Original Paper
DOI 10.15826/jtr.2021.7.1.091

Assessment of the effectiveness of anti-COVID tax support for innovation activities of small and medium-sized enterprises in OECD countries

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ABSTRACT
The global economy has rebounded from the lows of 2020, but its recovery will depend on innovations. Therefore, it is important to identify the most effective tax support instruments for the innovation activities of small and medium-sized enterprises (SMEs) that are used in the framework of anti-crisis economic policies in the OECD countries. It is suggested that tax incentives are the most effective tax instrument of all; the effectiveness of the profit tax benefit depends on the SME's profitability; as to the social insurance and pension contribution, there is an allowable minimum of the rate, determined by the level of wages, that will stimulate innovation. To assess the effectiveness of tax support tools, the study used the methods of linear multivariate regression and simulation in Simulink. The source of information for regression analysis was the data published by the World Bank and the Organization for Economic Cooperation and Development (OECD). It was concluded that the most effective measures of tax support are tax incentives, as well as deferred payment of social insurance and pension contributions. The 10% profit tax was shown to be optimal to stimulate innovation provided the company keeps the saved profit for development. For innovative SMEs, the minimum allowable contribution rate for social insurance and pension provision, which stimulates their innovative activities, is 12%. The results of modeling confirmed that the proposed threshold indicators for supporting SMEs' innovation activity can be an effective tool for overcoming the consequences of the global crisis caused by the COVID-19 pandemic.

KEYWORDS
tax incentives, tax support, income tax, social security and pension contributions, innovative activity, small and medium-sized enterprises, COVID-19

JEL H20, H21, H22, O38

Оригинальная статья
УДК 336.22

Оценка эффективности антиковидной налоговой поддержки инновационной деятельности малых и средних предприятий в странах ОЭСР

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АННОТАЦИЯ
Мировая экономика преодолела минимальные значения 2020 г., но ее будущее восстановление зависит от инноваций. Поэтому важно выяснить, какие инструменты налоговой поддержки инновационной деятельности малых и средних

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предприятий (МСП), используемые в рамках антикризисной экономической политики в странах ОЭСР, являются наиболее эффективными. В исследовании выдвигаются следующие предположения: налоговые льготы являются наиболее эффективным налоговым инструментом из всех применяемых; эффективность льгот по налогу на прибыль зависит от прибыльности МСП; существует допустимый минимум ставки социального страхования и пенсионных взносов, определяемый уровнем заработной платы, который будет стимулировать участников к инновационной деятельности. Для оценки эффективности инструментов налоговой поддержки в исследовании использовались методы линейной многомерной регрессии и моделирования в Simulink. В качестве источника информации для регрессионного анализа использованы данные, публикуемые Всемирным банком и Организацией экономического сотрудничества и развития (ОЭСР). Сделан вывод, что наиболее эффективными мерами налоговой поддержки являются налоговые льготы, а также отсрочка выплаты взносов на социальное страхование и пенсионных взносов. Показано, что ставка налога на прибыль 10% является оптимальным вариантом для стимулирования инновационной деятельности, при условии, что компания оставляет сэкономленную прибыль на развитие. Для инновационных МСП минимально допустимая ставка взносов на социальное страхование и пенсионное обеспечение, которая стимулирует их инновационную деятельность, составляет 12%. Результаты моделирования подтвердили, что предложенные пороговые показатели поддержки инновационной активности МСП могут быть эффективным инструментом преодоления последствий глобального кризиса, вызванного пандемией COVID-19.

КЛЮЧЕВЫЕ СЛОВА
налоговые льготы, налоговая поддержка, подоходный налог, социальный взнос, инновационная деятельность, МСП, COVID-19

1. Introduction

Since the beginning of 2020, the COVID-19 pandemic has become not only a threat to the health of citizens, but also a serious challenge for the global economy. World countries continue to implement fiscal policy measures and support particularly vulnerable sectors of the economy, including small and medium-sized enterprises. As an example, in the EU countries, in order to minimize the negative impact on business, the European Commission has taken comprehensive economic measures aimed at easing fiscal rules, revised state aid programs and initiated an investment initiative to respond to coronavirus in the amount of 37 billion euros to provide liquidity to small and medium-sized businesses and the health sector[1].

