavika@gmail.com

Тищенко Виктория Федоровна – доктор экономических наук, заведующая кафедрой таможенного дела и налогообложения, Харьковский национальный экономический университет имени Семена Кузнеца (61166, Украина, г. Харьков); ORCID: 0000-0001-5924-2061; e-mail: vf_hneu@ukr.net

Остапенко Виктория Николаевна – кандидат экономических наук, доцент кафедры таможенного дела и налогообложения, Харьковский национальный экономический университет имени Семена Кузнеца (61166, Украина, г. Харьков); ORCID: 0000-0002-4077-5738; e-mail: viktoria.ostapenko@hneu.net

Иванов Юрий Борисович – доктор экономических наук, профессор, директор Научно-исследовательского центра индустриальных проблем развития Национальной академии наук Украины (61166, Украина, г. Харьков); ORCID: 0000-0002-5309-400X; e-mail: yuriy.ivanov.ua@gmail.com

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The Influence of Taxes on Inflows and Outflows of Foreign Direct Investment

I.M. Drapkin
Ural Federal University named after the first President of Russia B.N. Yeltsin, Yekaterinburg, Russian Federation
✉ *i.m.drapkin@mail.ru*

ABSTRACT
The article discusses the effectiveness of tax incentives for regulation of the level of foreign direct investment inflows (FDI) and outflows in the economy. Theoretically, changes in tax levels should influence both the profitability of investment projects and companies' choice of locations for their production units. At the same time, transfer pricing opportunities in the world economy may neutralize the effects of tax changes on the level of countries' FDI inflows and outflows. The aim of the research is to study empirically the influence of tax levels in countries on bilateral FDI flows. Methodologically, this study relies on regression analysis. Two variables indicating the tax level of the economy are used: the share of total taxes on income, profits and capital gains and share of taxes and social contributions in total government revenues. The database includes observations over 71 recipients and 91 home countries in 2001–2016. The gravity approach is applied to construct the econometric model while the Poisson pseudo maximum likelihood method is used to derive unbiased estimates. The main results of the research are as follows. First, there is a negative relationship between the tax burden and level of FDI inflows to the country. Second, higher taxes lead to an increase in FDI outflows only in the countries with relatively low taxes, while in countries with relatively high taxes the opposite dependence is observed. Third, vertical (efficiency-seeking) FDI are much more sensitive to the level of taxes in the recipient country compared with horizontal (market-seeking) FDI. We have not found any evidence for the positive influence of tax differentials on bilateral FDI. The conclusion is made that tax regulation measures may be an efficient instrument for stimulating FDI inflows to the national economy.

KEYWORDS
foreign direct investment, taxes, tax burden, gravity model, Poisson pseudo maximum likelihood, vertical FDI, horizontal FDI

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Влияние налогов на потоки прямых иностранных инвестиций

И.М. Драпкин
Уральский федеральный университет имени первого Президента России Б.Н. Ельцина, Екатеринбург, Россия
✉ *i.m.drapkin@mail.ru*

АННОТАЦИЯ
Эффективность налоговых мер, направленных на регулирование потоков прямых иностранных инвестиций в экономике является предметом дискуссии. С одной стороны, изменение уровня налогов влияет на рентабельность инвестиционных проектов, а, следовательно, на выбор компанией места для своего производства. С другой стороны, возможности трансфертного ценообразования в современной экономике могут нивелировать влияние налоговых

изменений на потоки прямых иностранных инвестиций в стране. В данном исследовании с помощью эконометрического инструментария дается оценка влиянию уровня налогов на объем межстрановых потоков прямых иностранных инвестиций. В исследовании используются два показателя, отражающих уровень налогов в стране: доля налога на доход, прибыль и прирост капитала в общем объеме государственных доходов, а также доля налогов и социальных взносов в общем объеме государственных доходов. База данных включает наблюдения над 71 страной-импортером и 91 страной-экспортером ПИИ за период 2001–2016 гг. В основе построения эконометрической модели лежит гравитационный подход. Для получения несмещенных оценок используется метод псевдомаксимального правдоподобия Пуассона. В рамках исследования получены следующие основные результаты. Во-первых, уровень налогов в стране-импортере ПИИ обратно пропорционален объему поступающих в страну прямых иностранных инвестиций. Во-вторых, рост уровня налоговой нагрузки ведет к росту объемов оттока ПИИ из страны только для группы стран с относительно низким уровнем налогообложения, для группы стран с высоким уровнем налогообложения наблюдается обратная зависимость. В-третьих, вертикальные (ориентированные на рост эффективности) ПИИ являются гораздо более чувствительными к уровню налогообложения в экономике-реципиенте по сравнению с горизонтальными (ориентированными на внутренний рынок страны) ПИИ. В-четвертых, гипотеза о положительном влиянии разницы в уровне налогообложении стран на потоки ПИИ между ними не получила эмпирического подтверждения. Сделан вывод о том, что меры налогового регулирования способны являться действенным инструментом, направленным на стимулирование притока прямых иностранных инвестиций в национальную экономику.

КЛЮЧЕВЫЕ СЛОВА
прямые иностранные инвестиции, налоги, налоговая нагрузка, гравитационная модель, Пуассоновский метод псевдомаксимального правдоподобия, вертикальные ПИИ, горизонтальные ПИИ

1. Introduction

The role of foreign direct investment (FDI) in the development of countries is very difficult to overestimate. Together with international trade flows, FDI plays an integral part in the global value chains that are the key driver of the world development to date.

FDI affects both the host and home economies. In host economies, FDI increases budget revenues, creates jobs with high productivity, promotes advanced products to the market, brings new technologies, develops specific sectors of activity, changes the competitive environment, etc. In home countries, FDI outflows make national companies more competitive, trigger long-term positive changes in the market structure, and drive the economy to the efficiency frontier. Despite some negative effects of FDI (e. g. loss of the market shares by national companies in recipient economies and job losses in home economies), the increase in both FDI inflows and outflows is considered to be a "win-win-win" game for governments, companies and employees.

The level of taxes in the economy is an important determinant for investment projects implemented within the country and investment of national companies abroad. Intuitively, it is clear that lower taxes in a separate country, leading to a higher rate of return of investment projects, all other things equal, should increase the level of FDI inflows and decrease the level of FDI outflows. At the same time, according to the existing literature, the influence of taxes on FDI inflows and outflows is more complicated than their simple effects on the profitability of investment projects. First, the mechanisms of transfer pricing that legally allow companies to move their taxable profit from high-tax to low-tax countries may neutralize the effects of raising (decreasing) taxes in a separate country. Second, higher taxes often mean a larger amount of public

goods available in the country, which can influence multinationals' decisions to invest in the country. Third, the level of tax burden may lose its significance if the level of the pre-tax profit of the project is higher compared with the alternative project in another country. Generally speaking, the set of demand and supply parameters of an investment project may be much more important than the level of taxes in a particular country. Moreover, theoretically, tax differentials may be just the equalizing outcome of the equilibrium states in the economies with imperfect competition and factor price differentials [1].

The aim of this research is twofold. First, by using the rich dataset on bilateral FDI flow in 71 host and 91 home countries in 2001–2016, we are going to reassess the effect of taxes on the level of FDI inflows and outflows. Second, to study the influence of taxes on FDI flows depending on a set of factors, namely the level of the tax burden in the country, the purpose of FDI and the level of tax differentials.

2. Hypotheses

The hypotheses we are going to test further are as follows.

H1. An increase in the tax burden leads to a decrease in FDI inflows in the economy.

Following the mainstream literature on tax determinants of FDI inflows, we assume that there is a negative relationship between the variables. This negative relationship can be explained by the fact that higher taxes decrease the profitability of investment projects and hence fewer foreign projects will be accepted.

H2. An increase in the tax burden leads to an increase in FDI outflows in the economy.

Two possible explanations support this hypothesis. If a multinational company (MNC) is choosing between exporting and investing into a foreign market, then the increase in the home country's taxes will make it less profitable to export and more profitable to invest. On the other hand, an increase in taxes will stimulate national companies to move their production offshore to the countries with lower costs (including taxes) and supply the home market with the goods produced in another country. In both scenarios, an increase in taxes will lead to an increase in FDI outflows.

H3. Vertical (efficiency-seeking) FDI inflows are more sensitive to the tax level in the recipient economy compared with horizontal (market-seeking) FDI.

In a recipient economy, the motives of FDI are important when the role of taxation is considered. In the case of vertical FDI, multinationals are first of all interested in cutting costs. Therefore, the level of tax burden will play an important role when an MNC chooses the location for its plant. If market-oriented FDI is considered, the decreasing significance of taxes comparing to vertical FDI is expected for two reasons. First, higher taxes are usually imposed in countries with higher incomes of the population and thus, mean higher before-tax profits of the investment projects. Second, since the same statutory taxes are imposed on all companies within one industry in the country, an increase in taxes shouldn't influence the competitiveness of MNCs' investment projects.

H4. FDI inflows in countries with a low tax burden are more sensitive to the tax increase compared with the countries with a high tax burden.

The arguments for this hypothesis are similar to the previous ones. FDI to countries with low taxes is usually efficiency-seeking and more sensitive to an increase in costs. Otherwise, FDI to countries with high taxes is market-seeking and should be less sensitive to the tax increase.

H5. An increase in the tax differentials between the home and host country positively influences the level of FDI inflows.

It is assumed that not only the taxes in FDI home and recipient countries themselves influence FDI inflows but the tax differentials also matter. In other words, a particular recipient economy will attract more FDI from countries with higher taxes and a particular home economy will face larger FDI outflows to the countries with lower taxes, all other thing being equal.

3. Literature review

The research lies in the large field of foreign direct investment determinants. The most popular basis for modeling FDI determinants is the gravity approach because it has both theoretical justification and empirical evidence. For detailed discussion, see, e.g. [2]. The empirical studies of Bevan and Estrin [3], Hejazi [4], Kleinert and Toubal [5], Blonigen and Piger [6] and many others confirm the positive influence of the market size of both home and host countries together with the negative influence of the distance between them on the level of bilateral FDI inflows.

Various determinants of FDI inflows are studied both at national and regional levels. Noorbakhsh et al. focusing on FDI inflows to developing countries show that human capital is one of the key factors that attract foreign direct investment [7]. Based on FDI stock data from eight new EU member states for the period 1998–2004, Riedl argues that the degree of industrial concentration within a country appears to be a significant location factor as well [8]. Botrić and Škuflić, studying the determinants of FDI in south-eastern European countries in 1996–2002, show that FDI depends on the size and growth potential of a national economy, natural resources and quality of workforce, openness to international trade and access to international markets, and the quality of physical, financial, and technological infrastructure [9]. Daude and Stein study the effects of institutions on FDI inflows for 20 OECD home countries. They state that better institutions in the recipient countries have overall a positive and significant effect on FDI [10]. Asiamah et al. estimate determinants of FDI inflows in Ghana and find that a low inflation rate as an indicator of the macroeconomic stability in the recipient country attract higher levels of FDI, all other things being equal [11]. Du et al in their study of FDI inflows in Chinese regions find that regions with higher wages attract larger amounts of FDI [12]. Pearson et al. consider FDI inflows in the USA and observe higher FDI inflows in states with a higher growth rate [13].

There are fewer studies that deal with the factors that influence FDI outflows. Egger discusses the relationship between different types of economic activities in EU member states in 1986–1996 and shows that exporting and FDI outflows substitute each other thus presenting different ways of companies' expansion abroad [14]. Stoian and Mohr show that weak institutions in emerging economies stimulate FDI outflows because national companies are escaping from home country regulative voids [15]. Kayam examines the home country factors that determine the outward foreign investments from 65 developing and transition countries in the 2000–2006. The main findings are that the small market size, trade conditions, costs of production and local business conditions are the main drivers of outward FDI. Proxies for the institutional environment such as bureaucracy, corruption, investment risk are also significant push factors of FDI [16]. Das studies the role of home country determinants for a large sample of developing economies for 1996–2010. The results indicate that a source country's level of economic development, globalisation, political risk and science and technology investments contribute significantly to outward FDI from developing countries [17]. Cieślik and Tran distinguish between horizontal and vertical reasons for FDI. Their estimation results indicate that total market size, skilled-labour abundance, investment cost, trade cost as well as geographical distance between two countries are significant determinants of FDI outflows [18].

The influence of taxes on FDI inflows is studied in different papers. Nielsen et al. in their literature review report 12 papers showing a positive correlation between taxes and FDI inflows; 12 papers, a negative correlation; and 3 papers, no correlation [19]. Klemm and van Parys, using the data on 40 low-income countries for 1985–2004, demonstrate that tax reduction is an important factor for attracting FDI to the country [20]. Biggs, focusing on twenty-one developing countries, shows that tax incentives help increase FDI inflows [21]. Djankov et al., using data on 85 countries, demon-

strate that lower taxes attract investment to manufacturing but not to the service sector [22]. Zee et al. in their research on developing economies show that lower taxes do not encourage FDI inflows [23]. Chai and Goyal report that tax incentives have a limited influence on FDI inflows in the East Caribbean Currency Union [24]. Van Parys and James have found no robust positive effect between tax holidays and FDI attraction in Western and Central African countries [25]. Kinda, using the firm-level data on 30 Sub-Saharan Africa countries, shows that the role of taxes in attracting FDI is not very important [26].

The influence of taxes on FDI outflows is mainly considered in the context of how tax differentials influence bilateral FDI flows. Devereux and Griffith [27], Gorter and Parikh [28], Egger et al. [29] make similar conclusions, namely, that the larger tax differential increases FDI flows between countries. Benassy-Quere et al. report that larger tax differentials lead to higher FDI outflows [1]. There are just a few studies of the effects of tax levels on FDI outflows. Beck and Chaves show that FDI outflows increased together with an increase in the corporate income tax and decreased together with an increase in the labor income tax in 25 OECD countries in 1975–2006 [30]. Fan et al. show that an increase in domestic taxes in China stimulates FDI outflows [31].

To sum up, our literature review has brought to light two important points. First, the tax level in the country is one of the various determinants of FDI inflows and outflows discussed in research literature. In the econometric model of FDI flows, taxes should be considered together with other factors influencing MNCs' choice of location. Second, there is mixed evidence of how taxes influence FDI. Different factors that determine the specific features of this influence should be considered.

4. Econometric model, data and methods

The dependent variable FDI_{ijt} in the econometric model is the volume of FDI inflows to country *i* from country *j* in year *t*.

According to the gravity approach, the size and the distance variables should be included in the econometric model. But when the host and recipient countries' GDP is included as size variables, strong positive correlation between GDP and the tax level in the economies is observed (the largest and developed countries usually set highest taxes). To avoid a multicollinearity problem in the model instead of GDP, GDP per capita of the host ($GDPcap\_imp_{jt}$) and recipient countries ($GDPcap\_exp_{it}$) are used as size variables. The distance variable ($DIST_{ij}$) is calculated as the distance between the capitals of the countries. We expect to observe a positive influence of GDP per capita of both home and recipient economies and a negative influence of the distance on the level of FDI between the countries.

Following the approaches described in existing literature [32; 33], a set of control variables that influence the FDI bilateral flows is included in the model: the inflation rate in year *t* in the recipient economy ($Infl_{it}$), the dummy variable for the common official language in countries *i* and *j* ($Comlang_{ij}$) and the contiguity variable ($Contig_{ij}$). The negative influence of the inflation level and the positive influence of the common official language and the contiguity variable on the FDI inflow level to the recipient country are expected.

The choice of the main explanatory variable is an important issue. The indicators to estimate the tax burden are divided into backward-looking and forward-looking. Backward-looking indicators, e.g. the statutory tax rates or the average tax rates, are based on the observed tax payments. The disadvantage of the backward-looking indicators is the possible endogeneity that arises when future payments are influenced by the previous investment.

Forward-looking indicators can be calculated for a typical investment project on the basis of the rules of the tax base and tax rate. The standard forward-looking indicators used in empirical research are the average effective tax rate and the average marginal tax rate. Since tax systems are not linear, the former indicator may sub-

stantially differ from the latter one. Since these indicators are calculated for a specific way of financing, their drawback is the difficulties in aggregating investment across many projects.

Although in theory, preference should be given to forward-looking indicators, in practice backward-looking indicators may give us more information on the tax system in a particular country [34].

To estimate the influence of tax burdens on the level of FDI flows, two indicators are used: the share of total taxes on income, profits and capital gains in total government revenues in year t ($TaxI_{it}$ and $TaxI_{jt}$) and the share of taxes and social contributions in total government revenues in year t ($TaxSC_{it}$ and $TaxSC_{jt}$). Both indicators are backward-looking and the author doesn't have an opportunity to implement forward-looking indicators in the analysis due to the lack of necessary data.

The database is collected from the open source data: bilateral FDI data, from the OECD official website (https://data.oecd.org); inflation rates and GDP per capita levels, from the World Bank database (https://data.worldbank.org); the distance, common language and contiguity indicators, from CEPII gravity database (https://www.cepii.fr); and the tax level variables, from ICTD/UNU-WIDER Government Revenue Dataset (https://www.wider.unu.edu).

Thus, the estimated regression equation looks the following way:

$$\begin{aligned} FDI_{ijt} = \exp(&\beta_0 + \beta_1 \ln GDPcap\_imp_{it} + \\ &+ \beta_2 \ln GDPcap\_\exp_{jt} + \beta_3 \ln Distcap_{ij} + \\ &+ \beta_4 Infl_{it} + \beta_5 Comlang_{ij} + \beta_6 Contig_{ij} + \\ &+ \beta_7 Tax_{it} + \beta_8 Tax_{jt})\varepsilon_{ijt}, \end{aligned} \quad (1)$$

where β_0 is the constant term, $\beta_1 - \beta_8$ are the estimated coefficients before the regressors, Tax_{it} and Tax_{jt} are the levels of tax burdens in year t in countries i and j respectively, ε_{ijt} is the error term. When applying the Poisson pseudo-maximum likelihood method (discussed below), equation (1) is estimated in an exponential form.

There is a well-known discussion on the choice of the appropriate estimation technique for the data on bilateral FDI flows [32]. First, the data on bilateral FDI flows have a lot of (up to 65%) zero observations. Taking logs of the dependent variable leads to dropping these observations, resulting in a sample selection bias. Second, the heteroscedasticity in the error term is usually observed in the data. Third, some of the regressors may be endogenous in the model.

For the above-described reasons, application of the standard OLS approach to gravity-type data leads to biased estimation results. Although some researchers still include OLS estimates in their analysis for comparison [13; 35], for interpretation of the results most of them use different sophisticated estimation techniques: the dynamic panel generalized method of moments [36], tobit model [37], Hausman-Taylor approach [35], Heckmen two-step procedure [38], etc.

One of the best methods to estimate gravity models of FDI to date is the Poisson pseudo maximum likelihood method (PPML). It was first developed by Silva and Tenreyro [32] to estimate the gravity model of trade, and then applied to FDI flows by Head and Ries [39]. PPML is an interpretation of the generalized method of moments (GMM) from a variety of maximum likelihood methods. In turn, the GMM is often used to correct for bias caused by the endogenous nature of the explanatory variables. Poisson estimator includes observations for which the FDI level is zero. Moreover, PPML is consistent in the presence of fixed effects that are required by the gravity model. For detailed comparison of different estimation techniques of the gravity model see, for example, [2]. Technical details of using PPML methods are described in [40].

5. Estimation results

In this section, we are going to apply the PPML method. The estimates are derived by using clustering standard errors, thus allowing for correlation of the standard errors within the cluster.

The estimation results of equation 1 are presented in Table 1. The signs of the coefficients before the gravity variables

are as expected: we found a positive and statistically significant influence of the economic sizes of the recipient and home economies and a negative influence of the distance between these countries on the level of bilateral FDI inflows. As expected, we found that inflation in the recipient economy negatively influences the FDI inflows. The more similar the countries are, the larger are the FDI flows between them: the coefficients before the contiguity and the common language variables are positive and significant.

Due to the high correlation of *TaxI* and *TaxSC* variables, they are not included simultaneously in the model. The interaction term *TaxI*TaxSC* is added to capture both tax variables in the model (see Model 3 in Table 1). Further, for the sake of brevity, only the interaction term as the tax variable of both home and recipient economies is used. The interaction term *TaxI*TaxSC* is additionally multiplied by 20 to keep the dimension of the coefficients before tax variables. This operation doesn't affect the sign and significance of the explanatory variables.

As Table 1 illustrates, we found a statistically significant negative influence of the tax level in the recipient economy on the level of FDI inflows. This result supports Hypothesis 1.

At the same time, we found no support for Hypothesis 2 concerning the crowding out effects of national investment when taxes increase in the home country. The results of the estimations show the negative influence of the tax level on FDI outflows in home economies.

To make additional analysis of the influence of taxes on FDI outflows, equation 1 is considered separately for high-, medium- and low-tax home countries. Countries are divided into high-, medium- and low-tax based on the analysis of the distribution plots of the tax variables. The estimation results are presented in Table 2. It is observed that an increase in taxes leads to an increase in FDI outflows in the group of countries with low taxes and a decrease in FDI outflows in countries with high taxes. The latter result can be explained by the effect of decreasing competitiveness of the national business in the economies with high taxes. High taxes suppress business activity in the economy and make national business less effective and less competitive in the international markets. This, in turn, causes a decrease in FDI outflows. At the same time, there is the expected crowding out effect of the national investment in the economies with relatively low taxes. Thus, we can say that Hypothesis 2 is partially confirmed.