Economic forecasts reflect negative trends in terms of the scale of the global economic recession caused by the pandemic. In its forecast, the OECD predicts a 6–7.6% drop in global GDP by the end of 2020. In the most affected countries, a double-digit decline is forecasted, followed by a moderate recovery of 2.8% in 2021(OECD, 2020[2]). The IMF forecast shows a decline in global GDP by 4.9% in 2020, which is 1.9% lower than the April forecast, followed by a partial recovery, with growth of 5.4% in 2021 (IMF, 2020[3]). UNCTAD predicts a decline in global foreign investment of up to 40% in 2020, followed by a decline of 5–10% in 2021 (UNCTAD, 2020[4]). ILO estimates the impact of COVID-19 on global unemployment growth by optimistic (5.3 million) and pessimistic (24.7 million) forecasts,

[1] European Coordinated Response on Coronavirus: Questions and Answers. Available at: https://ec.europa.eu/commission/presscorner/detail/en/qanda_20_458

[2] OECD Economic Outlook. OECD Publishing, 2020. Available at: https://dx.doi.org/10.1787/0d1d1e2e-en

[3] World Economic Outlook Update, June 2020: A Crisis Like No Other, An Uncertain Recovery. Available at: https://www.imf.org/en/Publications/WEO/Issues/2020/06/24/WEOUpdateJune2020?utm_medium=email&utm_source=govdelivery

[4] World Investment Report 2020: International Production beyond the Pandemic. Available at: https://unctad.org/system/files/official-document/wir2020_en.pdf

indicating that "maintaining business operations will be particularly difficult for small and medium-sized enterprises" (ILO, 2020[5]). Of course, these impacts affect both large and small businesses, but the impact on SMEs is particularly severe due to the high level of vulnerability and lower resilience associated with their size.

As for post-Soviet countries, they remain vulnerable to economic shocks, for example, in Ukraine, according to forecasts, GDP may decline by 4–8% compared to 2019. As a result, according to NBU forecasts, Ukraine in 2020 may face a drop in exports (–10%), imports (–14.5%), an expansion of the budget deficit (8% of GDP) and an increase in the unemployment rate (up to 9.5%)[6].

In these circumstances, innovative SMEs particularly need support, including tax support. It is these enterprises that are at high risk. On the one hand, the conditions of isolation have increased the risk for innovative enterprises, and on the other hand, they have proved that it is difficult to survive in such conditions without innovation. At the same time, innovations have a direct impact on the profitability indicators of enterprises, and they can reduce the time of economic recovery from the consequences of COVID-19. Therefore, now it is especially advisable for the state not only to support, but also to stimulate the development of innovative activities of small and medium-sized enterprises.

The purpose of this article was to identify the most effective tools for tax support of innovative activities of small and medium-sized enterprises, which continue to be used to overcome the consequences of coronavirus. For analysis, were collected and grouped statistics by 36 OECD countries as of 2019. OECD countries use a single methodology, which makes it possible to use it as a reliable tool for analyzing and predicting the development of economic processes.

We have formulated three hypotheses:

Hypothesis 1. Among the tax support tools used, tax incentives are the most effective.

Hypothesis 2. The effectiveness of the income tax benefit depends on the profitability of the enterprise.

Hypothesis 3. The minimum allowable contribution rate for social insurance and pension provision to encourage participants in innovation activities is determined by the level of wages.

The article is structured as follows. The second section provides an overview of the literature on the impact of tax support on the development of innovative SMEs. The third section describes the research methodology. Section 4.1 contains an analysis of the world practice of tax support for innovation activities of SMEs. Section 4.2 provides calculations and estimates of the effectiveness of tax support used in the COVID-19 context. The fifth section contains our conclusions, the limitations of the study and the practical significance of the results obtained

2. Literature review

In the context of the global economic crisis caused by the COVID-19 pandemic, the development of innovative small businesses is of particular interest. For example, Fairlie [1] presented an analysis of the negative impact of the pandemic on the number of active small businesses. Sufficient attention continues to be paid to the issue of developing tax support programs for innovative activities of SMEs. Boot et al. [2] proposes the provision of funds to firms in exchange for a temporary increase in the income tax rate after the crisis. Drechsel & Kalemli-Ozcan [3] recommend an immediate negative one-off tax for SMEs since a negative one-time tax will allow remittances that may exceed the deferral of existing tax liabilities.