Table 1

Influence of tax levels in home and host countries on FDI inflows

Variable	Model 1	Model 2	Model 3
GDP per capita host	0.555*** (0.070)	0.550*** (0.056)	0.601*** (0.067)
GDP per capita home	1.314*** (0.058)	1.155*** (0.049)	1.287*** (0.055)
Distance	–0.119*** (0.040)	–0.148*** (0.042)	–0.132*** (0.040)
Inflation host	–0.062*** (0.011)	–0.049*** (0.009)	–0.047*** (0.010)
Common language	0.737*** (0.129)	0.669*** (0.130)	0.621*** (0.132)
Contiguity	0.604*** (0.156)	0.666*** (0.148)	0.642*** (0.151)
Tax on income host	–3.271*** (0.873)		
Tax on income home	–5.533*** (0.811)		
Tax on SC host		–2.004*** (0.532)	
Tax on SC home		–0.716 (0.432)	
*TaxI*TaxSC* host			–0.783*** (0.185)
*TaxI*TaxSC* home			–1.092*** (0.166)
No. obs.	83635	84488	75735

Notation. Hereinafter the standard errors are reported in parentheses; *** $p < 0.01$; ** $p < 0.05$; * $p < 0.1$; constant term not reported.

Source: Authors' own calculations by using Stata.

Table 2

Influence of tax levels in home countries on FDI outflows depending on the tax level

Variable	High taxes home	Medium taxes home	Low taxes me
GDP per capita host	0.605*** (0.097)	0.721*** (0.057)	0.515*** (0.063)
GDP per capita home	0.751*** (0.158)	1.112*** (0.049)	1.223*** (0.075)
Distance	–0.243*** (0.067)	– 0.078 (0.034)	0.002 (0.037)
Inflation host	–0.055*** (0.017)	–0.042*** (0.013)	–0.061*** (0.014)
Common language	0.545*** (0.174)	0.218*** (0.118)	1.075*** (0.118)
Contiguity	0.677*** (0.211)	0.531*** (0.144)	1.024*** (0.177)
*TaxI*TaxSC* host	–0.451 (0.280)	–0.963*** (0.167)	–1.028*** (0.262)
*TaxI*TaxSC* home	–1.421*** (1.873)	0.398 (0.787)	1.792*** (0.596)
No. obs.	11638	12423	51674

Source: Authors' own calculations by using Stata.

To test Hypothesis 3 about the different sensitivity of taxes in case of vertical and horizontal FDI, recipient economies are divided into groups with high, medium and low GDP per capita levels. The World Bank thresholds are used to divide countries into different groups according to their income level. The considerable difference in the value of the coefficient before the tax variable in high (–0.954) and low (–11.382) income countries is observed. Our results support the idea that efficiency seeking FDI is very sensitive to the tax rate in the recipient economy. At the same time, taxes for market-seeking FDI are comparatively less important because all companies supplying a particular market face the same tax burden, and higher taxes are compensated by the higher pre-tax profit for the company. Thus, Hypothesis 3 is confirmed.

To confirm Hypothesis 4 that vertical FDI is more sensitive to the tax level in the recipient economy, the database is divided into groups with high, medium and low taxes in recipient countries (see Table 4). As we expected, the level of taxes in low-tax countries influences FDI inflows more, compared with high-tax countries (the value of the coefficient – 1.056 against the value – 1.670). It should be noted that the difference is quite moderate compared with the difference observed for countries with different income levels.

At the last stage of the estimation procedure, the importance of tax differentials (*TaxDiff*) on bilateral FDI inflows is estimated. In columns 3 and 4 of Table 5 the estimates for the positive (*TDpos*, taxes in the home country are higher than taxes in the host country) and the negative tax (*TDneg*) differentials are reported. Contrary to our expectations, the positive influence of tax differentials on the level of FDI inflows is not observed.

Table 3

Influence of tax levels in host countries on FDI inflows depending on their GDP per capita

Variable	High GDPpc host	Medium GDPpc host	Low GDPpc host
GDP per capita host	0.920*** (0.085)	0.289* (0.171)	1.633*** (0.294)
GDP per capita home	1.250*** (0.063)	1.528*** (0.118)	1.048*** (0.275)
Distance	–0.135*** (0.045)	– 0.129 (0.100)	0.127 (0.193)
Inflation host	–0.064*** (0.015)	–0.086*** (0.014)	–0.107*** (0.036)
Common language	0.516*** (0.144)	1.055*** (0.377)	1.731*** (0.446)
Contiguity	0.651*** (0.162)	1.143*** (0.348)	2.112** (0.910)
*TaxI*TaxSC* host	–0.954*** (0.200)	2.272** (0.964)	–11.382*** (3.103)
*TaxI*TaxSC* home	–0.855*** (0.177)	–2.177*** (0.420)	–2.377*** (0.734)
No. obs.	46911	17814	11010

Source: Authors' own calculations by using Stata.

Column 1 of Table 5 shows the influence of the tax differentials (TD) for the full sample. Hypothesis 5 about the positive influence of tax differentials on bilateral FDI flows is not confirmed. Then the database is divided into two parts with the positive and negative of the tax differential (columns 3 and 4 of Table 5). Although a significant positive influence of TD is observed for the sample of negative TD we can assume that Hypothesis 5 will be true for the case of the positive tax differential, i.e. the case when taxes in the FDI home country exceed taxes in the FDI recipient country. As Column 3 of Table 5 shows, the sign of the coefficient before TD is negative, which means that Hypothesis 5 is not confirmed.

The negative relationship between TD and FDI inflows may be explained by the following. TD in the case of positive differentials reflects the degree of dissimilarity of the countries. When the difference between the countries increases (an equivalent to increase in TD), investors face additional costs of adapting to a foreign country, which leads to a decrease in bilateral FDI flows.

For additional examination of how tax differentials influence FDI inflows, equation 1 is estimated for the subsamples when taxes in the home economy are hig-

Table 4

Influence of tax levels in recipient countries on FDI inflows depending on their tax level

Variable	High taxes imp	Med taxes imp	Low taxes imp
GDP per capita host	0.809*** (0.187)	0.517*** (0.110)	0.459*** (0.073)
GDP per capita home	1.083*** (0.125)	1.359*** (0.078)	1.427*** (0.084)
Distance	–0.180*** (0.070)	–0.098 (0.646)	–0.079 (0.053)
Inflation host	–0.140*** (0.040)	–0.015 (0.019)	–0.062*** (0.013)
Common language	0.942*** (0.196)	0.205 (0.206)	0.974*** (0.173)
Contiguity	0.469** (0.230)	0.632*** (0.224)	1.179*** (0.220)
*TaxI*TaxSC* host	–1.056*** (0.369)	–1.790* (0.936)	–1.613* (0.860)
*TaxI*TaxSC* home	–0.563*** (0.323)	–0.979*** (0.226)	–1.670*** (0.258)
No. obs.	11655	17292	46788

Source: Authors' own calculations by using Stata.

Table 5

Influence of tax levels in recipient countries on FDI inflows depending on the tax level in home countries

Variable	All sample	TDpos	TDneg	Timp < Texp	Timp > Texp
(1)	(2)	(3)	(4)	(5)	(6)
GDP per capita host	0.467*** (0.058)	0.479*** (0.074)	0.570*** (0.102)	0.639*** (0.078)	0.608*** (0.108)
GDP per capita home	1.154*** (0.048)	1.086*** (0.070)	1.227*** (0.068)	0.966*** (0.125)	1.348*** (0.077)
Distance	–0.101** (0.040)	–0.162*** (0.056)	–0.202*** (0.068)	–0.233*** (0.055)	–0.245*** (0.070)
Inflation host	–0.053*** (0.010)	–0.060*** (0.012)	–0.030** (0.015)	–0.052*** (0.011)	–0.028* (0.015)
Common language	0.740*** (0.126)	0.497*** (0.157)	0.711*** (0.183)	0.605*** (0.147)	0.674*** (0.190)
Contiguity	0.583*** (0.152)	0.450** (0.188)	0.105 (0.241)	0.584*** (0.194)	0.146 (0.245)
Tax differential	–0.169* (0.092)	–2.169*** (0.289)	1.614*** (0.301)		
*TaxI*TaxSC* home				–1.291*** (0.307)	–1.355*** (0.277)
No. obs.	75735	33350	41515	45383	41515

Source: Authors' own calculations by using Stata.

her/lower than taxes in the host economy (Columns 5 and 6 of Table 5). As expected, the coefficients before tax variables have a negative sign but no significant difference in their levels is found.

To sum up, our analysis does not confirm Hypothesis 5 concerning the positive influence of tax differentials on bilateral FDI flows.

6. Conclusions

This paper analyzes the influence of taxes on FDI inflows and outflows. The theory doesn't provide us with an unam-biguous answer on how changes in tax burdens in a country influence FDI inflows and outflows. The research literature on the topic provides mixed results.

For the purpose of our research, we used a large dataset of bilateral FDI flows in 91 home and 71 recipient countries in 2001–2016. The resulting econometric model based on the gravity approach and the Poisson pseudo likelihood method is applied to derive unbiased estimates. Two indicators are used as the main explanatory variables in the research: the share of total taxes on income, profits and capital gains in total government revenue and the share of taxes and social contributions in total government revenue.

The main contributions to the existing research are the following. First, we reviewed the previous research results and showed that an increase in the tax burden decreases the level of FDI inflows in the country. Second, we found that higher taxes increase FDI outflows in low-income countries and decrease FDI outflows in high-income countries. The former result is associated with the crowding out effect of the national investment, the latter, with the decline in competitiveness of national companies due to high taxes. Third, it is demonstrated that horizontal (market-seeking FDI) are less sensitive to tax changes than vertical (efficiency-seeking FDI). We haven't found any evidence supporting the hypothesis that an increase in tax differentials leads to an increase in bilateral FDI flows.

The results show that tax policy can be an effective instrument for influencing both FDI inflows and outflows. However, the signs and significance of the effects of tax changes on FDI depend on the country's characteristics: the income level, level of taxes and motives of foreign investors in the country.

The data availability imposes some limitations on the results of the research. The use of firm and/or industry level data may bring some new results to the topic. The forward-looking indicators of measuring tax levels in the country may help obtain more precise estimates. If another country's characteristics that influence FDI inflows and outflows are added to the picture, the quality of the econometric model may be improved. Furthermore, the effects of taxes on FDI flows may be not linear. Future research may take these points into consideration.

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Information about the author

Igor M. Drapkin – Doctor of Economics, Professor at the Department of International Economics and Management, Ural Federal University (19, Mira St., Yekaterinburg, Russian Federation); ORCHID: 0000-0002-5989-8463; e-mail: i.m.drapkin@mail.ru.

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Информация об авторе

Драпкин Игорь Михайлович – доктор экономических наук, профессор кафедры международной экономики и менеджмента, Уральский федеральный университет имени первого Президента России Б. Н. Ельцина (620001, г. Екатеринбург, ул. Мира, 19), ORCID: 0000-0002-5989-8463; e-mail: i.m.drapkin@mail.ru

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The Fiscal Policy of Bulgaria from the Standpoints of the Business Cycle and the Twin Deficits Hypothesis

I. Todorov ✉, **K. Durova**
Southwest University "Neofit Rilski", Blagoevgrad, Bulgaria
✉ *ivank.todorov@swu.bg*

ABSTRACT
Macroeconomic management of a small open economy in a currency board arrangement faces two serious problems: first, under a fixed exchange rate, fiscal policy is the only effective macroeconomic instrument for smoothing out the business cycle; second, the twin deficits phenomenon, if it exists, may jeopardize the stability of the currency board arrangement. This paper uses quarterly seasonally adjusted Eurostat data for the period of 1999–2019, the Hodrick–Prescott filter and a vector autoregression (VAR) to answer the three questions that are of utmost importance to Bulgarian policy-makers: first, is the discretionary fiscal policy of the Bulgarian government procyclical or countercyclical? Second, do the automatic stabilizers in the Bulgarian state budget function properly? Finally, is the twin deficits hypothesis valid for Bulgaria? Our findings imply that the fiscal discretion of the Bulgarian government is procyclical, while the automatic fiscal stabilizers do not work effectively. The first part of the twin deficits hypothesis (the causal link between the fiscal balance and the current account balance) is confirmed but the second part of the twin deficits hypothesis (the positive relationship between the fiscal balance and the current account balance) is rejected for Bulgaria. It may be inferred that both sides of the Bulgarian state budget (revenue and expenditure) need to be improved in order to increase the effectiveness of Bulgaria's fiscal policy. Low budget deficits (not higher than 3% of GDP) are recommended for improving the current account balance and encouraging economic growth.

KEYWORDS
Bulgaria, fiscal policy cyclicality, twin deficits hypothesis, fiscal discretion, automatic fiscal stabilizers

JEL E32, E62, F32, H62

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Фискальная политика Болгарии с точки зрения делового цикла и гипотезы двойного дефицита

И. Тодоров ✉, **К. Дурова**
Юго-Западный университет имени Неофита Рильского, Благоевград, Болгария
✉ *ivank.todorov@swu.bg*

АННОТАЦИЯ
Макроэкономическое управление малой открытой экономикой в рамках механизма валютного регулирования сталкивается с двумя серьезными проблемами: во-первых, при фиксированном обменном курсе фискальная политика является единственным эффективным макроэкономическим инструментом для сглаживания делового цикла; во-вторых, явление двойного дефицита, если оно существует, может поставить под угрозу стабильность механизма валютного управления. С помощью квартальных сезонно скорректированных данных Евростата за период 1999–2019 гг., фильтра Ходрика – Прескотта и векторной авторегрессии (VAR) настоящее исследование пытается ответить на три вопроса, имеющих первостепенное значение для руководителей Болгарии: во-первых,

дискреционная фискальная политика правительства Болгарии имеет проциклический или антициклический характер; во-вторых, сделать функциональными автоматические стабилизаторы в болгарском государственном бюджете; и, в-третьих, верна ли гипотеза двойного дефицита для Болгарии? Результаты исследования показывают, что фискальные полномочия болгарского правительства являются проциклическими, а автоматические фискальные стабилизаторы не работают. Таким образом, для Болгарии первая часть гипотезы двойного дефицита (причинно-следственная связь между бюджетным балансом и балансом текущего счета) подтверждается, но вторая часть гипотезы двойного дефицита (положительная связь между бюджетным балансом и балансом текущего счета) отклоняется. Можно сделать вывод, что обе части болгарского государственного бюджета (доходы и расходы) должны быть улучшены, чтобы повысить эффективность налогово-бюджетной политики страны. Низкий бюджетный дефицит (не более 3% ВВП) рекомендуется для улучшения баланса текущего счета и стимулирования экономического роста.

КЛЮЧЕВЫЕ СЛОВА
Болгария, цикличность налогово-бюджетной политики, гипотеза двойного дефицита, фискальная свобода, автоматические фискальные стабилизаторы

1. Introduction

Macroeconomic managers of small open economies with currency boards cannot use monetary policies but only fiscal policies to mitigate cyclical fluctuations. A fiscal policy, which smoothes out the business cycle, is countercyclical. If a fiscal policy amplifies business cycle fluctuations, it is procyclical. For a small open economy in a currency board arrangement, it is essential to have a properly formulated and carefully implemented countercyclical fiscal policy.

An actual fiscal policy is a combination of an active fiscal policy (administrative discretion) and a passive fiscal policy (functioning of automatic fiscal stabilizers). For example, an actual fiscal balance is a sum of a trend in the fiscal balance (a proxy of active fiscal policy) and a cyclical fiscal balance (a proxy for the work of automatic fiscal stabilizers). Statistical filters can be used to decompose fiscal variables into a direct (discretionary, active) component and a cyclical (passive, automatic) component.

When designing and implementing a fiscal policy, policymakers have to consider the relationship between the fiscal balance and the current account balance. If this relationship is positive and significant, i.e. if an increase in the fiscal deficit leads to an increase in the current account deficit, then the twin deficits hypothesis holds true and fiscal surpluses need to be run to prevent worsening of the current account balance and to maintain the stability of the currency board.

This study relies on the quarterly seasonally adjusted Eurostat[1] data for the period 1999–2019, the Hodrick–Prescott filter and a vector autoregression (VAR) to address the following three questions, which are of huge importance to Bulgarian macroeconomic managers: first, what is the cyclical impact of Bulgarian government's discretionary fiscal policy (procyclical or countercyclical); second, whether the automatic stabilizers in the Bulgarian state budget work or not; and, third, whether the twin deficits phenomenon really exists in Bulgaria.

The study has two goals: first, to estimate the cyclical impact of discretionary and automatic changes in total government expenditure and revenue and, second, to test the validity of the twin deficits hypothesis in Bulgaria. The research has two working hypotheses. The first hypothesis is that discretionary and automatic changes in total government expenditure and revenue are procyclical. The second hypothesis is that the twin deficits hypothesis does not hold true for Bulgaria.

The paper is structured as follows. In Section 2, the theoretical and empirical

[1] The statistical office of the European Union, https://ec.europa.eu/eurostat/data/database

studies on the cyclicality of a discretionary fiscal policy, functioning of the automatic fiscal stabilizers and the twin deficits hypothesis are systematized. In Section 3, the cyclicality of Bulgarian government's fiscal discretion is empirically investigated. In Section 4, functioning of the automatic fiscal stabilizers is analyzed. Section 5 provides an empirical check of the validity of the twin deficits hypothesis for Bulgaria. The final section presents conclusions.

2. Literature review

2.1. Cyclicality of fiscal policy

Neycheva [1, pp. 237–240] examines the discretionary budget policy in 1994–2003 in Bulgaria, assessed by looking at the dynamics of the structural primary budget balance. She aims to describe the trends in the applied fiscal policy in the Bulgarian economy and draws a conclusion about the pro-cyclical nature of government spending, typical of emerging economies and countries in transition.

Halland and Bleaney [2] analyze the relative advantages of competition theories, taking into account alternative methods for assessing the cyclicality of fiscal policy and the differences between developing countries and OECD countries. Less clear is the authors' conclusion that income inequality and net external debt are important for fiscal pro-cyclicality in developing countries; these variables usually reach only a 10% significance level. The authors' conclusions about corruption and democracy are more justified than those concerning social inequality or net external debt. However, this result is not quite obvious, as the corruption index is closely linked to bad credit ratings. On the other hand, in OECD countries, the cyclicality of fiscal policies largely reflects the strength of automatic stabilizers.

Alesina et al. [3, pp. 1006–1036] explain the failure of policy in developing countries due to the pro-cyclical nature of fiscal policy driven by voters seeking to "starve for Leviathan" to reduce political rents. Voters monitor the state of the economy, but not the rents appropriated by corrupt governments. In the time of economic prosperity, voters optimally demand more public goods or lower taxes, and this causes a pro-cyclical bias towards the fiscal policy. The authors' empirical evidence is consistent with the following explanation: the pro-cyclicality of fiscal policy is more pronounced in more corrupt democracies.

Alesina and Tabellini [4] seek to demonstrate why many countries, especially developing ones, are pursuing pro-cyclical fiscal policies, namely spending increases (taxes decrease) in the period of expansion (growth) and expenditures decrease (taxes increase) in the period of recession. They provide an explanation for this suboptimal fiscal policy, based on political distortions and incentives less favorable for a government to find adequate rents. Voters have incentives similar to the classic Leviathan starvation argument and demand more public goods or fewer taxes to prevent governments from renting out when the economy is doing well.

Andersen and Nielsen [5] address the question why fiscal policy is pro-cyclical in developing and developed countries. They introduce the concept of fiscal transparency into a model of retrospective voting, in which pro-cyclical biases arise as a result of a problem with the political agency between voters and politicians. The introduction of fiscal transparency generates two new forecasts: 1) pro-cyclical biases in fiscal policy arise only in good times; and 2) a higher degree of fiscal transparency reduces bias in good times. The authors find strong empirical support for the first forecast in OECD countries, but also find encouraging results in favor of the second forecast in OECD countries as well as in a wider sample of countries: better access to information on government policies reduces pro-cyclical prejudices in government spending in good times.

Aliyev [6] analyzes the pro-cyclicality of fiscal policy in resource-rich countries. For developing countries, there is a strong U-shaped link between the pro-cyclicality of government capital expenditures and the indicator of resource wealth, which corresponds to the share of mineral exports in total exports of goods. This link

has proven to be robust to different methodologies and checks. The author considers two hypotheses: the hypothesis of political economy and the hypothesis of limiting loans. His empirical observations appear to be consistent with both hypotheses. A model has been created that can generate a U-shaped effect, combining political economy and borrowing constraint hypoheses.