Considering the policy of tax incentives for innovative SMEs, which was previously used during economic crises,

[5] ILO Monitor: COVID-19 and the world of work. Available at: https://gisanddata.maps.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6

[6] State program of stimulation of the economy to overcome the negative effects caused by restrictive measures to prevent the occurrence and spread of acute respiratory disease COVID-19 caused by coronavirus SARS-CoV-2, for 2020–2022. (Cabinet of Ministers of Ukraine). *Uryadoviy kur'er = Government courier*, 122. (In Ukrain.)

it is worth highlighting the work of Beca & Cozmei [4]. The authors studied that in order to mitigate the consequences of the 2008 crisis, the EU countries more often used a reduction in the established income tax rate; deductions for accelerated depreciation of capital expenditures; targeted investment tax incentives.

Most of the works of scientists are devoted to the question of the impact of tax incentives on the R&D of enterprises. Russo [5] concluded that tax incentives for R&D lead to a relatively significant increase in research and welfare, and lower rates of corporate income tax contribute to the development of innovative business. Kizim & Kasyanova [6] argue that R&D is sensitive to deferred payment of income tax and exemption from import VAT, as well as preferences for unified compulsory state social insurance.

Motivational impact on innovative business is expressed in an additional tax deduction, tax credit, and accelerated depreciation. Castellacci & Lie [7] note that the effect of additional tax credits on R&D is, on average, stronger for SMEs. Montmartin & Herrera [8] conclude that tax breaks increase business-funded R&D intensity. Freitas et al. [9] argue that firms in industries with a high R&D orientation, on average, have a higher propensity to use tax incentive schemes for R&D and more tangible effects of additionally in input and output. Cappelen et al. [10] found that projects that receive tax breaks lead to the development of new production processes and, to some extent, to the development of new products for the firm. Authors Foreman-Peck [11], Czarnitzki [12], Mitchell [13], Falk [14], Guceri & Liu [15], Acconcia & Cantabene [16] also argue that tax incentives for R&D have a significant and positive impact on firm performance.

Mohnen & Lokshin [17] investigated how the effectiveness of tax incentives for R&D was assessed in 2002–2009. Whether they are based on structural models that estimate the price elasticity of R&D or other valuation techniques, most studies estimate cost-effectiveness or complementarity.

Some scholars are analyzing the impact of the combined application of tax breaks and subsidies. Ples [18] found that higher tax credit rates significantly increase the impact of grants on R&D investment for small firms, especially those facing financial constraints, but lower it for larger firms. The author suggests that the complex of innovation policy should include both mechanisms for supporting small businesses. Busom [19] found that small and medium-sized enterprises with financial constraints were less likely to use tax incentives for R&D than subsidies. The authors suggest that subsidies may be more appropriate than tax breaks, at least for SMEs. In addition, in a joint work, Corchuelo & Martínez-Ros [20] found that tax incentives increase the innovation activity of large companies and high-tech enterprises, but can only be used randomly by small and medium-sized enterprises. Mitchell et al. [13], Dumont [21] in contrast, believe that R&D tax incentives targeting young companies tend to have a positive effect on R&D intensity and wages, but this impact is relatively reduced when combined with other instruments such as subsidies. Huergo & Moreno [22] found that the effects of subsidies and loans are mutually reinforcing when they are jointly provided to SMEs. However, for large firms, a crowding-out effect between subsidies and loans cannot be ruled out.

The positive impact of a tax credit on R&D is also common in the work of academics. Harris at al. [23] studied the effect of a regionally increased tax credit for R&D on "user costs" (or price) of R&D expenditures. The authors concluded that it is necessary to significantly increase the tax credit for R&D. Agrawal et al. [24] found that obtaining a tax credit for research and experimental development increases the overall volume of R&D among small private firms. The impact was more significant for firms that used tax credits as refunds because they had no current tax liability. Kasahara et al. [25] evaluating the equation of the linear R&D model using the GMM panel concluded that the effect of the tax credit

is significantly greater for firms with relatively large outstanding debts.

Considering the impact of tax cuts, it is worth highlighting the work of Zheng & Zhang [26]. The authors found a significant incentive effect of tax cuts. In addition, the incentive effect is greater in the service sector than in the manufacturing sector. Ghazinoory & Hashemi [27] found that for SMEs, tax exemption has a significant impact on investment in R&D, and financing has a significant impact on investment in R&D, employees in R&D, and new products. In addition, Rao [28] found that a 10% reduction in R&D costs for enterprises leads to the fact that the average firm increases the intensity of research – the ratio of R&D spending to sales – by 19.8% in the short term.

The effectiveness of tax incentives for innovation activities of SMEs is considered in many analytical studies of the OECD. The report titled "The effects of R&D tax incentives and their role in the innovation policy mix" notes the positive impact of tax incentives on both enterprises that take part in the R&D for the first time or enterprises repeatedly taking part in the R&D program (OECD, 2020)[7]). In the work of the European Commission (2015) "SME taxation in Europe", an assessment of tax incentives for the development of innovative SMEs was carried out[8]. It is noted that the tax incentive should provide enterprises with increased liquidity and provide additional investment and growth.

In the works of scientists, the topic of the effectiveness of tax incentives for innovative activities of SMEs is also often encountered. Guellec et al. [29] note that direct financing, as well as tax incentives, are more effective when they are stable over time: firms do not invest in additional R&D if they are not confident in the longevity of government support. Hall [30] presents the policy rationale for tax incentives, discusses potential effectiveness, and examines empirical evidence of their actual effectiveness. The focus is on two of the most important and most studied incentives: tax credits on R&D and super-deductibles and IP indexes (reducing corporate taxes on profits from patents and other intellectual property). Koga [31] studying the efficiency of tax incentives for R&D using data on Japanese manufacturing companies for 10 years (1989–1998), concluded that a tax credit for R&D is effective for increasing investment in R&D. Sokolovska & Rainova [32] identified the factors that affect the effectiveness of tax incentives for R & D, namely: 1) the type of tax benefits; 2) the effectiveness of the institutions that manage the national innovation system and tax administration; 3) the propensity of business to innovate and its response to tax benefits.

The authors Thomson [33], Cozmei & Rusu [34] emphasize the importance of further research on the effectiveness of tax incentives in R&D and emphasize the need to develop tax policies that will promote innovative development and enhance the strategy of transferring profits.

The literature review shows that the issue of assessing the effectiveness of tax support for innovative SMEs is insufficiently studied. It requires identifying the most effective tools for tax support of SME innovation activities, which are used in the framework of anti-covid economic policies.

3. Methodology

To confirm or refute hypothesis 1, based on the analysis of the world practice of tax support for SME innovation in previous years, it is proposed to identify the most effective tools for tax support for SME innovation that are used in the framework of anti-covid economic policy. To model and analyze the relationships between variables, as well as to see how

[7] The effects of R&D tax incentives and their role in the innovation policy mix: Findings from the OECD microBeRD project, 2016–19. OECD Science, Technology and Industry Policy Papers, 92. Available at: https://doi.org/10.1787/65234003-en

[8] SME taxation in Europe – An empirical study of applied corporate income taxation for SMEs compared to large enterprises. Internal Market, Industry, Entrepreneurship and SMEs. Available at: https://ec.europa.eu/growth/content/sme-taxation-europe-%E2%80%93-empirical-study-applied-corporate-income-taxation-smes-compared-0_en

these variables together affect the production of a certain result, we use regression analysis. Multiple linear regression involves establishing a linear relationship between a set of input independents and one output dependent variable.

One of the obstacles to effective application of regression analysis is the presence of multicollinearity. It arises when there are sufficiently close linear statistical relationships between the explanatory variables. In this regard, we use correlation analysis. Using this method it is possible to identify and eliminate multicollinearity. In addition, the main conceptual limitation of regression analysis methods is that they only detect numerical relationships, and not the underlying causal relationships.

For the construction and comprehensive analysis of multiple linear econometric models, statistics were collected and grouped by 36 OECD countries as of 2019. OECD countries use a single methodology, which makes it possible to use it as a reliable tool for analyzing and predicting the development of economic processes.

Under the dependent variable, we represent the rank value of the Global Innovation Index (Y). The advantage of this index is its wide coverage of all areas of innovation activity in 129 countries. The spectrum of sources of international statistics is: the World Bank, the Organizations for Economic Cooperation and Development (OECD), the International Telecommunications Union and the survey of managers' opinions, which is conducted annually by the Executive Opinion Survey. This index also evaluates innovation potential and infrastructure for innovation development.

The independent variables are: Income Tax Deferral (X_1), Value-Added Tax Deferral (X_2), social security and pension contributions (X_3), local tax deferral (X_4), and tax incentives (X_5). These tax support tools are currently used in the framework of anti-covid economic policies and are considered in the OECD reports.

Indicators for analyzing the impact of tax support forms on the innovative development of small and medium-sized enterprises are given in Table 1.