Riascos et al. [7] examine differences in the pro-cyclicality of government consumption, which corresponds to a standard neoclassical model of fiscal policy in which policymakers make optimal choices about both the level of government consumption and taxes. The results show that in the overall markets the correlation between government consumption and output is zero (as in the G-7 countries). However, with only risk-free debt, this correlation is usually above 0.7, which suggests that the lack of a sufficiently rich menu of financial assets may be a major factor in the way fiscal policy is implemented in developing countries.

Lane [8, pp. 2661–2675] demonstrates that the level of cyclicality varies across different cost categories and OECD countries. In line with the leading theories of fiscal cyclicality, the author concludes that countries with volatile outputs and dispersed political power are the most inclined to govern pro-cyclical fiscal policies. Government spending on wages is highlighted as the most important channel through which these variables affect fiscal cyclicality.

Alberola-Ila et al. [9] analyze the stabilizing role of discretionary fiscal policy at a time of fiscal financing and fiscal rules for a sample of eight Latin American economies. The analysis shows three main results: 1) fiscal policies became countercyclical during the crisis, but they have become pro-cyclical again in recent years; 2) the financing conditions have been confirmed as the main driver of the fiscal position, but their relevance has been declining recently; and 3) fiscal rules are associated with a more stabilizing role for fiscal policy.

Manasse [10] assesses the role of shocks, rules and institutions as possible sources of pro-cyclicality in fiscal policy by using parametric and nonparametric techniques. As a result, the following four main conclusions are made. First, politicians' reactions to the business cycle vary depending on the state of the economy – fiscal policy is "acyclic" during bad economic times, while it is largely pro-cyclical in good times. Second, fiscal rules and fiscal liability laws typically reduce deficit bias on average and appear to improve rather than weaken countercyclical policies. Third, strong institutions are associated with a lower deviation from deficit, but their impact on pro-cyclicality is different in good and bad times and is subject to declining returns. Fourth, unlike developed countries, fiscal policy in developing countries is even pro-cyclical during a (moderate) recession; in "good times", however, fiscal policy is actually more pro-cyclical in developed economies.

Bova et al. [11] examine the spread of fiscal rules in the developing world and the relationship between fiscal rules and pro-cyclical fiscal policy. The paper concludes that developing countries outperform advanced economies as consumers of fiscal rules, but greater use of fiscal rules has not prevented these countries from being pro-cyclical, as fiscal policy remains pro-cyclical after the adoption of fiscal rules. The article also found partial evidence that some features of second-generation rules, such as the use of cyclically-adjusted targets, well-defined escape clauses, together with stronger legal rules and implementing provisions, may be related to less procyclicality.

The reviewed literature sources can be systematized as follows:

1. According to their territorial scope, they are divided into studies on one country [1] and on more than one country [2–11].

2. According to their methodology, the reviewed literature sources can be divided into using those correlation coefficients [7] and those employing regression coefficients [1; 2–6; 8–11].

3. According to their results, the studies are divided into those demonstrating that fiscal policy is predominantly pro-cy-

clical [1; 2–6; 8; 10; 11]; mainly countercyclical [9] and acyclical [7].

The majority of authors agree on several important conclusions about the cyclical nature of fiscal policy:

- The cyclical nature of fiscal policy depends on many factors such as the phase of the business cycle, the quality of institutions and governance and others;
- During the time of growth and prosperity, fiscal policy is predominantly procyclical, and in times of recession – mostly acyclical. Cases of countercyclical fiscal policy are rare, even in times of crisis;
- Fiscal policy is much more procyclical in developing countries than in developed countries. In developed economies, higher quality institutions and governance help limit the propensity of politicians to increase government spending in the years before elections and to reduce them in the years after elections.

2.2. Twin deficits hypothesis

Mitra and Khan [12, pp. 10–23] analyze the double deficit hypothesis in India for the period from April 1994–1995 till July 2013–2014. The methods used in the article are descriptive statistics to check for the presence of normality in the frequency distribution, followed by a unit root test. The existence of a short-term and long-term relationship between the respective variables, current account balance and fiscal balance was tested by applying the cointegration test, followed by the error correction mechanism, Wald test and Granger causality test. The article also estimates the growth rate of the variables for the period, applying a simple regression model. The results of the Wald test and Granger test suggest that there is a two-way causal relationship between the variables in the short run, while the results of the cointegration test and the error correction mechanism show instability in the long run. In addition, there is a positive growth of both variables, as the fiscal balance grows at a higher rate. Therefore, the double deficit hypothesis is confirmed for India in the post-liberalization period.

Durusu-Ciftci [13, pp. 51–69] considers a dynamic causal link between the government budget deficit and the current account for five heavily indebted European countries: Greece, Ireland, Italy, Portugal and Spain (GIIPS) with newly developed econometric techniques. The study uses an analysis of the Toda-Yamamoto causal relationship and then its Fourier approximation to examine structural changes. The results reveal that addressing structural changes is important for the relationship between GIIPS fiscal and current account imbalances. The results of the analysis, which does not take into account structural changes, show that the double deficit hypothesis is supported by the Keynesian hypothesis (for Spain) or the current account targeting hypothesis (for Greece and Portugal), but the equivalence theory is also recognized of Barro – Ricardo Equivalence for Ireland and Italy. On the other hand, the analysis of causation, which takes into account structural changes, shows that the current account hypothesis is supported by all countries except Ireland.

Lonevskyi and Klimaitis [14] investigate the double deficit hypothesis for countries of the Eastern European group. The relationship between the budget balance and the current account balance is analyzed throughout the sample and three groups of sub-samples, based on the level of development, the structure of tax revenues and the level of debt. The effect of the budget balance is studied by using the model with fixed effects and the generalized method of moments. The initial findings of the study reject the double deficit hypothesis for the sample of Eastern European countries. However, the results for the sub-samples are drastically different. The study found a positive and statistically significant effect of the budget balance for economies in transition, countries with mostly indirect tax revenues and countries with a level of debt below the median sample.

Sobrino [15, pp. 9–15] examines a causal relationship between the current account and the fiscal surplus and the fiscal expenditures of the commodity-based economy of Peru. Using quarterly data on the open economy, the results reject

the double deficit hypothesis. Instead, the evidence suggests reverse causality, i.e. the current account causes the fiscal account. However, unlike previous empirical evidence on this issue, for one year the causal feedback shows a negative causal relationship, as fiscal consumption is not smoothed out when positive permanent current account shocks occur. In the short run, fiscal policy has no effect on the current account, but improvements in the current account increase the likelihood of achieving a lower limited fiscal deficit. This evidence is consistent with a small open commodity-based economy that is highly exposed and sensitive to external price shocks.

Kiran [16, pp. 59–66] examines the long-term relationship between the trade deficit and budget deficit in Turkey in the context of the factional approach to cointegration. This approach facilitates the assumption in conventional cointegration analyzes that cointegrating residuals must be integrated to zero and allows it to take any real value. Empirical results from the annual data for the period 1975–2009 show that there is little evidence of the partial correlation between the trade deficit and budget deficit, and therefore the validity of the double deficit hypothesis in Turkey.

Lau and Baharumshah [17, pp. 213–226] investigate the double deficit hypothesis using data from a panel of nine SEACEN countries. Their empirical results show that the Asian budget deficit causes the current account deficit both directly and indirectly. Moreover, their statistical analysis suggests that budget deficit management offers opportunities to improve the current account deficit. However, this finding does not support the policy of manipulating intermediate variables to reduce deficits to a sustainable level, as these variables appear to be endogenous in the system.

Ganchev [18, pp. 357–377] studies the validity of the double deficit hypothesis in Bulgaria. He analyzes the theoretical foundations and alternative explanations for this hypothesis and uses various econometric approaches to test its validity in Bulgaria. Granger's causality test assumes the existence of a double causal relationship between fiscal and current account deficits. An autoregressive vector and a vector error correction model reject the hypothesis of a double deficit in the short run, but this conclusion may be valid in the long run.

Epaphra [19, pp. 2–34] examines the relationship between the current account and general government deficit in Tanzania. The article tests the validity of the double deficit hypothesis using annual time series data for the period 1966–2015. Empirical tests have failed to reject the double deficit hypothesis, which shows that rising budget deficits are hampering Tanzania's current account deficits. In particular, the results of the vector error correction model support the conventional theory of a positive relationship between fiscal and external balance, with a relatively high rate of adjustment to equilibrium. This evidence is the same for small open economies. To address such a problem, which may be caused by this type of relationship, the author recommends using appropriate policy variables to reduce the budget deficit, for example, improving the collection of domestic revenues and actively fighting corruption and tax evasion. The government should also target export-oriented companies and encourage the import substitution industry by creating favorable business environments.

Tosun et al. [20, pp. 141–160] empirically examine the existence of a long-term relationship and the direction of the causal link between budget deficits and the current account for some economies in Central and Eastern Europe (Bulgaria, Latvia, Lithuania, Poland, Romania, Serbia and Slovenia). Empirical analysis depends on the bounds testing approach of Pesaran, Shin, and Smith to co-integration and non-causality. No evidence has been obtained in favor of the double deficit hypothesis for the selected countries, with the exception of Bulgaria, as the results support causality.

Bolaman and Yucel [21, pp. 467–476] analyze the hypothesis of a double defi-

cit in Turkey for the period 1950–2011. In the empirical part, Engle Granger's cointegration method and Toda Yamamoto's Causality Test are applied. The conclusion they reach is in line with the Keynesian proposal, and it can be said that the budget balance must prevail over the current account balance in the fight against the double deficit hypothesis. Internal balance is achieved by maintaining budget balance, which, as the authors argue, improves indirectly the current account balance.

Corsetti and Müller [22, pp. 597–638] review the international transmission mechanism in a standard two-digit business cycle model from two countries and find that fiscal expansion has no effect on the trade balance and thus on the current account i) if the economy is not very open to trade and ii), if fiscal shocks are not too constant. Under these conditions, the effect of pushing out fiscal shocks on private investment is stronger than is usually assumed. The authors examine the transmission of fiscal shocks in a VAR model calculated for Australia, Canada, the United Kingdom, and the United States. For the USA and Australia, which are less open to trade than Canada and the UK, the external impact of shocks on either government spending or the budget deficit has been found to be limited, while private investment has reacted significantly, according to theoretical forecasts. The opposite is true for Canada and the UK.

Vyshnyak [23] describes the experience with the double deficit hypothesis in Ukraine. The double deficit hypothesis is tested empirically by using Granger integration and causality tests. The study showed that the budget deficit and the current account deficit are co-integrated and the state budget deficit causes a current account deficit. The transmission mechanism between the two deficits works mainly through the exchange rate. The existence of a link to the double deficit implies certain policy recommendations needed to improve the situation. In particular, the development of a strong financial sector of the economy and the improvement of the investment climate are essential for the development of this country and can serve to break the link between the two deficits.

Ganchev et al. [24, pp. 1–21] analyze the theoretical foundations of the hypothesis of double deficit in the countries of Central and Eastern Europe. The authors apply different econometric techniques to refine the validity of different approaches based on panel data for CEE countries. The regression of the OLS panel shows a relatively modest positive relationship between the current account and the final deficit, which confirms the double deficit paradigm. Another conclusion of the authors is that the hypothesis of a double deficit can be transferred in the case of Bulgaria and Estonia. Autoregressive analysis is no longer compatible with the double deficit hypothesis.

The reviewed literature sources can be systematized as follows:

1. According to the territorial scope, they are divided into studies on one country [14; 16; 18; 19; 21; 23; 24] and on more than one country [17; 19; 20; 22];

2. The reviewed literature sources use two main groups of research methods – tests for causal relationships and coefficients for movement (regression or correlation). Among the causal tests, Granger's tests for short-term causality (Pairwise Granger Causality Tests) and for long-term causality (Granger Causality / Block Exogeneity Wald Tests) predominate [12; 15; 17–20; 22; 23]. Other tests for causal relationships, such as Toda-Yamamoto, are also employed [13; 21]. The coefficients for co-movement are mainly regression coefficients, which are evaluated with the help of different variations of regression analysis – cointegration analysis [16; 21; 23], vector autoregression [13; 18; 22], vector error correction [12; 18; 19], generalized method of moments [14] and autoregressive distributed lag model [20].

3. According to the results, the reviewed literature sources are divided into those confirming the validity of the twin deficits hypothesis [12–13; 16; 19; 21; 23] and rejecting the validity of the twin deficits hypothesis [15; 18; 20; 22].

3. Empirical analysis of the cyclical impact of Bulgarian government's discretionary fiscal policy

The cyclical impact of Bulgaria's fiscal discretion was measured by two correlations:

1) The correlation between the output gap and the change in the trend share of total government expenditure in GDP. If this correlation is negative, the discretionary fiscal policy is countercyclical. If this correlation is positive, the discretionary fiscal policy is procyclical. A negative correlation between the output gap and the change in the trend share of total government expenditure in GDP may occur in two cases: first, a positive (inflationary) output gap and a negative change (decrease) in the trend share of total government expenditure in GDP; and second, a negative (deflationary) output gap and a positive change (increase) in the trend share of total government expenditure in GDP. In the first case the discretionary decrease in the government expenditure mitigates inflation and diminishes the risk of overheating of the economy. In the second case the discretionary increase in the government expenditure combats deflation and contraction. In both cases, a negative correlation means countercyclicality of the discretionary government spending.

2) The correlation between the output gap and the change in the trend share of total government revenue in GDP. If this correlation is positive, the fiscal discretion is countercyclical. If this correlation is negative, the fiscal discretion is procyclical. A positive correlation between the output gap and the change in the trend share of total government revenue in GDP may arise in two cases: first, a positive (inflationary) output gap and a positive change (increase) in the trend share of total government revenue in GDP; and second, a negative (deflationary) output gap and a negative change (decrease) in the trend share of total government revenue in GDP. In the first case the discretionary increase in government revenue mitigates inflation and diminishes the risk of overheating of the economy. In the second case the discretionary decrease in government revenue combats deflation and contraction. In both cases, a positive correlation means countercyclicality of the discretionary government revenue policy.

The changes in the trend shares of total government expenditure and total government revenue in GDP result from the discretionary fiscal policy of the government, while the output gap indicates the cyclical position of the economy.

For Bulgaria, the calculated correlations between the output gap, on the one hand, and, the changes in the trend shares of total government expenditure and total government revenue in GDP, on the other hand, for 1999–2019 were 0.20 and –0.17 respectively. This means that discretionary changes in both total government expenditure and total government revenue in the period of investigation were procyclical.

The output gap was calculated by the following formula:

$$Gap = (Actual\ GDP - Potential\ GDP) \times 100 / Potential\ GDP \quad (1)$$

The potential GDP, the trend share of total government expenditure in GDP and the trend share of total government revenue in GDP were obtained via the Hodrick–Prescott filter.

4. Empirical assessment of the automatic fiscal stabilizers' functioning in Bulgaria

The empirical assessment of the automatic fiscal stabilizers' functioning in Bulgaria was made on the basis of two indicators:

1) The correlation between the output gap and the change in the cyclical share of total government expenditure in GDP. If this correlation is negative, it means that the fiscal stabilizers function well. If this correlation is positive, it indicates a failure in the functioning of the fiscal stabilizers. A negative correlation between the output gap and the change in the cyclical share of total government expenditure in GDP may occur in two cases: first, a positive (inflationary) output gap and a negative change (decrease) in the cyclical share of

total government expenditure in GDP; and second, a negative (deflationary) output gap and a positive change (increase) in the cyclical share of total government expenditure in GDP. In the first case the automatic decrease in government expenditure mitigates inflation and diminishes the risk of overheating of the economy. In the second case the automatic increase in government expenditure combats deflation and contraction. In both cases, a negative correlation means that the automatic fiscal stabilizers function effectively.

2) The correlation between the output gap and the change in the cyclical share of total government revenue in GDP. If this correlation is positive, it means that the fiscal stabilizers function well. If this correlation is negative, the fiscal stabilizers do not work well. A positive correlation between the output gap and the change in the trend share of total government revenue in GDP may arise in two cases: first, a positive (inflationary) output gap and a positive change (increase) in the cyclical share of total government revenue in GDP; and second, a negative (deflationary) output gap and a negative change (decrease) in the cyclical share of total government revenue in GDP. In the first case the automatic increase in government revenue mitigates inflation and diminishes the risk of overheating of the economy. In the second case the automatic decrease in government revenue combats deflation and contraction. In both cases, a positive correlation means that the automatic fiscal stabilizers function effectively.

3) The changes in the cyclical shares of total government expenditure and total government revenue in GDP are a result of the work of the automatic fiscal stabilizers, while the output gap indicates the cyclical position of the economy.

For Bulgaria, the calculated correlations between the output gap, on the one hand, and, the changes in the cyclical shares of total government expenditure and total government revenue in GDP, on the other hand, for 1999–2019 were respectively 0.08 and –0.09. This means that automatic changes in both total government expenditure and total government revenue in the period of investigation were procyclical, i.e. that automatic stabilizers in both the expenditure part and the revenue part of the state budget did not function effectively.

The potential GDP, the cyclical share of total government expenditure in GDP and the cyclical share of total government revenue in GDP were obtained via the Hodrick–Prescott filter.

5. Empirical test of the twin deficits hypothesis for Bulgaria

According to the twin deficits hypothesis, a causal link and a positive relationship exist between the national government's budget balance and its current account balance. This implies that an increase in the government budget deficit will cause an increase in the current account deficit.

To check the validity of the twin deficits hypothesis for Bulgaria, a vector autoregression (VAR) of quarterly data for 1999–2019 was employed. The VAR model included two variables – *CAB* (current account balance) and *FISCB* (fiscal balance), which were measured as a percentage of GDP. The target (dependent) variable was *CAB*.

The group unit root tests (see Table 1) showed that as a group, *CAB* and *FISCB*

Table 1

Group stationarity tests of CAB and FISCB

Method	Statistic	Probability	Cross-sections	Observations
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	–2.34	0.01	2	165
Breitung t-stat	–1.52	0.06	2	163
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	–3.68	0.00	2	165
ADF – Fisher Chi-square	30.00	0.00	2	165
PP – Fisher Chi-square	30.74	0.00	2	166

Source: Prepared by the authors

were stationary at a level that required the application of unrestricted VAR.

The test for the optimal number of lags in the vector autoregression indicated that, according to all criteria, this number was two (see Table 2). The vector autoregression was estimated with two lags.

Table 2

Optimal lag length in the VAR model

Number of lags	FPE	AIC	SC	HQ
0	932.8944	12.51404	12.57538	12.53856
1	143.6098	10.64277	10.82678	10.71631
2	124.7729*	10.50187*	10.80854*	10.62443*
3	134.2447	10.57437	11.00372	10.74596
4	133.3627	10.56659	11.11861	10.78721
5	141.6631	10.62511	11.29980	10.89475
6	149.3572	10.67530	11.47266	10.99396
7	133.5826	10.55998	11.48000	10.92766
8	146.3736	10.64653	11.68923	11.06324

* Shows the optimal number of lags according to the respective criterion

Source: Prepared by the authors

The equation for the target variable in the VAR model *CAB* after the step-by-step removal of statistically insignificant variables is as follows:

$$CAB = -0.13 + 0.51 \times CAB(-1) + \\ + 0.43 \times CAB(-2) - 0.24 \times FISCB(-1)$$

The standard errors, t-statistics and probabilities of the regression coefficients in Equation (1) are shown in Table 3.

The current account balance of Bulgaria is affected by its own past values and the previous value of the fiscal balance. The negative value of the regression coefficient before *FISCB* (–0.24) means that the twin deficits hypothesis is not valid for Bulgaria since a 1% change in the fiscal balance will lead to a 0.24% change in the current account balance in the opposite direction. Hence, a 1% increase in the fiscal deficit will not raise the current account deficit but decrease it by 0.24%.

Table 3

Results from the econometric estimation of Equation (1)

Variable	Coefficient	Standard error	*t*-Statistic	Probability
C	–0.133830	0.401262	–0.333521	0.7396
CAB(–1)	0.506065	0.104621	4.837141	0.0000
CAB(–2)	0.427012	0.103196	4.137863	0.0001
FISCB(–1)	–0.242900	0.097330	–2.495638	0.0147

Source: Prepared by the authors

The value of the coefficient of determination (R-squared = 0.87) indicates that 87% of the variation of Bulgaria's current account balance can be explained by changes in the independent variables in Equation (1). The probability of the *F*-statistic (0,00) shows 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 one but simply that it adequately reflects the relationship between the dependent and independent variables.

The CUSUM test results imply that Equation (1) is dynamically stable (see Figure 1), as the actual CUSUM values are

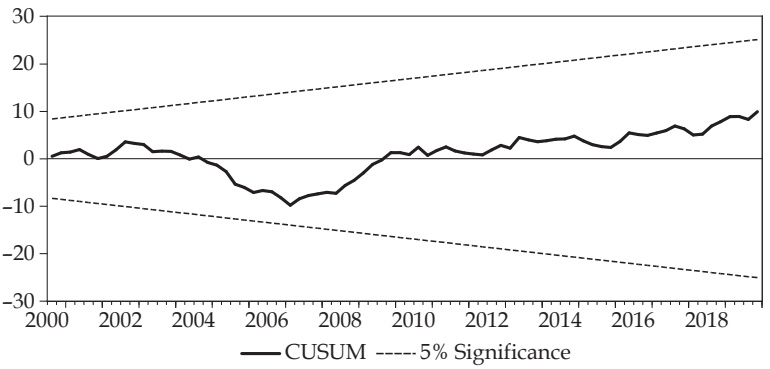

Fig. 1. **CUSUM test for dynamic stability of Equation (1)**

Source: Prepared by the authors

within the confidence interval at the 5% significance level.