Table 1

Indicators for analyzing the impact of tax support forms on the innovative development of small and medium-sized enterprises

Symbol	Indicator	Unit of measurement
Y	Global Innovation Index	Rank value
X_1	Deferred income tax payment	Binary value
X_2	Deferred payment of Value Added Tax	Binary value
X_3	Deferral of social security and pension contributions	Binary value
X_4	Deferral of local taxes	Binary value
X_5	Tax incentives	Rank value

Source: compiled by the authors based on WIPO, OECD data.

These indicators were selected based on the results of research by scientists, in particular Drechsel & Kalemli-Ozcan [10], Fairlie [11] it is noted that tax deferral will allow businesses to delay the payment of outstanding tax liabilities, and the practical implementation of this tool can be fast. Kizim & Kasyanova [14], noted in the classification of tools for tax incentives for innovation the application of tax incentives, including a reduction in income tax and social insurance rates.

In order to take into account all available tools of tax support for innovation activities of SMEs that affect their development, we will conduct a correlation analysis of indicators to determine the density of the relationship between the performance feature and factor values and build an economic and mathematical model.

The analysis of the impact of these factors on the state of innovation activity of enterprises in the OECD countries allows us to assess the situation that has developed as a result of the use of tax support tools by states during 2000–2019.

Interaction of the resulting indicator (Y) with factor features (X_1, X_2, … X_n) is described by the equation of linear multivariate regression, determined by the formula [24, p. 54]:

$$\hat{Y} = \hat{a}_0 + \sum \hat{a}_i \cdot X_i. \quad (1)$$

Separately, we will evaluate the effectiveness of using income tax incentives and social security and pension contributions, since the use of incentives for these types of taxes is most popular for innovative small and medium-sized enterprises.

Income tax. A reduction in the income tax rate may affect R&D investments due to the expected higher future net income from productive R&D investments. To confirm or refute hypothesis 2 using the Simulink program, we will build a model that demonstrates the dependence of changes in budget revenues on the size of the preferential income tax rate (Table. 2).

Table 2

Indicators for building a model for using the income tax benefit of innovative small and medium-sized enterprises

Symbol	Indicator	Unit of measurement
Innovative SMEs	Equity of innovative SMEs	Monetary units
Rent	Profitability	%
Prof	Profit (calculated value)	Monetary units
Tax	Income tax rate	%
Budget	Tax revenues to the state (estimated value)	Monetary units
Prof2	Net profit (estimated value)	Monetary units

Source: compiled by the authors based on OECD data.

Indicators for building the model were selected according to the stages of forming and calculating tax revenues to the state. The object of income tax calculation is profit, which is calculated by multiplying the equity of innovative SMEs by profitability. The income tax rate is determined by the state. Tax revenues to the state are calculated as a multiplication of profits by the income tax rate. Net profit is the part of the balance sheet profit of an enterprise that remains at its disposal after taxes.

The initial value of the equity of innovative SMEs will be set at 1 money units, profitability from 0 to 100%, in 5% increments, income tax rate from 0 to 50%, in 5% increments. If the optimal tax rate is set, tax revenues to the state budget will reach their maximum value.

In the Matlab program, we will plot a graphical representation of the relationship between tax revenues and the dynamics of the income tax rate in the form of a Laffer curve (on the X-axis – the size of the tax rate, on the Y-axis – tax revenues to the budget).

Contribution to social security and pension contributions. A reduction in social security and pension contributions may affect the de-shadowing and wage increases of innovative SMEs. Let's put forward hypothesis 3 – the minimum allowable social security and pension contributions rate for stimulating participants in innovation activities is determined by the salary level. Using the Simulink program, we will build a model that will demonstrate the effectiveness of using a preferential regressive tax rate for social security and pension contributions (Table. 3).

Table 3

Indicators for building a model for using the preferential regressive tax rate for social security and pension contributions

Symbol	Indicator	Unit of measurement
Min_salary	Minimum wage	Monetary units
Step	Salary increase step	Monetary units
ESV	Social security and pension contributions	%
ESV1	Tax incentives	%

Source: compiled by the authors based on OECD data.

Indicators for constructing the model were selected depending on the calculation of social security and pension contributions for different salary amounts (from the minimum to the maximum, with the setting of the increase step) using the tax incentives.

At the same time, the minimum wage value will be set at 200 USD (rounded minimum wage rate in OECD countries), the step by which the tax will be reduced by 2% will be 200 USD, the maximum salary is 2,500 USD. If the optimal tax rate is set, tax revenues to the state budget will reach their maximum value.

In the Matlab program, we will plot a graphical representation of the relationship between the amount of wages and the dynamics of the social security and pension contributions (on the *X*-axis – the amount of wages, on the *Y*-axis – tax revenues to the budget at a regressive tax rate).

4. Empirical research results

4.1. Analysis of the world practice of tax support for innovation activities of SMEs

The assessment of the innovative development of the OECD countries in 2019 according to the GII index showed the best results in Switzerland (67.2), Sweden (63.7) and the United States (61.7). The lowest level of innovation development among the analyzed countries is in Turkey (36.9), Chile (36.6) and Mexico (36.1) (Fig. 1).

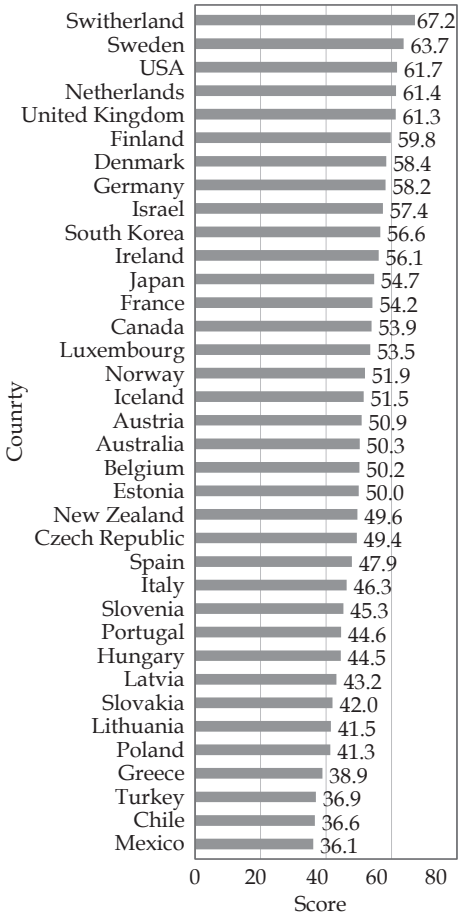

Fig. 1. **Global Innovation Index (GII) of OECD countries for 2019**

Source: compiled by the authors based on WIPO data

The OECD countries that had the highest rating in terms of innovation development in 2019 – Switzerland (66.1), Sweden (62.5) and the United States (60.6) – did not all use tax support for SME Innovation equally. For example, Switzerland did not provide tax incentives or other tax support for R&D for businesses during 2000–2018. However, in the context of COVID-19, Switzerland granted a deferral of social insurance contributions and reduced the 0% rate on VAT, customs duties and special excise taxes from March 21, 2020 to December 31, 2020. In turn, Sweden and the United States provided R&D tax incentives for businesses in the amount of 0.01% and 0.08% of GDP, respectively, for the period 2000–2018. To overcome the consequences of the coronavirus, these countries also introduced deferral and tax reductions.

An analysis of tax support for innovative development in 2019 showed that 33 OECD countries provided preferential tax treatment for R&D expenses compared to 19 OECD countries in 2000 [25]. In 2018, the largest total government support for R&D expenses as a percentage of GDP was provided in the France and United Kingdom (Fig. 2). Other countries have provided significant tax assistance – Australia, Belgium, Italy, Japan, Lithuania, the Netherlands and Portugal.

Some countries that provide little support solely on a direct funding basis provide significant assistance through the tax system. For example, Australia, Ireland, Japan and the Netherlands, where tax incentives account for more than 80% of total government support. In OECD countries, the share of tax incentives in total government support increased from an average of 36% in 2006 to 46% in 2018. This trend was fairly uniform among the OECD countries, with only a few exceptions, such as Canada and Hungary, which abandoned a high share of tax support in 2006 and balanced it with public funding [25].

In 2019, the largest amount of tax incentives for profitable innovative SMEs was in France, Portugal and Chile (Fig. 3).