The results of the Ramsey test (probability of the F-statistic 0.16) give reason to accept the null hypothesis of lack of errors in the specification of Equation (1).

The probability of Jarque-Bera statistics is 0.53 (see Figure 2), which justifies the acceptance of the null hypothesis of normal distribution of the residuals in Equation (1).

The null hypothesis for the absence of a serial correlation of residuals in Equation (1) was confirmed (see Table 4). The results of the heteroscedasticity test of the residuals in Equation (1) listed in Table 5 gave reason to accept the null hypothesis for the lack of heteroscedasticity.

Table 4

Results from the serial correlation test of residuals in Equation (1)

F-statistic	0.42	Probability *F* (2.76)	0.66
Observations R^2	0.90	Probability Chi-square (2)	0.64

Source: Prepared by the authors

Table 5

Results from the heteroscedasticity test of residuals in Equation (1)

F-statistic	0.48	Probability *F* (3.78)	0.70
Observations R^2	1.48	Probability Chi-square (3)	0.69

Source: Prepared by the authors

The results from the Pairwise Granger Causality Tests (see Table 6) show that in the short term at the significance level of 10% Bulgaria's fiscal balance Granger-causes Bulgaria's current account balance but Bulgaria's current account balance does not Granger-cause Bulgaria's fiscal balance.

Table 6

Results from short-term causality tests

Null Hypothesis	Probability
FISCB does not Granger Cause *CAB*	0.0518
CAB does not Granger Cause *FISCB*	0.3774

Source: Prepared by the authors

The results from the Granger Causality / Block Exogeneity Wald Tests (see Table 7) indicate that in the long run at the significance level of 5% Bulgaria's current account balance is Granger-caused by Bulgaria's fiscal balance but Bulgaria's fiscal balance is not Granger-caused by Bulgaria's current account balance.

Table 7

Results from long-term causality tests

Null Hypothesis	Probability
FISCB does not Granger Cause *CAB*	0.0461
CAB does not Granger Cause *FISCB*	0.3727

Source: Prepared by the authors

The response of Bulgaria's current account balance to changes in Bulgaria's fiscal balance is shown in Figure 3.

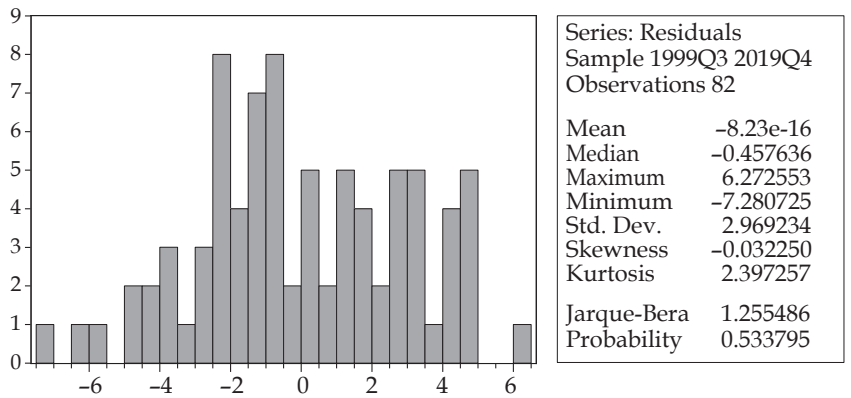

Fig. 2. **Test for normal distribution of residuals in Equation (1)**

Source: Prepared by the authors

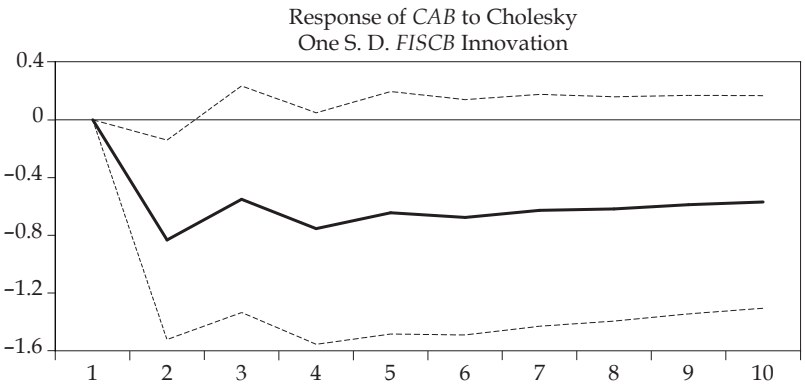

Fig. 3. **Response of Bulgaria's current account balance to changes in Bulgaria's fiscal balance**

Source: Prepared by the authors

The study results imply that the fiscal discretion of the Bulgarian government is procyclical, while the automatic fiscal stabilizers do not work. The first part of the twin deficits hypothesis (the causal link between the fiscal balance and the current account balance) is confirmed but the second part of the twin deficits hypothesis (the positive relationship between the fiscal balance and the current account balance) is rejected for Bulgaria.

6. Conclusion

Our empirical results indicate that the Bulgarian government's fiscal discretion has a procyclical impact on Bulgaria's economy, whereas the automatic fiscal stabilizers do not function effectively. The discretionary and the automatic changes in both sides of Bulgaria's state budget (revenue and expenditure) are procyclical, which requires an improvement in the formulation and implementation of the fiscal policy.

As for the twin deficits hypothesis, our findings confirm the causal link between the fiscal balance and the current account balance but refute the positive relationship between them. The empirically ascertained negative relationship between the fiscal balance and the current account balance can be explained by the consumption-based tax system in Bulgaria and the non-functioning of the automatic adjustment mechanism of the Bulgarian currency board arrangement.

An important inference from this research is that it is not the fiscal surpluses but the fiscal deficits that improve Bulgaria's current account balance. The moderate fiscal deficits (below 3% of GDP) are advisable since they can both stimulate economic growth and decrease the current account deficits.

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Information about the authors

Ivan Todorov – PhD, Associate Professor, Southwest University "Neofit Rilski", Faculty of economics, (66 Ivan Mihailov Str., Blagoevgrad 2700 Bulgaria); ORCID: 0000-0002-4325-0195; e-mail: ivank.todorov@swu.bg

Kalina Durova – PhD, Assistant Professor, Southwest University "Neofit Rilski", Faculty of economics, (66 Ivan Mihailov Str., Blagoevgrad 2700 Bulgaria); ORCID: 0000-0001-8051-1342; email: kalina_durova@swu.bg

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Информация об авторах

Иван Тодоров – PhD, доцент, Юго-Западный университет имени Неофита Рильского, экономический факультет (2700 Болгария, Благоевград, ул. Ивана Михайлова, 66); ORCID: 0000-0002-4325-0195; e-mail: ivank.todorov@swu.bg

Калина Дурова – PhD, ассистент, Юго-Западный университет имени Неофита Рильского, экономический факультет (2700 Болгария, Благоевград, ул. Ивана Михайлова, 66); ORCID: 0000-0001-8051-1342; email: kalina_durova@swu.bg

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Pandemics and Tax Innovations: What can we Learn from History?

A.I. Pogorletskiy[1], **F. Söllner**[2]
[1] *St. Petersburg State University, St. Petersburg, Russian Federation*
[2] *Technical University of Ilmenau, Ilmenau, Germany*
✉ *a.pogorletskiy@spbu.ru*

ABSTRACT
In this article, we shall see how pandemics of deadly diseases have changed tax systems over the past two millennia, each time leading to the emergence of new forms of taxation and tax administration. The purpose of the article is to prove that pandemics and the most notable innovations in tax policy are closely interrelated and that the consequences of the largest pandemics in the history of mankind are new approaches to the organization of national tax systems as well as the formation of interstate tax regulation. The lessons from history can be applied to the current corona crisis and may help us devise the appropriate anti-crisis tax policy. The study is based on the historical empirical-inductive method applied to reliable facts of the past related to pandemics and taxation. We trace the evolution of tax policy under the impact of the most significant pandemics and identify patterns of taxation and tax administration that are specific to their eras and are still relevant in the course of the pandemic COVID-19. Our analysis allows us to draw the following conclusions: (1) There is a historical link between pandemics and tax regulation. Many tax innovations originated in response to the consequences of large-scale epidemics of deadly diseases. (2) Many of the tax incentive tools used today in the fight against the corona crisis have already been used during previous pandemics so that we may learn from the experience of earlier times. (3) The COVID-19 pandemic can be expected to have several important consequences for taxation and public finance: innovations in tax administration with an emphasis on remote fiscal audits and digital control; innovations in the taxation of digital companies and their operations at the national and international level; possibly fundamental changes in the tax system of the European Union; and possibly a return of the inflation tax.

KEYWORDS
history of taxation, pandemics, tax administration, tax innovations, tax policy, tax system

JEL H2, H51, I13

УДК 336.2б; 336.02 *Оригинальная статья*

Пандемии и налоговые инновации: чему нас учит история?

А.И. Погорлецкий[1], **Ф. Зольнер**[2]
[1] *Санкт-Петербургский государственный университет, г. Санкт-Петербург, Россия*
[2] *Технический университет Ильменау, г. Ильменау, Германия*
✉ *a.pogorletskiy@spbu.ru*

АННОТАЦИЯ
В предлагаемой статье мы выявим воздействие пандемий смертельных болезней на модификацию налоговых систем на протяжении двух последних тысячелетий, что приводило к появлению прогрессивных форм налогообложения и налогового администрирования. Цель статьи – доказать, что пандемии

и самые заметные инновации в налоговой политике тесно взаимосвязаны и что последствием самых масштабных пандемий в истории человечества стали новые подходы в организации национальных налоговых систем, а также становление межгосударственного налогового регулирования. Уроки истории могут оказаться полезными в условиях преодоления последствий коронакризиса начала 2020-х гг., помогая разрабатывать соответствующую антикризисную налоговую политику. Исследование основано на историческом эмпирически-индуктивном методе, примененном в отношении достоверных фактов прошлого, связанных с пандемиями и налогообложением. Сравнительный метод осмысления исторических событий позволил авторам сопоставить последствия эволюции налоговой политики под влиянием воздействия наиболее масштабных пандемий инфекционных заболеваний, а также выявить закономерности налогообложения и налогового администрирования, характерные для соответствующих исторических эпох и по-прежнему актуальные в ходе пандемии COVID-19. Проделанный авторами анализ позволяет сделать следующие выводы: (1) существует историческая связь между пандемиями и налоговым регулированием: многие налоговые инновации возникли в ответ на последствия масштабных эпидемий смертельно опасных заболеваний; (2) значительная часть инструментов налогового стимулирования экономики, применяемых в ходе антикризисного регулирования в период пандемии COVID-19, уже использовалась ранее, во время предыдущих пандемий, что позволяет учитывать соответствующие исторические уроки; (3) можно ожидать, что пандемия коронавируса SARS-CoV-2 будет иметь несколько важных последствий для налогообложения и государственных финансов: инновации в налоговом администрировании с акцентом на дистанционный финансовый аудит и цифровой контроль; инновации в налогообложении цифровых компаний и их операций на национальном и международном уровнях; вероятные фундаментальные изменения в налоговой системе Европейского союза; и, возможно, возврат в мировую практику инфляционного налога.

КЛЮЧЕВЫЕ СЛОВА
история налогообложения, пандемии, налоговое администрирование, налоговые инновации, налоговая политика, налоговая система

1. Introduction

In 2020, the global economy was hit by the pandemic caused by the virus SARS-CoV-2 and the severe infectious disease COVID-19 it causes. This kind of external shock has been almost forgotten during the past century but, in the previous history of mankind, often played a major role in social and economic development. Estimated consequences of the coronavirus pandemic paint a pessimistic picture for the world economy, predicting a long-term economic crisis caused by the disruption of global production, standstill in business activity, falling incomes and demand, and mass unemployment. In such circumstances, the first blow was taken by public finances: many national governments initiated large-scale monetary and fiscal stimulation programs for their economies. As of July 2020, these packages amounted to a total of $28 trillion (more than 30% of global GDP)[1]. Moreover, considerable changes are expected in taxation systems. It is necessary, firstly, to create fiscal incentives in order to stimulate economic activity and, secondly, to raise revenue in order to reduce the huge public deficits which have been and still will be incurred and the level of public debt, which is increasingly becoming unsustainable. Therefore, taxation will be an important tool of anti-crisis policy.

Pandemics should not be thought of only in the negative light. Despite and, often, because of their large-scale impact on human health, they led to major technological, social and economic changes that were conducive to progress and deve-

[1] Global Economic Effects of COVID-19. *Federation of American Scientists* (FAS). 2020. July 24. Available at: https://fas.org/sgp/crs/row/R46270.pdf

lopment, both socially and economically. Post-pandemic society very often went through transformations and institutional changes which proved to be beneficial in the long term. In particular, pandemics led to the emergence of new forms of taxation and improvement of tax administration, as a scientific approach towards taxation and tax systems was adopted.

In this article, we will analyze how pandemics have influenced tax policy for two millennia, each time leading to the emergence of new forms of taxation and new ways of tax administration. We will show that global pandemics and important innovations in tax policy are closely linked. We put forward the hypothesis that new approaches to taxation and tax administration were among the consequences of the most serious pandemics in human history. These historical lessons may be helpful for economic policy-makers during the current crisis and thus contribute to restoring economic and fiscal stability.

The structure and logic of the paper will correspond to the historical sequence of the known pandemics, which we will evaluate in terms of their consequences for taxation and tax systems. We will cover the time from antiquity, the Middle Ages and modern period right up to the present. Our focus in terms of geography will be on Europe. It should be noted that in what follows we will use the term "taxation" in a wide sense – comprising the imposition not only of taxes in the narrow sense of the word but of all compulsory levies, i.e. contributions and fees. Our analysis of published sources on the research topic shows that the hypothesis of the article is original and has not yet been sufficiently covered by the relevant publications.

2. Literature review

In our research we used both historical and modern sources that allow us to analyze the relationship between the evolution of taxation and the occurrence of the most serious pandemics. We will turn to publications about the corresponding epochs, in particular, the works of Bonvech [1], Grant [2], Kovalev [3], Selunskaya [4], Voigtländer and Voth [5]. Economic development and taxation in a historical context are discussed by Adams [6], Golubtsov [7], Kucherov [8], Lanin [9], Maddison [10], Mayburov and Leontieva [11], Pochinok [12], Schanz [13], Scheidel [14], Schmelzing [15], Tanzi [16], Vinnitsky [17] and Wagner [18]. Some interesting ideas for improving tax administration were proposed by Becher [19], Boisguilbert [20] and De Vauban [21].

The first scientific concept of taxation that was influenced by a pandemic was William Petty's "A Treatise of Taxes and Contributions" [22]. In his "Political arithmetic" [23], Petty also provided a methodological framework to evaluate tax collections in a post-pandemic economy. The theory behind inflation (or coin debasement) as a fiscal instrument was expounded first by Oresmius [24], then by Copernicus [25]. The role of the plague in the development of modern institutions is analyzed by Acemoglu and Robinson [26]. In addition, the demographic and economic consequences of the Black Death are discussed by Clark [27; 28]. An interesting publication about the role of pandemics in the process of economic modernization was presented by Scherbak [29], after the emergence of the COVID-19.

For medical characteristics of pandemics, we drew upon Byrne [30], Dunkan-Jones [31], Horrox [32], Littman [33], Mihel [34], Sokolova [35], Supotnitskii and Supotnitskaja [36]. The influence of religion on the reaction to epidemics and on taxation is discussed by Bulst [37], Lo-zinskij [38], Lvova and Pokrovskaya [39] and Vereshchagin [40]. Some of the consequences of the most famous pandemics, such as the Black Death, for national taxation are mentioned by Beresford [41], Falkovsky [42] and Goldberg [43]. The consequences of pandemics for the development of medical legislation were explained by Pechnikova [44], who focused on the case of Russia.

In addition, we use current publications from the World Bank, World Trade Organization (WTO), International Labor Organization (ILO), International Monetary Fund (IMF), Organization for Economic Cooperation and Development

(OECD), UNIDO (United Nations Industrial Development Organization), European Economic Advisory Group [45] as well as a number of other historical, legal and technical sources.

Putting aside the medical aspects of the pandemics as well as the social, political and technological processes of each historical epoch in question, we systematize the most valuable concepts for our study in Table 1. This table focuses on the historical and current tax research that confirm our hypothesis.

However, the available research literature does not explicitly discuss the relationship between pandemics and the evolution of taxation. In our paper we intend to fill this research gap, continuing the research done by one of the authors and presented in [46; 47]. As we will show, pandemics trigger significant changes in the sphere of public finance. Their connection to state revenues, in particular tax revenues, is obvious. Indeed, pandemics have contributed to significant innovations in taxation: this historical legacy of pandemics in public finance continues to this day. We can expect some innovative changes in taxation in the current context of the COVID-19 pandemic in 2020 as well as in the post-coronavirus world.

3. Methodology

Our analysis is based on the historical, empirical-inductive method. We consider the historical facts related to pandemics and taxation to find out whether there are any patterns in the impact that different pandemics had on taxation. This will enable us to clarify the relationship between pandemics and the development of taxation and thus to identify general tendencies in the evolution of taxation and tax administration.

Looking at how tax policies developed, we will be able to use reflexive approach for assessing modifications that current tax policies require. Critical thinking based on historical facts and the modern interpretation thereof will help us understand the innovations of today and tomorrow. Thus we will get answers to questions about possible law-like patterns in the development of tax systems under the influence of turbulent events triggered by pandemics, not only for the past but also, thanks to the reconstructive approach, for the present and future.

Table 1

Studies of the impact of pandemics on the evolution of taxation and tax administration

Author(s) and years	Summary
Nicolaus Oresmius (1373), Nicolaus Copernicus (1522), William Petty (1662)	"Inflation tax" and the law of coin spoilage in the post-pandemic period: justification, analysis, and criticism
William Petty (1662, 1690)	Theoretical principles of taxation and tax administration as a response to pandemic impact on the national economy
Adolf Wagner (1876), Vito Tanzi (2011)	Growth trend in the public sector of the economy due to increased public spending on social needs (including state health insurance for employees to cover pandemic risks)
Georg von Schanz (1892)	Basic principles of international taxation, whose development was influenced by pandemics
Charles Adams (1993), Alexander Pochinok (2015, mortem)	Historical approach to the development of tax systems: pandemics are discussed in the context of historical events that influenced the formation of taxation and tax administration
Angus Maddison (2007)	Historical approach to the development of macroeconomics: formation of tax theories in the context of historical events, including pandemics
Daron Acemoglu and James Robinson (2012)	Institutional approach to assessing economic development, including the role of tax institutions formed as a result of the impact of pandemics
Walter Scheidel (2017), Paul Schmelzing (2020)	Growth of the tax base in a post-pandemic period

Compiled by the authors.

We will analyze written and electronic sources of information, selected and systematized on the basis of their connection with tax theory and policy as well as the history of pandemics.

We are going to compare historical and recent events to reveal the consequences of the evolution of tax policy under the influence of various calamitous events, identifying patterns characteristic of the corresponding time periods. We are also going to use such general theoretical methods as analysis, synthesis, classification, generalization and analogy. This will help us find common patterns and draw conclusions about the transformation of tax regulation. We will focus on the specifics of the development of tax regulation not only at the national level, but also consider peculiarities of intergovernmental interactions in the tax field.

4. Pandemics and the evolution of taxation: chronology and main tax innovations

According to historical records, there have been several large-scale pandemics in the history of mankind (i.e. pandemics with more than one million casualties). Most of these pandemics, especially those of the antiquity, Middle Ages, and modern period (listed in Table 2 in chronological order), have left significant technological, political, economic, and social footprints. Pandemics, despite their deadly nature, often accelerated development by giving rise to new technologies, new institutions, and new forms of government. In addition, for effective governments' response to pandemics, innovative scientific approaches to public administration and public finance became more and more adopted from the beginning of modernity. Without exception, all major pandemics of the past have left their mark on taxation and tax administration, ushering in innovative tax policies and new tax systems in their respective historical eras.

Examples of the role of pandemics in the evolution of taxation are given in Table 3. It should be noted that, in recent times, only the coronavirus SARS-CoV-2 pandemic can be expected to noticeably influence taxation and tax administration. All the other recent pandemics were either too short-lived (e.g., Asian flu) or affected only a very small part of the population (e.g., AIDS), so that economies were not disrupted by them and changes in taxation were not necessary. It is different with the coronavirus pandemic, however. In this case, the serious and far-reaching economic and social effects of the pandemic are comparable to such terrible pandemics of the past as the plague or the Spanish flu. Therefore, the coronavirus pandemic will probably give rise to changes in taxation comparable to those of the major pandemics of earlier times.

Table 2

Major pandemics and their description

Historical period	Pandemics description
Antiquity	Antonine Plague (Plague of Galen): 2nd century (165–180)
Middle Ages	Plague of Justinian: 6th – 8th century (541–750) Medieval plague (Black Death): 14th century (1331–1353)
Modern period	Great Plague: 17th – early 18th century (1600–1714) Pandemics of the 19th and the first half of the 20th century: – first cholera pandemic (1817–1824); – second cholera pandemic (1826–1837); – third cholera pandemic (1852–1860); – third plague pandemic (1882–1927); – Russian flu pandemic (1889–1890); – Spanish flu (H1N1) pandemic (1918–1920)
Post-World-War-II period	– Asian flu (H2N2) pandemic: 1957–1958; – Hong Kong flu (H3N2) pandemic: 1968–1970; – swine flu (H1N1) pandemic: 2009–2010; – AIDS/HIV pandemic: since 1980; – coronavirus (SARS-CoV-2) pandemic: since the beginning of 2020

Compiled by the authors by using https://en.wikipedia.org/wiki/List_of_epidemics

Table 3

Pandemics and the evolution of taxation in human history

Pandemics, period	Death cases (estimates)	Technological, political and structural changes	Economic and social consequences of pandemics	Tax innovations related to pandemics
Antonine Plague (Plague of Galen), 165–180	7–10 million	Crisis of slave economy, expansion of foreign trade, development of crafts, formation of the territorial structure of the state, development of the law	Weakening of the Roman Empire: severe financial crisis, assimilation of barbarian tribes, spiritual decline, strengthening of monotheistic religions (in particular, Christianity)	Beginning of **fiscal centralization** (financial links between the center and territories through taxation system), **legal foundation of taxation** originated in the Roman law, **introduction of an "inflation tax"**
Plague of Justinian, 541–750	More than 150 million	Expansion of foreign trade, strengthening of state religion (Christianity)	Decline of the Byzantine economy (devastation of cities and the countryside), collapse of the Roman Empire, demographic crisis in the Mediterranean, birth of Islam	**Church taxes** imposed on a pro-rata income basis (forerunners of income taxation); Islamic model of taxation
Medieval plague (Black Death), 1331–1353	200 million	Shortage of labor, increase in the cost of labor, long wars (to finance wars, a high fiscal was imposed)	Shortage of labor resources, redistribution of land, increasing consumption of luxury goods and strong liquors, increasing influence of the Catholic Church	**Personalization of taxes** (poll tax, luxury tax), centralization of administration of Church tithes, tax incentives for foreign trade, excise taxes on strong liquors
Great Plague, 17th to the early 18th century	1,3 million	Self-government of cities, birth of demography and financial accounting as the scientific basis for assessing income	Growth of handicrafts and trade, acceleration of urbanization and monetary circulation, mass migrations	Development of tax theories (W. Petty), **centralization of tax collection systems on a scientific basis**, introduction of health care contributions, **analysis of the "inflation tax"**
Pandemics of 19th and the first part of 20th century (cholera, smallpox, plague, flu)	More than 60 million	Industrial revolution, abolition of slavery, multiple wars, conflicts, revolts and revolutions	Mass production, industrialization and construction of large-scale infrastructure, urbanization, creation of public health systems	**Contributions and quasi-taxes (because of the social responsibility of business) to finance medicine and health care**, including anti-epidemic measures
COVID-19 pandemic (started in 2020)	More than 1 million (as of beginning of October 2020)	New technological structure (digitalization, robotics and automation, artificial intelligence); aggravation of geopolitical contradictions and conflicts; trade, currency and technology wars; increase in income inequality	"Great Lockdown": decline of economic activity, disruption of global production systems and transport links, decline of trade and tourism, cancellation of cultural and sports events, social distancing, economic egoism, digital surveillance; crisis of public health care; rising public expenditures, declining tax revenues, high budget deficits and government debts	**Digitalization of taxes and tax control** (remote tax audits, introduction of tax ratings of citizens, changes in taxation of income of digital companies, digital service tax), growth of tax transparency of domestic and international operations, **growth of international tax cooperation**

Compiled by the authors.

In order to speculate about these changes, it is necessary to establish the mechanisms which link pandemics with taxation and tax systems. We will try to deduce these mechanisms by analyzing the consequences of earlier pandemics in the chronological order already used in Table 2.

It is important to note that pandemics have long-term consequences for taxation, regardless of the motivation and the intention behind the changes in tax policy at the time of their implementation. Unfortunately, for a long time the previous experience of relevant tax changes under the influence of pandemics was simply ignored. We believe that the time has come to make use of this experience, and a scientific basis we outlined will help to overcome the negative consequences of the current corona crisis.

5. The pandemic of antiquity: fiscal Centralization and the legal foundations of modern taxation

The first pandemic described in historical records was ***the Antonine Plague*** (165–180 AD), which happened during the reign of the last of the "five good Roman emperors" – the stoic philosopher Marcus Aurelius (reigned in 161–180). The second name of this pandemic is the Plague of Galen, after the Roman physician and philosopher Claudius Galen, who described its symptomatic manifestations. Perhaps, in reality, this pandemic was not really a plague but a pandemic caused by the smallpox or measles virus. In any case, it was the most serious outbreak of disease in Roman times, both in terms of the human lives lost and its socio-economic impact [33].

The Antonine Plague broke out at the beginning of the crisis of the slave economy which was gradually replaced by crafts and manufacturing. In addition, in that period, the Roman Empire was characterized by the expansion of foreign trade with surrounding territories, and its political organization can be called a "territorial state", a kind of conglomerate of various cities, regions and tribes, often at different levels of development, but governed from the center – Rome. The spread of the disease was facilitated by the war between the Romans and the Parthians over Armenia [3, p. 603].

The main consequence of the Antonine Plague was a significant decrease in the number of inhabitants of the Empire; modern historians estimate the population loss at seven to ten million people, about a third of the pre-pandemic population [31; 33]. A financial crisis followed this depopulation, because public revenue fell far behind public expenditure; more and more barbarians from the North of Europe settled in the Roman empire; religious doubts in the face of the catastrophic pandemic led to a decline of traditional religion and morals. All of these developments contributed to the weakening of the Roman Empire and were the first steps towards its final collapse a few centuries later.

Interestingly, Marcus Aurelius, in contrast to his predecessors, was very averse to raising taxes because he considered high tax burdens to be very harmful. Therefore, he tried to fight the fiscal crisis not by raising taxes, but by selling off a lot of his personal property to cover at least a part of the shortfall in revenue and by reducing government expenditure [6, pp. 107–109]. Perhaps this was the first attempt in history to overcome the crisis of public finances not by increasing tax revenues but by selling public (or semi-public) property in order to keep the tax burden at moderate levels and not to overtax the population that suffered great losses of income and property.

His son Commodus (reigned in 180–192), whom Marcus Aurelius named his successor, not only abandoned the moderation and thoughtfulness shown by his father but, more importantly, failed to reinvigorate social and economic life in Rome after the pandemic. This led not only to the secession of provinces from the Empire but also to riots and conspiracies due to the increase of the tax burden. As a result of one of those plots, Commodus was killed. Under Emperor Septimius Severus (reigned in 193–211), thanks to centralization and reorganization, Rome

began to recover from the consequences of the Antonine Plague [3, p. 608].

The period following Severus' rule was characterized by the decline of the Roman tax system and a significant depreciation of money (due to the decrease in the silver content of the denarius). This practice at first enabled the government to raise more revenues but, in the end, it failed when the denarius became almost worthless and taxes had to be collected not in money, but in kind, such as clothes or weapons [12, p. 23]. It was only during the reign of the Emperor Diocletian (284–305), a century after the end of the pandemic, that the disastrous effects of this "inflation tax" could be overcome; furthermore, the centralization of Rome's finances was then completed, including the reorganization of tax collection [6, pp. 113–118].

We can describe the influence of the Antonine Plague on taxation in the Roman Empire as follows. By the time the largest pandemic of ancient times began, the "Imperial system" of tax collection had already been established. This system turned out to be superior to the system of Republican times. The establishment of fixed contributions and customs duties meant that Imperial officials exerted less fiscal pressure on the provinces than the Republican magistrates of former times who had much more discretion and often used it to plunder the provinces [3, pp. 559–560]. The financial transformation under Diocletian after the end of the pandemic led to the unified collection of taxes in the provinces under the control and according to the interests of Rome. From the modern point of view, this system can be considered a prototype of fiscal centralization, i.e. the concentration of both the spending and the taxing authority in the center of power: Rome. The centralized system of direct collection of taxes from the provinces was controlled by Imperial procurators [3, p. 571]. In addition, since the time of Septimius Severus, a legal framework was established for taxation and tax administration in the form of well-developed Roman law, both conceptually and practically. In particular, important contributions were made by the outstanding lawyers Papinian (Aemilius Papinianus) and Ulpian (Gnaeus Domitius Annius Ulpianus), who systematized and built on executive and legal practices and principles formed in earlier times [2].

The Antonine Plague gave rise to several important tax innovations that have survived to the present era. Firstly, it was fiscal centralization in taxation, which became the basis for the architecture of most modern tax systems. Secondly, the codification of tax rules in the form of Roman law. The tax legislation in a significant number of countries, including Germany and Russia, was built upon this foundation. Thirdly, the concept of a comprehensive public finance reform, which aims not only at taxes but also at public expenditure and public property, was pioneered by the philosopher-emperor Marcus Aurelius. Last but not least, it was in the aftermath of the Antonine Plague that the most conspicuous case of coin debasement occurred, one of the earliest examples of the use of the "inflation tax". It should be noted that the adjustments to tax policy under the influence of the Antonine Plague were carried out more or less intuitively, without developing any systematic approach. Nonetheless, changes in public policy made by Marcus Aurelius and aimed at matching government spending to the ability to raise revenue in critical circumstances were repeatedly copied in the anti-crisis policies of later epochs.

6. Pandemics in the Middle Ages: church tithes, centralization of tax administration and personalization of taxes

The largest pandemics of the Middle Ages were the Plague of Justinian (541–750) and the Medieval plague or Black Death (1331–1353). Both of these pandemics, like the Antonine Plague that preceded them, had a noticeable impact on European development and on the development of tax institutions.

The Plague of Justinian, a period of devastation that spanned two centuries between the sixth and eighth centuries (the so-called "dark age" of the Middle

Ages), is named after the Byzantine Emperor Justinian I the Great (reigned from 527 to 565), who tried to restore the Roman Empire[2]. It is estimated that the number of victims of the pandemic in its first 50 years in Europe (the so-called "first coming") amounted to up to 100 million lives [36]; in total it is supposed to have killed more than 150 million people[3]. The pandemic began when what we would today call globalization was at its highest in the territories of the former Roman Empire: The Middle East, North Africa and Southern Europe were being integrated into the Byzantine Empire. It is believed that the main reason for the spread of the plague was foreign trade. The deadly disease was transmitted through rodents by way of grain shipments from Egypt to Europe and the Middle East[4]. The demographic catastrophe in the Mediterranean with its huge population losses and the devastation of cities and rural areas was a major cause of the decline of the Byzantine economy, which put an end to the prospects of revival of the Roman Empire.

The Plague of Justinian, which began at the time of the establishment of Christianity as the state religion in Byzantium[5], led to significant changes in social behavior. Due to Church teachings, the inhabitants of the Empire acquired a sense of common guilt and sin, characteristic of early Christianity. At the same time as Byzantium became Christian and as the Mediterranean region was devastated by the plague, a new religion began its triumphant ascent – Islam, which was established in the final period of the pandemic (7th and 8th century). Islam, and with it Arab influence, expanded in the Mediterranean (including North Africa and Spain), Central Asia, and the Middle East, and Arab-Muslim culture flourished after 750 AD.

The Plague of Justinian left its mark on the history of taxation in at least three ways. Firstly, the Emperor Justinian, continuing to wage war during the plague, increased the tax pressure on his citizens, forcing the living to pay not only their own taxes but also those of their dead neighbors. Excessive taxation is considered by some historians to be one of the most important reasons for the decline of the Byzantine Empire and for the appeal of Islam [6, pp. 131–132]: the Muslim conquerors were perceived by the enslaved inhabitants of the former Roman world as liberators, in particular from excessive taxation [6, pp. 133–136]. Not only was Islam more tolerant of other religious denominations than Christianity, it also pursued a tolerant and pragmatic approach towards taxation. In general, tax rates were moderate, the tax burden was distributed fairly, and tax collection was less corrupt [39, pp. 33–35]. The Roman poll taxes were imposed only on non-Muslims, which attracted many people into the fold of Islam [10, pp. 298–299].

Secondly, in some cases, Justinian applied a perfectly reasonable anti-crisis tax policy, trying to use tax incentives to solve the economic problems caused by the pandemic. Thus, Venice[6] in 551 received from Justinian its first "bulla" – a reduction in taxes on foreign trade operations (the Byzantine duties on trade amounted to 10–12.5%) [12, p. 59]. This played an im-

[2] In 330, the Roman Emperor Constantine I the Great officially moved the capital of the Roman Empire to the ancient Greek city of Byzantium, which became Constantinople.

[3] Schegolev I. A terrible epidemic, tamed by man. *Rossijskaya gazeta*. 2015. January 2. (In Russ.) Available at: https://rg.ru/2015/01/02/pandemia-site.html

[4] Smirnov S. Plague, inflation, and income growth: how epidemics changed the world economy. *The Bell*. 2020. February 5. (In Russ.) Available at: https://thebell.io/chuma-inflyatsiya-rost-dohodov-kak-epidemii-menyali-mirovuyu-ekonomiku

[5] During the reign of Justinian the Great, paganism was finally abolished in the Byzantine Empire: All pagans and their family members were forcibly baptized, and Christianity was codified by the introduction of appropriate titles (sections) in the Code of Justinian (see *Digests of Justinian*. Book 1. Titles I, VIII. (In Russ.) Available at: http://www.vostlit.info/Texts/Dokumenty/Byzanz/VI/520-540/Digestae_Just/).

[6] Venice, like many medieval European cities, suffered from the Plague of Justinian. It is in 543 that the dark history of the "Plague Island" of Poveglia begins. On this quarantined island in the Venetian lagoon, numerous victims of the plague found their last resting place.

portant role in the establishment and development of Venice as one of the centers of Mediterranean trade. In contrast, when, beginning in 1324, the citizens of Venice who engaged in trade and commerce were subjected to high taxes, the end of Venice as a prosperous state was approaching fast [26, pp. 152–156]. The stimulating role of reducing indirect taxes on foreign trade operations is a lesson of the Plague of Justinian worth remembering. In subsequent pandemics, this policy was repeated – however, without referring to historical precedent and analyzing the positive effects this policy had had in earlier times.

Thirdly, the pandemic made the Church pay more attention to its finances. In Byzantium there was a so-called "tithe" – a tax applied to certain types of income, including that from trade, and in proportion to the amount of the respective incomes. However, it was not regulated by Roman law in any way, despite the rather detailed Digests of Justinian[7] [9]. At the same time, the Church, whose influence was increasing, was interested in permanent sources of income that would be assigned to it by law. Since, on the one hand, the pandemic helped to strengthen faith in God and, on the other, it involved the Church in the care for the sick and in other kinds of charity[8], it was clearly the right time to expand and to stabilize the financial basis of the Church. The Synods of Tours (567) and Mâcon (585) commanded the faithful to pay Church tithes, first as an appropriate gesture of goodwill, and then as a Christian duty. Later, in 779, king Charlemagne of the Franks made Church tithes a mandatory tax[9]. From a modern point of view, Church tithes can be considered as a precursor to income taxation.

Therefore, they represent the really innovative element of the changes in taxation during the period of the Justinian plague. In addition, the Church tithe as such continues to be relevant even today; for example, in Germany, it is levied on Church members in the form of a surcharge on the income tax.

The Medieval plague or Black Death (epidemiologists call it the bubonic plague), which occurred at the beginning of the "little ice age" in the 14th century, was the most devastating pandemic in terms of the number of victims. Europe lost at least a third of its population only in the period from 1347 to 1352. According to various estimates, the region's losses ranged from 25 to almost 50 million people [30, p. 45]. The maximum number of fatalities from the Black Death in Eurasia over the entire period of its spread may have reached 200 million[10]; the mortality rate was 80–90% [32, p. 2]. There were two main reasons for the spread of the plague: the development of trade between Europe and Asia and military conflicts. The accepted theory is that the disease was brought to Europe by Genoese traders after the siege of the fortress of Kaffa (modern Feodosia in Crimea) by the Tatars under the leadership of Khan Janybek [36]. The pandemic developed against the background of famines which resulted both from crop failures due to the cooling during the "little ice age" and from the Hundred Years' War between England and France (1337–1453).

In contrast to previous pandemics, the Black Death caused an economic shock that in the end completely transformed European society and economy – and thus laid the foundation for the rise of Europe in the following centuries [5]. The immediate effect of the plague was the depopulation of vast parts of Europe. On the one hand, this led to a crisis in the feudal economy which was based on agricultural serfdom: land was redistributed among

[7] *Digests of Justinian*. (In Russ.) Available at: https://www.gumer.info/bibliotek_Buks/Pravo/digest/01.php

[8] In particular, in 651 (just at the time of the Plague of Justinian), the Hôtel-Dieu de Paris (Parisian Asylum of God) was founded under the patronage of the Catholic Church. It is the oldest hospital in the world still active and it is still located opposite Notre-Dame Cathedral. Once it had a special isolation ward for plague patients.

[9] Tithe. In: *The Encyclopaedic Dictionary of Brockhaus and Efron*. (In Russ.) Available at: https://rus-brokgauz-efron.slovaronline.com/43294-%D0%94%D0%B5%D1%81%D1%8F%D1%82%D0%B8%D0%BD%D0%B0

[10] Majzul's M. History of Plague. *Arzamas*. 2020. April 29. (In Russ.) Available at: https://arzamas.academy/mag/823-plague

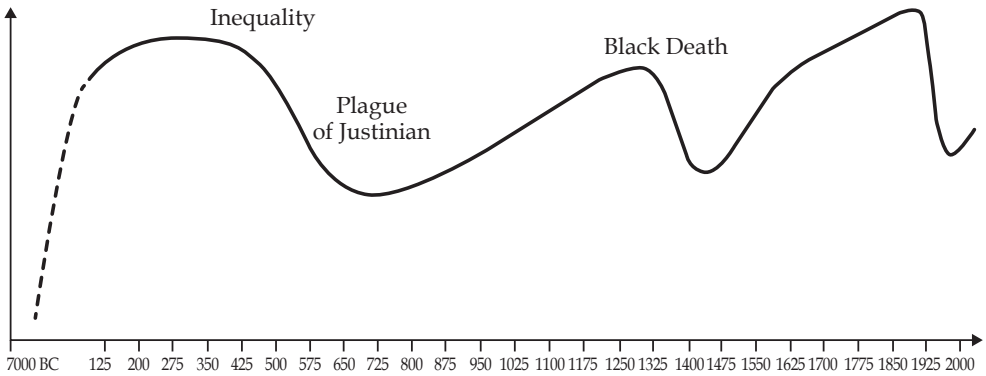

Figure 1. **Dynamics of inequality in Europe on a broad historical scale**

Source: [14, p. 32]

the survivors, and serfs became free agricultural workers, tenants or even land owners. On the other hand, there was a shortage of labor which gave rise to the improvement of the economic position of labor relative to the owners of capital and land [14, pp. 99–100]. Wages increased considerably, which at first caused the income disparity to narrow and then gave an impetus to the mechanization of agriculture and to technological progress in general[11]. Walter Scheidel's estimates of the development of income equalization during the Plague of Justinian and the Black Death are shown in Fig. 1 [14, p. 32].

Figure 2, which is based on studies of income diffusion by Paul Schmelzing [15] from the 14th century to the present day, shows that the leading European countries – Italy, England, Germany and France – in the post-pandemic period (late 14th – late 15th centuries) significantly increased their share in advanced economy real GDP, thanks to the new economic structure and development institutions adapted to the consequences of the Black Death. It is clear that the Black Death drastically expanded the tax base, contributing to income growth in the historical development period that followed the pandemic.

But there were also more indirect and longer lasting consequences: higher wages meant that income did not have to be spent only on food and other essential goods but that part of it could be used to buy "luxury goods". The crafts and the arts profited from this increase in demand and the towns and the cities grew where the craftsmen and the artisans were living and working. Higher incomes and urbanization had two important consequences for taxation: the tax base grew and tax administration became easier[12].

"After the plague, incomes per capita were higher; there was more surplus above subsistence that could be expropriated. As a result of the so-called 'commercial revolution' of the late Middle Ages, the economy had already become more urban, monetized and commercialized. Surpluses could be taxed more easily, providing the means for fighting more, and fighting longer" [5, pp. 781–782].

Thus, in fact, a self-propagating process was started: higher tax revenue could be used to wage more and longer wars which caused still more deaths (not only in battle but also because the plague was spread by wars) which, in turn, led to still higher wages, higher consumption and more urbanization.

[11] Smirnov S. Plague, inflation, and income growth: how epidemics changed the world economy. *The Bell*. 2020. February 5. (In Russ.) Available at: https://thebell.io/chuma-inflyatsiya-rost-dohodov-kak-epidemii-menyali-mirovuyu-ekonomiku

[12] Piper N. Die Ökonomie des Todes. *Süddeutsche Zeitung*. 2020. 10. April. Available at: https://www.sueddeutsche.de/wirtschaft/pest-coronavirus-wirtschaft-1.4873813

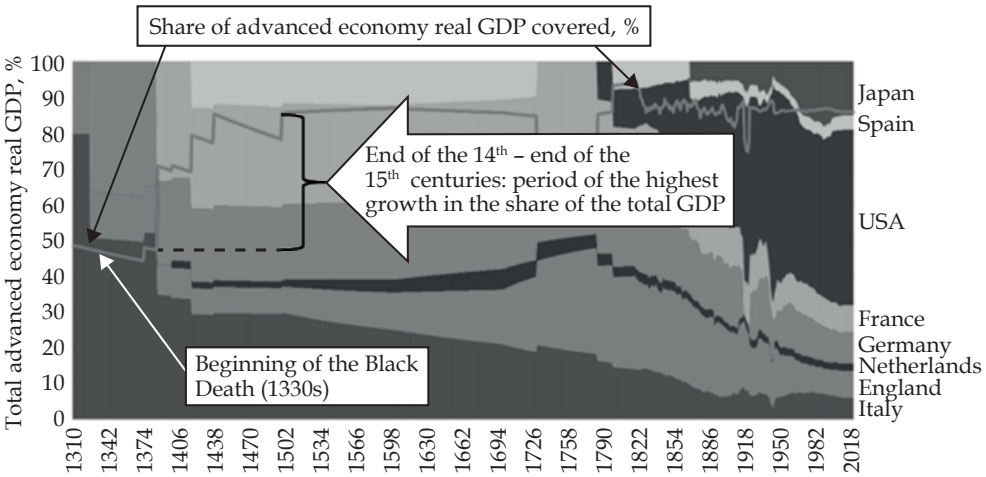

Figure 2. **GDP weights and the share of total advanced economy real GDP covered by the world's leading countries (estimated by the market value of national currency exchange rates): dynamics of the 14th – 21st centuries**

Source: [15, p. 4]

The economic consequences were accompanied by social ones. The attitude to consumption changed significantly. The awareness of the impermanence of existence led to a desire to maximize the enjoyment of life and even encouraged wasteful consumption [15, p. 71]. On the other hand, the influence of the Church on the faithful grew. Thus, in the most famous work of fiction about the plague – the "Decamerone" by Giovanni Boccaccio, which describes the sad events in Florence in 1348, one of the causes of the deadly disease is called the "righteous wrath of God". In fact, Pope Clement VI, in a message dated September 26, 1348, called the plague the judgment of God and a disease with which God struck the Christian people for their sins [37, p. 155]. The desire to atone for that sinfulness explains the emphasis on social justice and social responsibility: Charity and material sacrifices for the benefit of the sick and the poor, but also asceticism, were important phenomena in the late Middle Ages – in contrast and in opposition to hedonism and luxury [14, pp. 99–101]. In order to rein in the latter tendencies, sumptuary laws were passed on a large scale in Europe in the 14th and 15th century [15, p. 71].

In our opinion, there were several changes in taxation closely related to the Black Death and its aftermath:

1. In the affected regions, tax incentives for foreign trade were used on a large scale – both in the form of lower rates and in the form of tax harmonization. In 1356 in Lubeck the governing body of the Hanseatic League ("Hansetag", i.e. General Hanseatic Congress[13]) was formed[14]. The "Hanse" united the merchant guilds of 130 cities of the North Sea and the Baltic Sea region according to the principles of duty-free trade. In fact, the Hanse became the first private organisation in history which accorded its members most-favored-nation (or, rather, "-member") treatment in the form of tax exemptions in each of the member cities [1]. The growth of trade became one of the drivers of the economy in the late Middle Ages. The duty-free union of merchant cities of the Hanse can be seen, from a modern point

[13] The Hansetag met every two or three years and determined the general policy of the Hanseatic League. The decisions of the Hansetag were binding for all members of the Hanseatic League.

[14] Hansa, Hanseatic League. In: *Encyclopedia of World History*. (In Russ.) Available at: https://w.histrf.ru/articles/article/show/ganza_ganzieiskii_soiuz_niem_hanse

of view, as a kind of corporate code of honour in taxation. It also can be considered an early precursor of tax harmonization in Europe, which began only in the second half of the 20th century, when duties were unified.

2. Different types of luxury taxes were levied on a permanent basis in many regions. For example, in Italian cities after the Black Death pandemic both sumptuary laws and luxury tax laws were passed [4, p. 62]. Thus, wasteful and ostentatious consumption led to higher taxes on luxury goods.

3. In 1377 in England the poll tax was introduced, a precursor of personal taxes (such as the individual income tax) [41; 43]. It was intended to help to stabilize public finances during the Hundred Years' War with France. In order to exploit the growth of income of the population as simply as possible, the new tax base "heads of taxpayers" was used [12, p. 105]. However, the poll tax proved to be unsuccessful, causing numerous protests, including the large-scale peasant revolt of Wat Tyler (1381).

4. For the first time after the Roman Empire, tax administration was centralized in the part of Europe dominated by the Catholic Church. The core of its fiscal apparatus was the Apostolic Chamber. This institution managed the collection of Church taxes not only in the Papal State but also in all the administrative provinces of the Church and from the monastic orders [40]. The Apostolic Chamber was the largest and most advanced fiscal institution of the Middle Ages, its tasks and its powers were codified soon after the end of the plague pandemic – in the constitutions of Popes Urban V and Urban VI (in 1363 and 1379, respectively). However, in terms of revenue, the Apostolic Chamber did not work very successfully. After the death of Urban VI, the Papal Treasury was empty and it had to be replenished with bank loans, mortgages of jewelry (left from Urban VI himself), "jubilee fees", increased sales of benefices and the introduction of "annates" on a permanent basis ("annates" are the first year's profits of a benefice, to be paid to the Pope) [38]. For modern tax policy, interstate centralization of tax administration during the Black Death pandemic – notwithstanding its rather poor results – is important as the very first historical example of interstate tax coordination, which was tried again only in the 20th century.

5. Finally, another consequence of the Black Death was the imposition of taxes on alcoholic beverages. In the pandemic of the 14th century strong liquors became popular because people began to drink them heavily for "prevention" of infection and also to forget about the fatal disease [36]. Both the excessive consumption of alcohol (the so-called "feast during the plague") and the extravagance associated with luxurious consumption during the pandemic subsequently gave rise to the introduction of the respective excise taxes.

Innovations in taxation and tax administration that were closely related to the Black Death pandemic were the following: tax incentives for foreign trade; personal taxes in the form of the poll tax; taxes on alcohol and luxury goods (which can be interpreted as the first manifestation of the principles of social justice and social responsibility in taxation); and tax harmonization and interstate centralization of tax administration. These tax innovations remain relevant to this day.

7. Pandemics of the modern period: social policy, modern medicine and a scientific approach to taxation

Although there was a fairly large number of different pandemics in the modern period, it is the Great Plague of the 17th and early 18th century and the pandemics of the 19th and early 20th century (cholera, smallpox, plague and influenza) that are of interest in the context of taxation. In this historical era, both taxation and tax administration were based on scientific principles, and the church was replaced by modern medicine as the main institution for healing and caring for the sick. In contrast to the church, medical science went beyond the cure of diseases and worked hard on disease prevention, a task intimately related to epidemiology, which then came into being, too.

The Great Plague, which took place from the middle of the 17th to the beginning of the 18th century, was the deadliest in cities. In 1654, a major outbreak of plague happened in Moscow; in 1655, in Kazan; and in 1663 it hit Amsterdam and Rotterdam. In 1665 and 1666, London suffered from the plague (it was here that the epidemic received the name "Great Plague"), which claimed the lives of 70 to 100 thousand Londoners[15]. In 1678 and 1679, the Great Plague engulfed Vienna; 80 thousand inhabitants died of it; in memory of the struggle against the deadly disease, the famous Plague Column was erected in the city center in 1693. In 1681 the plague reached Prague; from 1708 to 1714, it spread across Northern Europe (in Danzig and the cities of East Prussia, such as Königsberg, it broke out in 1709 and 1710). Kiev was affected in 1710 and 1711, Marseille in 1720–1722.

Despite its awful name, the Great Plague did not take as many lives (less than 1.5 million) as the previous pandemics. However, its toll was great in cities which, having resurged after the Black Death, were overcrowded and where living conditions were insanitary. As the pandemics of times past, this one occurred against the background of long-distance trade, geopolitical conflicts and wars; but the Great Plague was also accompanied by urbanization and the development of urban self-government.

The population decline during the Great Plaque, as in times past, led to a shortage of labor, a decline in production and, thus, lower public revenues. As many European states waged wars of one kind or another (the Russian-Polish war, 1654–1667; the English civil war, 1640–1660; and the Great Northern war, 1700–1721), governments were preoccupied with raising money and improving their finances.

For the first time in world history, governments could enlist the help of science: New disciplines like economics (in the form of mercantilism), demography and "political arithmetic" (the precursor of econometrics) came into being. Thus, taxation no longer needed to be done (more or less) intuitively, but could rely on scientific expertise. It was during this period that tax science was born: William Petty (1623–1687), who was a physician in Cromwell's army and studied the effects of the plague in Ireland, published "A Treatise of Taxes and Contributions" [22]. This treatise had a significant long-term impact on the principles of taxation and tax policy in Great Britain and beyond [10, pp. 255–256]. Furthermore, his was also the first quantitative study of the economy [23], which showed how to get and how to use economic data for purposes of taxation. Consequently, tax censuses, trade statistics, systems of national accounts, and demographic statistics became the quantitative foundation of tax policy.

It is interesting to note the relations between different scientific approaches. Petty taught at Gresham College in London, founded in 1579 on a grant from the banker and Royal tax collector Thomas Gresham (1519–1579). To the latter the law is often ascribed, according to which "bad" money displaces "good" money from circulation. This pattern was first noticed by the scholastic Nicolaus Oresmius (1323–1382) [24]. "Bad" money results from the debasement of coins, i.e. the decrease of their silver (or gold) content. It occurred in Rome after the Antonine Plague (see sec. 4); it also was observed by the astronomer Nicolaus Copernicus (1473–1543) in the lands of the Teutonic Order after the plague of 1519 [25]. Debasement of coins represents a kind of indirect tax: it allows the government to mint more coins, which increases the money supply, which in turn leads to inflation. In effect, part of the purchasing power of the citizens is being transferred to the state. This kind of "inflation tax" was also discussed (and criticized) by Petty [22, pp. 65–71].

John Graunt (1620–1674), the first demographer and a close friend of Petty's, also made important contributions to developing "political arithmetic". He ana-

[15] Majzul's M. History of Plague. *Arzamas*. 2020. April 29. (In Russ.) Available at: https://arzamas.academy/mag/823-plague

lyzed the causes of death of Londoners during the Great Plague, estimated the probability of survival and life expectancy and, in turn, the number of taxpayers in the future [10, pp. 256–258]. In addition, Gregory King (1648–1712) and Charles Davenant (1656–1714) also did work in this field. Thanks to their development of methods for assessing income ("field tax audits") and forecasting tax revenues, England by the end of the 17th century had a quite sophisticated system of tax administration, based on scientific principles. Thus, in the modern period, tax theory and tax practice were adapted to the blows of the Great Plague which, once again, negatively affected the size of the population and the economy.

It should be noted that centralization of tax administration with the aim to improve the efficiency of tax collection also happened in France at the turn of the 17th to the 18th century. Here, authors like Pierre Le Pesan, sieur de Boisguilbert (1646–1714) and Sébastien Le Prestre de Vauban (1633–1707) tried to put taxation on a scientific footing [10, pp. 284–287]. Boisguilbert criticized the French tax system, which he regarded as highly inefficient and extremely inequitable [20]. The arguments of Boisguilbert inspired de Vauban, a famous military engineer, to write "The Royal Tithe" (*Le Dîme Royal*) [21], where he argued for a radical reform of the complicated system of taxation in France. The centerpiece of his proposal was a general income tax without exceptions. This proposal owed a lot to the success of his earlier proposal for a temporary wartime tax. This was a mixture between a poll tax and an income tax: all taxpayers were assigned to one of 22 social classes which served as proxies for income. All members of one class paid the same tax, but taxes were graduated between classes according to their members' typical level of income. Unfortunately, the new reform proposals were not accepted by the "sun king" Louis XIV, who, instead of a general income tax, introduced a poll tax – without, however, the key feature of graduation, characteristic of the earlier wartime tax.

The above-mentioned trends could also be observed in Russia. Here, between 1653 and 1667, customs duties were unified in the New Trade Charter [12, p. 155]. In 1654 the Accounting Affairs Chamber was created to analyze revenues and expenditures of the Muscovite state. Finally, in 1679, a city household tax (a tax on households of city residents) was introduced [7]; it had city residents' households as a tax base, which was simple to assess. Later, during the reign of Emperor Peter I in the mid-1720s, the poll tax was introduced in Russia, following the example of other countries, especially that of France [12, p. 233].

In Germany, Johann Joachim Becher (1635–1682) discussed, inter alia, the effect of taxes on the growth of population and on economic activity [19]. However, the potential for a tax reform aiming at rationalization and unification was extremely limited in Germany, because Germany was then not a nation state but a hodgepodge of many independent kingdoms, duchies, counties and cities.

Public revenue consists not only of taxes but also of contributions and fees. During the Great Plague several European cities levied special "anti-pandemic" contributions which they used to finance anti-epidemic measures, such as the installation of sewers and the improvement of cleanliness in general. This was seen as a social responsibility of citizens. For example, London parishes collected contributions from residents to pay for the inspectors who were to supervise anti-pandemic measures [35, p. 84]. This is probably the first attempt in the history of taxation to finance anti-epidemic measures with contributions. In other European cities, similar measures were carried out; often, they were covered from the revenue from contributions or fees imposed for this very purpose. For instance, in Moscow, in the 16th century, after the deadly pandemics, *Zemsky prikaz*[16] collected special bridge tolls for street improvement. After the

[16] This is the name of the central government institution responsible for the administration of Moscow and some other Russian cities from the 16th to the 18th century.

plague of 1654 and 1655, Russian authorities began paving city squares and streets to improve cleanliness [42].

Thus, the Great Plague was related to several important innovations in taxation. The tax system was rationalized and centralized according to the new theories of taxation, tax administration, statistics, accounting and demography, all of which had their origin in the late 17th and early 18th century. Moreover, the inflation tax, which already had been used in the context of previous pandemics, now was analyzed in greater detail. In addition, it should be noted that special contributions for anti-epidemic measures were introduced, which might be interpreted as the precursors of social security contributions.

The pandemics of the 19th and the early 20th century include several waves of various deadly diseases – cholera, smallpox, plague and flu. Some of them, like the outbreaks of cholera, were local and could be contained quickly, while others, like the infamous Spanish flu, claimed up to 100 million lives[17]. All these pandemics occurred in the context of rapid industrialization and economic expansion, of social and political revolutions, of large-scale wars and urbanization. Numerous military conflicts of this era and the growing concentration of the population in cities, together with insufficient sanitation and hygiene, contributed to the development of pandemics.

For the evolution of taxation and tax administration, the pandemics of the 19th and early 20th century were also quite important. They led to structural changes in tax systems, as opposed to the unsystematic imposition of special taxes or other levies to cover the cost of pandemics on a case-by-case basis. These structural changes include the introduction of contributions for health care, which were an equivalent of today's social security contributions. Furthermore, due to the growing awareness of their social obligations, the business and the political establishment in some countries took over (more or less voluntarily) the responsibility to establish hospitals and infirmaries.

In particular, Russia was at the forefront of promoting health insurance and charitable health care. Firstly, public hospitals were established under the patronage of members of high society and industrial tycoons. In 1805, with support from the Dowager Empress Maria Feodorovna, the Mariinsky hospital was opened in St.Petersburg, which ever since has played an important role in the fight against epidemics. Count Nicholas Sheremetiev, at his own expense, built the Hospice for Travellers (opened in 1810), one of the best private hospitals in Moscow. Now it is the Research Institute of Emergency Medicine named after N. Sklifosovsky. The Sheremetiev family spent 6 million rubles on the maintenance of the clinic during the first century of its existence. In the 19th century, the hospital provided medical care for 2 million patients free of charge[18]. From 1833 to 1835, the Peter and Paul Hospital (now a part of the First State Medical University named after Ivan Pavlov) was built in St. Petersburg from the donations of Emperor Nicholas I. The hospital has been involved in the treatment of all epidemics and pandemics from the 19th century until today. Nicholas I personally inspected the new buildings of the hospital where cholera patients were treated in the 1830s and 1840s. In 1900, Merchant of the 1st Guild Vikula Morozov initiated the construction of a new children's hospital for infectious diseases in Moscow. Now it is the Morozov City Children's Clinical Hospital of the Russian capital.

Secondly, at the expense of commercial and non-commercial public organizations, a mass program of vaccination against smallpox was carried out. This campaign was organized by specially cre-

[17] Schegolev I. A terrible epidemic, tamed by man. *Rossijskaya gazeta*. 2015. January 2. (In Russ.) Available at: https://rg.ru/2015/01/02/pandemia-site.html. It should be noted that even the losses from the First World War (approximately 18 million victims, including those who died of war-related famines and diseases) were smaller than those from the Spanish flu pandemic.

[18] *Research Institute of Emergency Medicine named after N. Sklifosovsky*. Available at: https://sklif.mos.ru/about/history.php

ated smallpox committees under the patronage of the Imperial Humane Society and with the participation of the Ministry of Internal Affairs and the Free Economic Society[19]. Moreover, anti-plague measures and vaccines were developed, and technologies for disinfecting drinking water were introduced. Especially noteworthy is the effectiveness of the Commission on Measures to Prevent and Combat Plague Infection (Komochum), established in 1897 under the chairmanship of Prince Alexander von Oldenburg, and the development of an anti-plague serum at the St. Petersburg Institute of Experimental Medicine [34, pp. 145–146].

Thirdly, to prevent the spread of cholera epidemics, the Regulations of the Cabinet of Ministers on the Organization of Hospital Treatment for Factory Workers (1866), required large manufacturers to maintain in their firms at least one hospital bed per one hundred employees. After 1867, seven major industrial centers of the Russian Empire (St. Petersburg, Moscow, Odessa, Ivanovo-Voznesensk, Lodz, Kharkiv and Warsaw) began to levy contributions to fund city hospitals[20].

Fourthly and finally, in 1912, the Third State Duma (Parliament) of the Russian Empire adopted the Law on Hospital Insurance Funds, which stipulated the establishment of insurance schemes for workers. Every firm had to set up a fund to cover the costs of medical treatment and sick pay; the funds came from the contributions from both workers and employers; smaller firms could co-operate and establish common funds[21]. Thus, after originating in specific cities in the 1860s, public health care was finally established nation-wide.

All of these measures were instrumental in reducing significantly the health risks of industrialization and urbanization, which included the danger of pandemics. The hospital infrastructure created in the Russian Empire during the fight against the cholera and plague in the 19th century was in high demand not only during the Spanish flu pandemic in the early 20th century, but is now still being used to treat patients suffering from COVID-19. Our review of medical regulations and tax support of medicine to prevent epidemics in the Russian Empire in the 19th – early 20th centuries is given in Table 4.

In our opinion, personal experience of the country's rulers was of great importance for the development of a national strategy to fight infectious diseases. In 1831, the participation of Tsar Nicholas I (reigned from 1825 to 1855) in the suppression of the cholera riot on Sennaya Square in St. Petersburg left an indelible impression on him. One year later, in 1832, new rules and statutes were written into the Code of Laws of the Russian Empire to provide for the funding of public health care. In 1836 the Statute on Quarantines was adopted and in 1842 the Statute on Sanitary Police was passed [44]. Detailed rules on quarantines and sanitary inspections, vaccinations against smallpox[22], construction of cholera hospitals, getting business to contribute to the financing of public health care – all of this would not have worked without the country's lea-ders' personal involvement and their understanding of the dangers of epidemics for socio-economic development.

The situation in Germany was similar to that of Russia in that it also suffered from numerous epidemics in the 19th century. These provided one of the

[19] *The Code of Laws of the Russian Empire, compiled by the order of the Emperor Nicholas I*. The edition of 1857. Vol. 13. Charters About the national foodstuffs, Public assistance and Medical. St. Petersburg; 1857. (In Russ.) Available at: https://runivers.ru/bookreader/book388226/#page/1/mode/1up

[20] Gorfin D. Factory medicine. In: *The big medical encyclopedia*. Moscow: Sovetskaya entsiklopediya; 1928. Vol. 10, pp. 645–648. (In Russ.)

[21] Tsvetkov A. How factory workers were treated in the Russian Empire. *Solidarnost*. 2012. Oktober 3. (In Russ.) Available at: https://www.solidarnost.org/thems/uroki-istorii/uroki-istorii_9263.html

[22] *The Code of Laws of the Russian Empire, compiled by the order of the Emperor Nicholas I*. The edition of 1857. Vol. 13. Charters About the national foodstuffs, Public assistance and Medical. St. Petersburg; 1857. (In Russ.) Available at: https://runivers.ru/bookreader/book388226/#page/1/mode/1up

Table 4

Medical regulations and tax support of medicine to prevent epidemics in the Russian Empire in the 19th – early 20th centuries

Years	Regulation and tax initiatives and their description
1832–1842	**Medical regulations of Nicholas I** (See: The Code of Laws of the Russian Empire, compiled by the order of the Emperor Nicholas I. The edition of 1857. Vol. 13. Charters About the national foodstuffs, Public assistance and Medical. St. Petersburg; 1857 (In Russ.)). Detailed characteristics of anti-epidemic and quarantine measures. Vaccination against smallpox at the state expense from the Ministry of Internal Affairs and the Free Economic Society. The fee for being in quarantine is charged if the observed have the appropriate funds, the poor are not charged. Payment for medical services is made by mutual agreement between the doctor (hospital) and the patient, the poor receive medical care in city hospitals or almshouses.
1864	**Alexander II's land reform (Zemstvo reform).** Local self-government bodies (zemstvos) were granted the right to organize medical and, consequently, medicinal assistance to the population of the territories under their jurisdiction with funds from local taxes and fees. Zemstvo medicine mainly served the Empire's rural population.
1866	**Establishing of the factory medicine by the order of the Committee of Ministers approved by Alexander II on August 28, 1866** (See: About the organization at factories and factories in the Moscow province of hospital rooms // Collection of laws and orders of the government, published under the Government Senate. 1887. SPb.: Publishing house of the government Senate, 1887. First six months. No. 12. Art. 126. P. 212 (In Russ.)). The document was adopted as a temporary measure in the face of the threat of a cholera epidemic. It did not become a permanent law and was not codified. This document obliged owners of industrial enterprises with at least 1,000 workers to open hospitals within a month at the rate of 1 bed per 100 people.
1870	**The urban reform: introduction of the system of state-funded (non-commercial) medicine. Public hospitals were built by using cities revenues.** Compared to zemstvos, city governments spent significantly less money on medical assistance to the population – on average, only about 5%, while zemstvos spent up to a third of their budgets. Only in Moscow, St. Petersburg, Riga, and Odessa, expenditures for medical and sanitary needs accounted for 15 to 20% of the city budget. In the 19-early 20th century in many cities of the Russian Empire, including Moscow and St. Petersburg, there was a so-called hospital fee for the maintenance of hospitals. In Moscow, this fee was collected from non-residents who came to work at the same time as obtaining a residence permit. Initially, the annual fee was 70 kopecks in silver per person, then the fee rose to one ruble, and since May 21, 1890 – one rouble and a quarter.
1912	**Laws "On the Establishment of Offices for Workers' Insurance", "On the Establishment of the Council for Workers' Insurance", "On the Provision of Workers in Case of Illness", " On Insurance of Workers from Accidents".** Hospital funds were established at all enterprises (small ones, up to 200 participants, were combined into general ones at several enterprises). All workers and employees with a period of employment of at least one week were required to join the hospital funds. Workers participating in the cash register were insured under the law not only against accidents, but also in case of illness. The owner of the enterprise was obliged to provide the first medical aid and outpatient treatment, as well as to provide or pay for hospital treatment and all medications (including women in labor) until recovery, but no more than 4 months. At the same time, patients were given a monetary allowance (from ½ to ⅔ earnings – having dependents, from ¼ to ½ earnings for the rest) from the fourth day of illness to recovery, but no longer than 26 weeks during one illness and no longer than 30 weeks during the year, and for temporary disability as a result of injury – from the moment of accident to recovery, but no longer than 13 weeks.

Compiled by the authors.

reasons for German Chancellor Otto von Bismarck (in office from 1871 to 1890) to introduce, in the 1880s, compulsory insurance for workers, organized and supervised by the state [16, pp. 114–116][23]. As the first element of this social security system, health insurance was established in 1883. Not coincidentally, the influential German economist Adolph Wagner (1835–1917), who was a strong supporter of Bismarck and his social security legislation, lived and worked for some years in Dorpat (then in Russia, now Tartu in Estonia), where he witnessed both the effects of the epidemics of the 1860s and the attempts of the Russians to improve public health and sanitation. In fact, he argued strongly in favor of the "welfare function" of the state in which he also included the prevention of infectious diseases and the care for sanitary living conditions [18, p. 257]. In order to finance these and other tasks, Wagner proposed a progressive income tax – one of the first economists to do so.

In this context, the development of the modern principles of taxation, in particular of income taxation, became important. The taxation of the income and of foreign citizens' property was especially controversial. Georg von Schanz (1853–1931) proposed the doctrine of "economic connectedness", according to which a state has the right to tax everybody who is in any way economically related to that state [13, p. 8]. Thus, it not only has the right to tax its own citizens but also the right to tax foreigners. Schanz came up with this idea just after the lethal Russian flu epidemic had spread in Germany (1889–1890). This might have inspired the following argument in favor of his doctrine: a foreign national can expect to receive medical care in the host country, including treatment for infectious diseases; therefore, the host country must have the right to tax income and property of foreigners who reside in this country. Subsequently, the two most important principles of international taxation – the source principle (withholding tax at the source of income generation) and the residence principle (taxing people in the country where they live) – were derived from the Schanz doctrine of "economic connectedness".

This period was also marked by the beginning of coordination of taxation at the interstate level due to the emerging problems of double taxation of income and property. Initially, this was due to the tax consequences of property transfers through inheritance [17, pp. 12–13], which occurred, in particular, after deaths from infectious diseases which were still widespread in the 19th and the early 20th century. After the end of the First World War, the first institution of international tax regulation emerged as a part of the League of Nations. Beginning in 1921, the Finance Committee of the League of Nations led the process of creating a system of legal regulation of international tax relations and developed measures aimed at eliminating double taxation of income and property [8, p. 13].

Thus, three major tax innovations can be interpreted as (at least, partly) the result of the pandemics of the 19th and the early 20th century: (1) private funding of medical research and health care through contributions of businesses that were voluntary only de jure and that therefore can be regarded as quasi-taxes; (2) the introduction of organized public health care, financed through compulsory social security contributions; (3) the development of international taxation principles and the creation of an institutional framework for the development of intergovernmental tax cooperation. Of course, the latter two innovations still retain their importance.

8. The COVID-19 pandemic of 2020: the digitalization of tax administration and the taxation of digital transactions

By the end of the 2010s, uncertainty and turbulence due to geopolitical conflicts and trade wars made themselves felt more and more. This could not but affect global development: by the end of 2019, production and trade slowed down

[23] There were also other reasons, of which the intention to make socialism less attractive for workers was the most important.

worldwide[24]. The beginning of the 2020s, however, turned out to be even worse than expected: the new type of coronavirus (SARS-CoV-2) that had appeared in China at the end of 2019 caused the global COVID-19 pandemic (the World Health Organization declared it as such on March 11, 2020), which triggered a major global economic crisis. The "Great Lockdown", as the IMF called it[25], brought the economies of many countries almost to a standstill and disrupted economic ties and glo-bal production systems; many jobs were lost; production, incomes and consumption went down; stock and commodity markets fell sharply; in a word, the world economy plunged into a catastrophe.

It is estimated that the fall in global GDP in 2020 will be close to 5%[26], the value of international trade will be reduced by almost a third[27], and up to 200 million jobs will be lost worldwide[28]. The strict quarantine measures introduced in March 2020 in Europe, North America and East Asia have interrupted not only global production systems, an important part of which is China, but also global tourism and transport[29]. According to IMF experts, the negative consequences of the Great Lockdown will significantly exceed the losses from the global financial crisis of 2008/2009[30]. It is obvious that the world economy needs massive support in order to get back on a growth trajectory.

As soon as the catastrophic consequences of the COVID-19 pandemic became obvious, proposals for changes in national tax systems were formulated at the level of international organizations. The OECD, the leading organization for international tax cooperation, has already recommended to reduce or eliminate taxes for the sectors of the economy most affected by the crisis[31].

Initially, the OECD planned for 2020 to be the key year for reforming income taxation of global high-tech companies that sell their services and digital products remotely[32]. According to the original plan, the countries affected were to submit, by the end of the year, proposals for the transition from taxation according to the principle of physical presence in the state ("nexus" rules) to taxation based on the sale of products in the country of consumption. Under current conditions, this

[24] *World Economic Outlook*. 2020. January. Tentative Stabilization, Sluggish Recovery? IMF. 2020. Available at: https://www.imf.org/en/Publications/WEO/Issues/2020/01/20/weo-update-january2020

[25] *World Economic Outlook*. The great lockdown. IMF. 2020. April. Available at: https://www.imf.org/en/Publications/WEO/Issues/2020/04/14/weo-april-2020

[26] *A Crisis Like No Other, An Uncertain Recovery*. IMF. 2020. June. Available at: https://www.imf.org/en/Publications/WEO/Issues/2020/06/24/WEOUpdateJune2020; Pandemic, Recession: The Global Economy in Crisis. *The World Bank*. 2020. June. Available at: https://openknowledge.worldbank.org/bitstream/handle/10986/33748/211553-Ch01.pdf

[27] Trade set to plunge as COVID-19 pandemic upends global economy. *WTO*. 2020. April 8. Available at: https://www.wto.org/english/news_e/pres20_e/pr855_e.htm

[28] *ILO Monitor: COVID-19 and the world of work*. 2nd ed. Updated estimates and analysis. 2020. 7 April. Available at: https://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/documents/briefingnote/wcms_740877.pdf

[29] Seric A. et al. *Managing COVID-19: How the pandemic disrupts global value chains*. UNIDO's Department of Policy Research and Statistics. 2020. April. Available at: https://iap.unido.org/articles/managing-covid-19-how-pandemic-disrupts-global-value-chains

[30] Gopinath G. *The Great Lockdown: Worst Economic Downturn Since the Great Depression*. IMF Blog. 2020. April 14. Available at: https://blogs.imf.org/2020/04/14/ the-great-lockdown-worst-economic-downturn-since-the-great-depression/

[31] *Tax and Fiscal Policy in Response to the Coronavirus Crisis: Strengthening Confidence and Resilience*. OECD. 2020. May 19. Available at: https://read.oecd-ilibrary.org/view/?ref=128_128575-o6raktc0aa&title=Tax-and-Fiscal-Policy-in-Response-to-the-Coronavirus-Crisis

[32] *OECD leading multilateral efforts to address tax challenges from digitalisation of the economy*. OECD. 2019. October 9. Available at: https://www.oecd.org/tax/beps/oecd-leading-multilateral-efforts-to-address-tax-challenges-from-digitalisation-of-the-economy.htm; *Secretariat Proposal for a "Unified Approach" under Pillar One*. OECD. 9 October 2019 – 12 November 2019. Available at: https://www.oecd.org/tax/beps/public-consultation-document-secretariat-proposal-unified-approach-pillar-one.pdf

approach is becoming more important, as the business of leading cross-border online firms such as Netflix, Zoom or Amazon actually increased, while traditional suppliers of goods and services saw a sharp drop in income or even faced bankruptcy.

Most of the anti-crisis tax regulation measures proposed in the first half of 2020 are not new, they were already used during previous pandemics. The general characteristics of possible tax regulation measures applied both at the national and interstate levels in the context of the COVID-19 pandemic are presented in Table 5.

Currently, tax systems are expected to fulfill two obviously conflicting tasks: (1) stimulating production, investment and consumption to save and create jobs; and (2) raising revenue to cover the large budget deficits.

It is obvious that in the phase of economic downturn, tax incentives may help the economy recover. Nonetheless, the expenditure side of the public budget is more important. With jobs lost and production cut to the extent we observe today, the investment and consumption climate has suffered so badly that tax in-

Table 5

General characteristics of tax regulation measures applied in the context of the COVID-19 pandemic

Periods and their characteristics	Tax regulation measures: realized and desired
PRE-PANDEMIC SITUATION (until the beginning of 2020): slowing down the growth rate of the world economy and national economies as a result of geopolitical confrontations and trade wars	**Development of national and intergovernmental tax response measures to stimulate economic growth and increase tax transparency of operations:** ● modification of national tax systems (2017–2018 tax reform in the United States, sales tax reform in Japan in 2019, adjustment of VAT and excise tax rates in Russia in 2019); ● implementation of the BEPS Actions plan under the auspices of the G20 and the OECD (prevention of aggressive tax planning by multinational corporate structures); ● establishment of a framework for taxation of income from cross-border electronic transactions (OECD). **Using the previous experience of tax regulation in the context of crises and epidemics:** ● ***SARS epidemic of 2003:*** tax benefits for affected industries (passenger air transport, tourism sector in South-East Asia); ● ***The "Great Recession" of 2008–2009:*** tax incentives for development (reduction of income tax and VAT rates to support production and consumption growth) and increased tax collection to normalize the situation in public finances (increase of individual income tax rates for high incomes; increase of excise tax and VAT rates), fight against tax evasion and counteract tax optimization of companies and individuals both at the national and interstate level.
COVID-19 PANDEMIC (beginning – February–March 2020): sharp decline in economic activity in the global and national economies as a result of the «Great Lockdown»	**Stimulating tax support measures:** ● manufacturing activities; ● consumer demand (reduction in tax rates on consumption, including VAT, sales taxes and excise taxes); ● the most affected industries and sectors of the economy (transport and logistics; tourism and hospitality; retail; culture, sports and entertainment; public catering; education); ● small and medium-sized businesses; ● self-employed population. **Fiscal measures to increase tax revenues of the state budget:** ● increase of current tax rates and introduction of new taxes; ● waiving obligations under previously signed double tax agreements that included reduced tax rates for the repatriation of passive income (including dividends, interest, and royalties); ● increasing tax collection through stricter methods of controlling taxpayers' incomes, operations and properties (large-scale use of digital platforms for monitoring taxpayers' actions).

End of table 5

Periods and their characteristics	Tax regulation measures: realized and desired
POST-PANDEMIC RECOVERY: recovery growth of the world economy and national economies in the face of escalating budget deficits and public debt with the likelihood of continuing geopolitical conflicts and trade wars	**Creating tax incentives for recovery and investment activity in national economies:** ● reduction of income, property and consumption tax rates for the period when national economies enter the path of sustainable recovery growth; ● tax incentives (tax holidays) for startups, especially in small and medium-sized businesses; ● tax incentives for activities that create new jobs, especially for local residents in regions with mass unemployment; ● reduced taxation (or no taxation at all) for the self-employed population during the period of national economic recovery; ● tax incentives for foreign investors which create import-substituting industries or industries with local employment in depressed regions. **Introduction of tax incentives for the development of national health systems, including:** ● diagnostic, treatment, rehabilitation, research and educational medical organizations; ● manufacturers and suppliers of medical equipment and supplies used in healthcare; ● pharmaceutical companies in the supply of medicines and substances for their production under public procurement; ● construction of healthcare facilities and installation of medical equipment; ● medical personnel (increased tax deductions when buying or renting housing, compensation for the cost of using personal vehicles for official purposes, and so on); ● R&D in the field of medicine (accelerated depreciation of equipment, reduced taxation of grants for medical research). **Fiscal measures to increase tax revenues of the state budget:** ● increase in tax rates for the upper income ranges of financially secure individuals; ● continued digitalization of tax administration; ● continuing international tax cooperation to combat tax evasion and non-transparent tax optimization mechanisms. **Escalation of protective tax barriers as part of improving national economic security:** ● tax incentives for import-substituting industries (including a review of global production systems); ● no tax benefits for suppliers and investors from countries subject to restrictions

Compiled by the authors.

centives alone will be of little help. Maybe they can slow the economic downturn but they will not be able to prevent it, let alone to reverse it. Firms need to be saved, the unemployed need to be helped, and health systems and medical research need to be supported – all of which is leading to an enormous increase in public expenses and, with tax revenue down at the same time, a virtual explosion of public debt. Table 6 shows the state of public finances in the leading countries of the world before the corona crisis and the preliminary forecasts for 2020 and 2021. As we can see, everywhere in the world public finances have suffered markedly. And these numbers do not even include the huge sums the EU has decided to spend on its corona recovery plan: € 750 billion will be raised on the capital market and allocated to the EU members according to how hard hit they were by the corona crisis – € 390 billion as grants, € 360 billion as loans[33]. For the first time in its history, the EU was empowered to take on debt for grants to member countries. Because all EU members will be liable for this debt according

[33] See, e.g.: https://www.consilium.europa.eu/en/policies/the-eu-budget/long-term-eu-budget-2021-2027/

to their shares in the EU budget, a big step has been made towards establishing a redistributive transfer system – something the richer EU members fought hard against hitherto.

As the world economy will, hopefully, recover and follow again a path of sustainable growth, it will become necessary, firstly, to deal with the negative consequences of the current crisis and, secondly, to prevent other pandemics from causing similar crises in the future. The second objective requires, on the one hand, public health systems to be overhauled radically and, on the other, the autonomy and resilience of national economies to be strengthened. In this context, both the stimulus and the fiscal role of taxes will be of great importance.

However, it is the fiscal function of taxes that will then be most important. When the economic situation will have normalized again, the ballooning budget deficits and public debts will have to be reined in again, because, after all, fiscal stability and budgetary prudence cannot be neglected for good. In order for the state to be able to fulfill its essential functions, a sound financial basis is necessary, which means adequate and stable tax revenues. Therefore, tax policy will have to find ways and means to improve the state of public finances again.

Even though the potential of taxation to overcome the crisis seems to be rather limited, there will be important consequences of the crisis for taxation.

1. *Changes in tax administration, with an emphasis on remote fiscal audits and digital control.* The coronavirus pandemic made it necessary to minimize social (or, rather, physical) contacts, a measure that had been used in one form or another during all previous pandemics. Reducing the number of tax audits and carrying them out remotely with the help of digital technology has already become common practice for many tax services. In addition, further progress is expected towards increasing transparency and control over tax compliance, which will make not only tax evasion significantly more difficult, but also tax avoidance (or tax optimization), which is in a kind of "grey zone".

Table 6

Indicators of economic growth and public finance state, 2018–2021 (IMF evaluation, June 2020)

	World Output, Year over Year (%)				Overall Fiscal Balance, % of GDP				Gross Debt, % of GDP			
			Projections				Projections				Projections	
	2018	2019	2020	2021	2018	2019	2020	2021	2018	2019	2020	2021
World	**3.6**	**2.9**	**–4.9**	**5.4**	**–3.1**	**–3.9**	**–13.9**	**–8.2**	**81.2**	**82.8**	**101.5**	**103.2**
Advanced Economies	**2.2**	**1.7**	**–8.0**	**4.8**	**–2.7**	**–3.3**	**–16.6**	**–8.3**	**104.0**	**105.2**	**131.2**	**132.3**
USA	2.9	2.3	–8.0	4.5	–5.8	–6.3	–23.8	–12.4	106.9	108.7	141.4	146.1
Euro Area	1.9	1.3	–10.2	6.0	–0.5	–0.6	–11.7	–5.3	85.8	84.1	105.1	103.0
Germany	1.5	0.6	–7.8	5.4	1.9	1,5	–10.7	–3.1	61.9	59.8	77.2	75.0
France	1.8	1.5	–12.5	7.3	–2.3	–3.0	–13.6	–7.1	98.1	98.1	125.7	123.8
Italy	0.8	0.3	–12.8	6.3	–2.2	–1.6	–12.7	–7.0	134.8	134.8	166.1	161.9
Spain	2.4	2.0	–12.8	6.3	–2.5	–2.8	–13.9	–8.3	97.6	95.5	123.8	124.1
Japan	0.3	0.7	–5.8	2.4	–2.5	–3.3	–14.7	–6.1	236.6	238.0	268.0	265.4
UK	1.3	1.4	–10.2	6.3	–2.2	–2.1	–12.7	–6.7	85.7	85.4	101.6	100.5
Emerging Market and Developing Economies	**4.5**	**3.7**	**–3.0**	**5.9**	**–3.8**	**–4.9**	**–10.6**	**–8.5**	**48.9**	**52.4**	**63.1**	**66.7**
China	6.7	6.1	1.0	8.2	–4.7	–6.3	–12.1	–10.7	47.0	52.0	64.1	70.7
India	6.1	4.2	–4.5	6.0	–6.3	–7.9	–12.1	–9.4	69.6	72.2	84.0	85.7
Russia	2.5	1.3	–6.6	4.1	2.9	1.9	–5.5	–3.9	13.5	13.9	18.5	18.8
Brazil	1.3	1.1	–9.1	3.6	–7.2	–6.0	–16.0	–5.9	87.1	89.5	102.3	100.6

Source: https://www.imf.org/~/media/Files/Publications/WEO/2020/Update/June/English/WEOENG202006.ashx?la=en

There is likelihood that things will even go further and the national tax services will learn from the experience of the People's Republic of China in creating special ratings of taxpayers as part of their Social Credit System [11]. Whether this would be acceptable or desirable from a political and legal point of view is a totally different question. Most countries of the world already have the appropriate technologies for digital tax administration and collection of data from citizens and companies; and digitalization, to which the COVID-19 pandemic gave an additional impetus, will increasingly influence the lives of taxpayers and tax authorities.

2. *Changes in taxation of digital companies and their operations at the national and international level.* At the end of the active phase of the COVID-19 pandemic, we can expect the implementation of the pre-crisis proposals of the OECD on the taxation of the digital presence of companies in the source country of their income. A number of countries around the world began to change their tax policies in this direction during the pandemic. In May 2020, the working group of the Federation Council of the Russian Federation on improving legislation in the context of the pandemic proposed to introduce a digital tax in Russia corresponding with the general guideline of the OECD[34]. The German government has not yet followed suit, but demands to that effect are being made by German politicians[35]. In addition, we can expect growing international cooperation on such matters as the exchange of information to prevent tax evasion, the development of tax coordination programs in economically integrated regions (especially in the European Union) as well as unification of taxation of income and sales from cross-border e-trade [46].

3. *New tax powers for the EU?* In the EU, consequences for taxation may go further still. The present system, in which the EU as such does not have any power to tax but relies on the contributions of its members, may seem inadequate: now that the EU has taken up so much debt, it may be thought necessary to provide it with the means to service that debt. To that end, new "European" taxes may be introduced, i.e. taxes that are levied by and whose revenue is due to the EU.

4. *A return of the inflation tax?* In addition, it seems possible that there may be another, deeply problematic, consequence of the corona crisis for taxation: as of today, nobody knows (or even cares) how to repay the enormous debts incurred by nations and supranational entities (such as the EU). If economic growth falls behind expectations or if a new crisis hits, politicians may be tempted to avoid high and unpopular taxes and to monetize the debts instead: they would have central banks take them over by expanding the money supply correspondingly. Inflation would result and the debts would thus be redeemed by an "inflation tax" [45, pp. 9–14]. Modern authorities would again use a kind of tax which was often used in history when regular tax sources had run dry or would have been too difficult to tap – in particular, after epidemics, as we have noted above.

9. Pandemics and taxation: Are there any regularities?

What insights have we gained from our journey through the history of pandemics and taxation? Are there any regularities? Of course, history does not repeat itself – at least, not exactly. Nonetheless, we can identify some common traits in the responses of tax authorities to pandemics.

1. Pandemics lead to improvements in tax administration: as a rule, we observe more centralization, more rationalization and more standardization. The reason is always a combination of dwindling revenues and increasing expenses which calls for a more effective exploitation of the tax sources.

[34] The Federation Council has sent the proposal to introduce the "digital tax». 2020. May 20. *TASS. Russian News Agency*. (In Russ.). Available at: https://tass.ru/ekonomika/8522947

[35] See, e.g.: Sahra Wagenknecht fordert Digitalsteuer: Besteuert Google und Co! *Frankfurter Rundschau*. 2020. 19. Juli. Available at: https://www.fr.de/wirtschaft/gastwirtschaft/sarah-wagenknecht-gastbeitrag-digitalsteuer-besteuert-google-und-co-13836280.html

Table 7

Pandemics as triggers of sufficient tax changes in human history

Historical period	Pandemic	Tax innovations
2nd century	Antonine Plague (Plague of Galen)	Fiscal centralization (analog of modern tax federalism), "inflation tax"
6th – 8th centuries	Plague of Justinian	Church taxes
14th century	Medieval Plague (Black Death)	Personalization of taxes (poll tax, luxury tax), tax incentives for foreign trade, excise taxes on strong liquors
17th – 18th centuries	Great Plague	Theoretical basis of taxation and tax administration
19th – 20th centuries	Cholera, smallpox, plague, flu	Contributions and quasi-taxes to finance national health protection systems,

Compiled by the authors.

2. In most pandemics, tax incentives of one form or another are used in order to re-energize the economy.

3. Debt plays an important role in raising the revenue needed to finance health care and anti-crisis measures.

3. In the aftermath of pandemics, the tax burden increases in order to service the debts incurred. To this end, "new" taxes are often introduced (formerly, the Church tithe, the poll tax, the income tax; today, possibly taxes on digital transactions).

4. Insofar as the necessary revenue cannot be raised through "regular" taxes, governments often resort to the "inflation tax". In former times, this meant the debasement of coins; in modern times it is levied by way of having the central banks print money.

To determine the most effective impact of pandemics on taxation and tax administration which remains relevant to this day let us refer to the data in Table 7. Of course, it is impossible to say that pandemics transformed the tax environment of the corresponding historical era in a given direction. At the same time, pandemics have undoubtedly triggered significant tax changes that resulted in significant tax innovations. It can be argued that tax changes related to pandemics are regular, since this is confirmed by the relevant historical facts for each of the most notable pandemics.

Based on previous historical experience, we can expect another tax innovation from the COVID-19 pandemic. Most obviously, such innovations will cover tax collection technologies, with an emphasis on digitalization of taxation and tax administration. Undoubtedly, this fits into the logic of the regularity of tax changes associated with pandemics.

10. Conclusion

Our research allows us to draw the following conclusions:

1. There are historical links between pandemics and taxation as many tax innovations resulted from the challenges that large-scale epidemics of deadly diseases posed for taxation and tax administration.

2. These links are not arbitrary, but there are certain regularities and patterns one can observe throughout the common history of pandemics and taxation. To give but one example, most of the tax tools used today in the fight against the corona crisis have already been used during previous pandemics.

3. Under the influence of the COVID-19 pandemic and the resulting economic crisis, tax administration will be strengthened through increased digitalization. Thus, transparency will increase, control of tax payers and tax returns will become easier, and tax evasion will become more difficult.

4. In the sphere of international tax relations, we can expect, as a consequence of the COVID-19 pandemic, a better coordination of the taxation of both the sales and the incomes of digital companies. The OECD and its plans for a large-scale transformation of the taxation system will be of great importance to the introduction and coordination of digital taxes.

5. Russia and Germany have historically been at the forefront of tax

innovations related to pandemics. As a result of the COVID-19 pandemic, both in the Russian Federation and in the Federal Republic of Germany, digital control of the incomes and the expenses of citizens will become more acceptable and changes in the taxation of income of digital companies will be realized according to proposals of the OECD.

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Information about the authors

Alexander I. Pogorletskiy – Doctor of Economics, Professor, Faculty of Economics, Department of World Economy, Saint Petersburg State University (62 Chaykovskogo St., Saint Petersburg, 191123, Russian Federation); ORCID: 0000-0003-4495-5557; e-mail: a.pogorletskiy@spbu.ru

Fritz Söllner – Doctor of Economics, Professor, Head of Department of Public Finance, Technical University of Ilmenau (Postfach 10 05 65, 98684 Ilmenau, Germany); ORCID: 0000-0003-1047-6662; e-mail: fritz.soellner@tu-ilmenau.de

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Информация об авторах

Погорлецкий Александр Игоревич – доктор экономических наук, профессор кафедры мировой экономики, Экономический факультет, Санкт-Петербургский государственный университет (Россия, 191123, г. Санкт-Петербург, ул. Чайковского, 62); ORCID: 0000-0003-4495-5557; e-mail: a.pogorletskiy@spbu.ru

Зольнер Фриц – доктор экономических наук, профессор, заведующий кафедрой публичных финансов, Технический университет Ильменау (Германия, 98684, г. Ильменау, п/я 10 05 65); ORCID: 0000-0003-1047-6662; e-mail: fritz.soellner@tu-ilmenau.de

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1. Статья, представляемая для публикации, должна обладать новизной, быть самостоятельным, завершенным, характеризующимся внутренним единством исследованием актуальной проблемы, связанной с налоговыми реформами на международном и национальном уровнях.

2. Текст статьи следует структурно разбивать на разделы с заголовками, отражающие:

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- абзацный отступ — 1,25 см;
- поля — 20 мм со всех сторон;
- нумерация — внизу страницы.

3. Объем статьи не менее 18–25 страниц.

4. Статья должна содержать следующие элементы, оформленные в соответствии с требованиями журнала (см. образец оформления статьи):

- индекс УДК;
- JEL коды;
- заглавие статьи на русском и английском языках;
- информацию об авторе (ах) на русском и английском языках;
- аннотацию на русском и английском языках;
- 5–10 ключевых слов на русском и английском языках;
- список использованной литературы (References);
- ссылки на литературу, оформленные согласно списку литературы в квадратных скобках.

5. Все элементы, перечисленные в п. 4, указываются сначала на английском языке, а затем на русском языке.

Рекомендации по подготовке аннотации статьи

Аннотация является источником информации о содержании статьи и изложенных в ней результатах исследований.

1. Аннотация выполняет следующие функции:

- дает возможность установить основное содержание статьи, определить его релевантность и решить, следует ли обращаться к полному тексту статьи;
- предоставляет информацию о статье и устраняет необходимость чтения полного текста статьи в случае, если статья представляет для читателя второстепенный интерес;
- используется в информационных, в том числе автоматизированных, системах для поиска необходимых статей и информации.

2. Аннотация к статье должна быть:

- информативной (не содержать общих слов);
- оригинальной;
- содержательной (отражать основное содержание статьи и результаты исследований);
- структурированной (следовать логике описания результатов в статье и разделенной на подзаголовки: цель исследования, методы, результаты, заключения);
- компактной (укладываться в **объем от 200 до 250 слов**).

3. Аннотация включает следующие аспекты содержания статьи:

- предмет, цель исследования (указываются в том случае, если они не ясны из заглавия статьи);
- метод или методологию проведения работы (целесообразно описывать в том случае, если они отличаются новизной или представляют интерес с точки зрения данной работы. В рефератах статей, описывающих экспериментальные работы, указывают источники данных и характер их обработки);
- результаты работы (описываются предельно точно и информативно. Приводятся основные теоретические и экспериментальные результаты, фактические данные, обнаруженные взаимосвязи и закономерности. При этом отдается предпочтение новым результатам и данным долгосрочного значения, важным открытиям, выводам, которые опровергают существующие теории, а также данным, которые, по мнению автора, имеют практическое значение);
- область применения результатов;
- выводы (могут сопровождаться рекомендациями, оценками, предложениями, гипотезами, описанными в статье).

4. В тексте аннотации следует употреблять синтаксические конструкции, свойственные языку научных и технических документов, избегать сложных грамматических конструкций. Текст должен отличаться четкостью формулировок и содержать только значимую информацию. Сведения, содержащиеся в заглавии статьи, не должны повторяться в тексте аннотации. В ней следует применять значимые слова из текста статьи.

Рекомендации по выбору ключевых слов

1. Ключевые слова выражают основное смысловое содержание статьи, служат ориентиром для читателя и используются для поиска статей в электронных базах,

поэтому должны отражать дисциплину (область науки, в рамках которой написана статья), тему, цель и объект исследования.

2. В качестве ключевых слов могут использоваться как одиночные слова, так и словосочетания в единственном числе и именительном падеже. Количество слов внутри ключевой фразы (словосочетания) может быть не более трех.

3. Основные принципы подбора ключевых слов:

• применяйте базовые термины вместе с более сложными (бухгалтерский учет основных средств, бухгалтерский учет, основные средства); повторы и синонимы (грузовые перевозки — транспортная логистика, организация перевозок — логистика);

• не используйте слишком сложные слова (словосочетания, в которых приводится больше трех слов, чаще всего можно разбить на несколько ключевых слов (обработка и анализ данных — обработка данных, анализ данных)); слова в кавычках (ОАО «Иркутскэнерго» — Иркутскэнерго); слова с запятыми (факторы, определяющие качество — факторы качества, определение качества);

• каждое ключевое слово — это самостоятельный элемент. Ключевые слова должны иметь собственное значение (человеческий капитал, его оценка — человеческий капитал, оценка человеческого капитала).

Рекомендации по оформлению ссылок на использованную литературу

1. Нумерация в списке литературы осуществляется по мере цитирования. При повторном цитировании источника ему присваивается номер первоначального цитирования.

2. Ссылки на использованную литературу приводятся в тексте в квадратных скобках с указанием в них номера источника по Списку использованной литературы и страницы цитируемого фрагмента, напр.: [5, с. 115].

3. В оригинальной научной статье необходимо упоминание не менее 25–40 источников, имеющих автора, в научном обзоре — 50–80, в том числе не менее 50 % источников на иностранном языке. Редакционная коллегия рекомендует цитировать статьи из журналов, которые индексируются в международных базах данных (Scopus, Web of Science).

4. Электронные ресурсы, в которых не указан автор материала, статистические сборники, нормативно-правовые акты размещаются в постраничных сносках и в список использованной литературы не выносятся.

5. Самоцитирование автора допускается не более 20 % от количества источников в списке.

Примеры оформления библиографических записей

1. Статьи в журналах:

Pimenov N. A. Fiscal risks in the system of tax security of businesses and State. *Nalogy = Taxes*. 2010;(4):10–13. (In Russ.)

Slemrod J. Lessons for tax policy in the great recession. *National Tax Journal*. 2009;52(3):387–397. Available at: http://webuser.bus.umich.edu/jslemrod/Great_Recession.pdf

Jensen O. W. Transfer Pricing and output decisions: the dynamic interaction. *Decision Sciences*. 1986;17:428–436.

Börner K., Klavans R., Patek M., Zoss A. M., Biberstine J. R., Light R. P., Larivière V., Boyack K. W. Design and update of a classification system:

The UCSD map of science. *PloS one*. 2012;7(7):1–10. DOI: 10.1371/journal.pone.0039464

2. Статьи из сборников научных трудов и материалов конференции:

Reingold I. I. The financial policy of NEP. In: Sokolnikov G. Ya. (ed.) *Fundamentals of the financial system of the USSR*. Moscow: Gosfinizdat; 1930. Pp. 56–61. (In Russ.)

Atkinson A. B. Horizontal equity and the distribution of tax burden. In: Aaron H., Boskin M. (eds) *The Economics of Taxation*. Washington, DC: Brookings Institution; 1980, pp. 3–18.

Börner K., Boyack K. W., Milojević S., Morris S. An introduction to modeling science: Basic model types, key definitions, and a general framework for the comparison of process models. In: Scharnhorst A., Börner K., van den Besselaar P. (eds). *Models of science dynamics, encounters between complexity theory and information sciences*. Berlin: Springer; 2012, pp. 3–22.

Alam S. L., Campbell J., Lucas R. Using social media in government: The Australian taxation office e-Tax facebook page. In: *Proceedings of the 2011 IEEE 9th International conference on dependable, autonomic and secure computing (DASC, 2011), December 12–14, 2011, Sydney, Australia*. Institute of Electrical and Electronics Engineers; 2011, pp. 1002–1009.

3. Монографии, учебники, учебные пособия:

Kormishkina L. A., Koroleva L. P. *Financial security*. Saransk: The National Research Mordovia State University; 2016. (In Russ.)

James S., Sawyer A., Budak T. (eds). *The complexity of tax simplification: experiences from around the world*. London: Palgrave Macmillan; 2016.

Taleb Nassim Nicholas. *The Black Swan. The impact of the highly improbable*. Random House; 2007.

4. Диссертации, авторефераты диссертаций:

Gombozhapova S. V. *Improving tax control in context of historical experience. PhD (Econ.) Thesis*. Irkutsk; 2012. (In Russ.)

Urban I. *Redistributive effects of direct taxes and social benefits in Croatia. Dr. (Econ.)*. Slovenia; 2010.

5. Электронные ресурсы, в которых указан автор материала:

Ivanov A. *Strong ruble and cheap loans. How effective are the proposals of Sergei Glazyev*. Available at: http://svpressa.ru/economy/article/156619/ (In Russ.)

Feldstein Martin. *The Case for fiscal stimulus*. Available at: https://www.project-syndicate.org/print/the-case-for-fiscal-stimulus

Предоставление сведений об авторе (ах) статьи

1. В статье в информации об авторах на русском и английском языках указываются следующие данные:

- фамилию, имя, отчество (полностью);
- ученую степень, ученое звание (полностью);
- занимаемую должность;
- рабочее подразделение (кафедра, факультет, институт и др.);
- место работы в соответствии с официальным названием организации;

• почтовый индекс организации — места работы (с указанием почтового индекса);

• адрес электронной почты (e-mail);

• ORCID (Open Researcher and Contributor ID) — уникальный идентификатор ученого, связывающий его исследовательскую деятельность и помогающий идентифицировать ссылки на его научные публикации в международных базах данных (Scopus, Web of Science) (если имеется).

2. Дополнительно указывается информация, которая служит для связи с автором и в журнале не публикуется:

• почтовый адрес для переписки (с указанием индекса);

• телефоны (рабочий, мобильный).

3. Фамилия и имя на английском языке указываются автором в соответствии с их написанием в ORCID или ранее опубликованным в зарубежных изданиях, входящих в международные базы данных (Scopus, Web of Science), либо указанным в заграничном паспорте.

Publication requirements for articles submitted to Journal of Tax Reform

The requirements for the structure and content of the article

1. The article submitted for publication must contain novelty, must be an independent, complete and internally united research work on a current issue, related to tax reform at international and national levels.

2. The article should be structurally divided into sections with headings, reflecting:
- relevance of the research;
- background of a problem;
- proposed research methods and their originality;
- analysis of the study findings;
- main conclusions, the results of the research and further discussion of them, or the problem solution.

3. The article should contain illustration material, showing the results of the research.

Format requirements

1. The manuscript files in Microsoft Word format should be converted to .docx. files

2. Technical format of the article has to comply with the following requirements:
- the page size — A4;
- font – Times New Roman; main text – 14-point, supplementary text (abstract, keywords, tables, figures, references) – 12-point, footnotes – 11-point;
- line spacing – 1,0;
- fit to the width;
- indent – 1,25;
- margins – 2.0 cm on all sides;
- page numbers – at the bottom of the page;

3. Article should be 18–25 pages.

4. The article has to contain the following components drawn up in accordance with the journal's requirements (see the sample):
- JEL classification;
- title of the article;
- information about the author;
- abstract;
- 5–10 key words;
- the list of references;
- the article should have reference notes given in square brackets provided according to the references.

Guidelines for Abstract writing

An Abstract is a source of information on your paper's content and findings.

1. An Abstract has the following functions:
- allows readers to identify the basic concept of your paper as well as its relevance and decide if the full text paper is of interest to them;

• provides information on your paper and makes it unnecessary to read its full text version if it is of secondary interest to a reader;

• is used in information (including computerized) search systems to find papers and information.

2. An Abstract should be:

• informative (no general words);

• original;

• relevant (reflects your paper's key content and research findings);

• structured (follows the logics of results' presentation in the paper and divided into sub-headings: the purpose of the research, methods, results, conclusions);

• concise **(between 200 and 250 words**).

3. An Abstract should contain the following content aspects:

• the statement of the object and purpose of your study;

• research methods/methodology;

• results observed;

• the sphere of results application;

• conclusions drawn from your study.

• the object, topic and purpose of the research (if they are not clear from the title of the paper);

• the research methods/methodology if they are original or of interest for this particular research. For papers concerned with experimental work describe your data sources and data process technique;

• the results of research should be described as precisely and informatively as possible. Include your key theoretical and experimental results, factual information, revealed interconnections and patterns. Give special priority to new results and long-term impact data, important discoveries and verified findings that contradict previous theories as well as data that you think have practical value.

• the sphere for implementation the results of the research;

• conclusions could be associated with recommendations, estimations, suggestions, hypotheses described in the paper.

4. Use the language typical of research and technical documents to compile your abstract and avoid complex grammatical constructions. Information contained in the title should not be repeated in the abstract. The abstract should be concise and clearl and reflect only the main information of the original paper. The text of the abstract should include key words of the paper

Guidelines for Keywords

1. Keywords encapsulate the principal topics of the paper. These keywords will be used for indexing purposes as a guide to search the articles in electronic databases, therefore, they should reflect area of science in which the article was written, the subject, the purpose and object of research

2. The keywords can be used as single words and phrases. Key phrase (phrases) should contain no more than three words.

3. Basic principles for keyword selection:

• avoid general and plural terms and multiple concepts (avoid, for example, "and", "of").

• be sparing with abbreviations: only abbreviations firmly established in the field may be eligible. These keywords will be used for indexing purposes.

• each keyword should have its separate meaning.

Guidelines for Reference

1. The list of references should be arranged in the order of the appearance the citations in the text. In case of repeated citation the number is the same.

2. To associate the list of references with the text of the article, you should include a reference as a number (running number of the source from the list) and also the page number in square brackets: [5, c. 115].

3. In the original scientific paper must be not less than 25–40 references, in the scientific review – 50–80 references. The Editorial Board recommends to cite papers indexing in international databases (Scopus, Web of Science).

4. The electronic sources without an author, statistic and regulation materials should not be included in the list of reference, but preferably set as a footnotes at the end of the page.

5. Author's self-citations should not exceed 20 % of the number of sources in the list of references.

Information about the author (s)

1. The information about the authors indicates the following data:
- surname, first name, middle name (in full);
- academic degree, academic title (in full);
- position;
- operating unit (department, chair, institute etc.).
- affiliation (the official name of the organization);
- organization address (including postcode);
- author's e-mail;
- ORCID (Open Researcher and Contributor ID) (if available).

2. Information for communication with the author (not published in the journal):
- post address for correspondence (with post index);
- phone numbers (office, mobile).

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E-mail: press-urfu@mail.ru

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