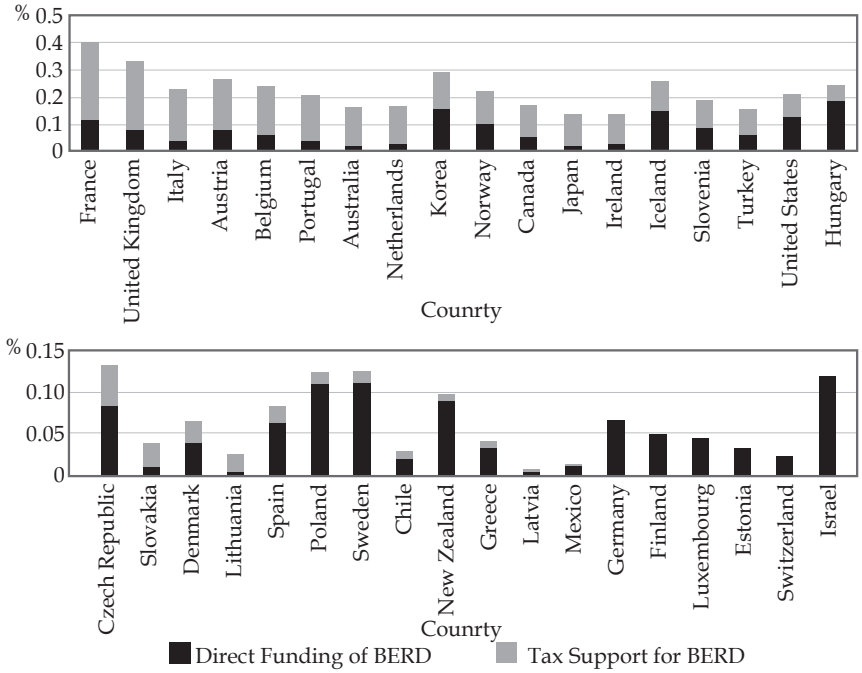

***Fig. 2.* Government funding and tax support for business research and development, 2018**

Source: compiled by the authors based on OECD data

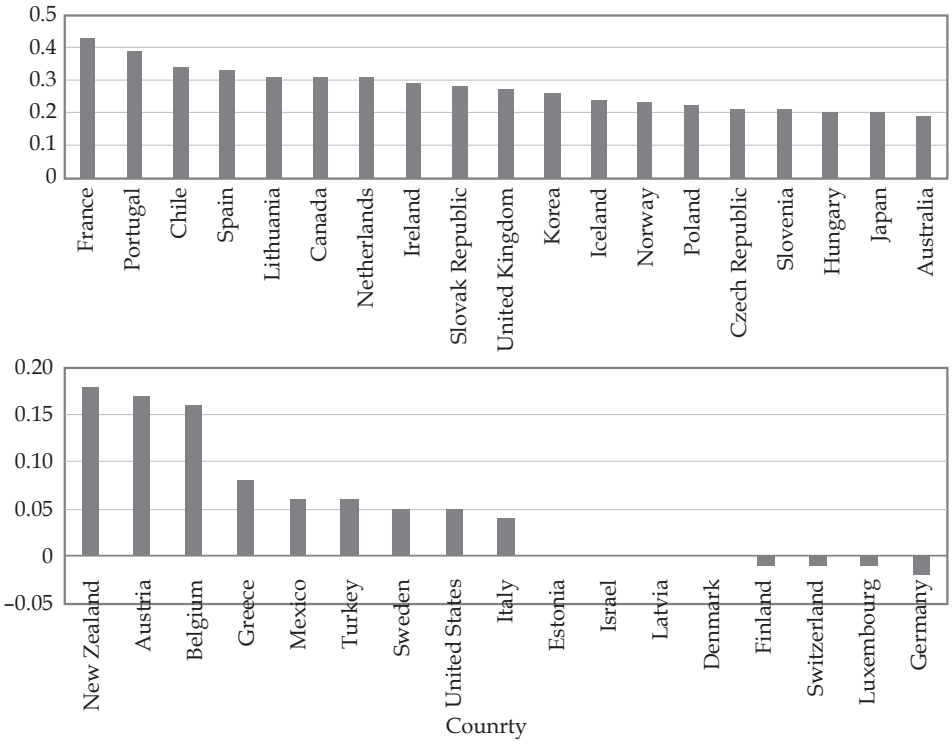

***Fig. 3.* Tax subsidy rates for R&D expenses for profitable SMEs, 2019**

Source: compiled by the authors based on OECD data

To facilitate research work in firms that cannot otherwise use their loans or benefits, countries around the world offer refunds (payable) or equivalent incentives. Such provisions tend to be more generous for SMEs and young firms compared to large enterprises, as in the case of Australia, Canada and France. In contrast, R&D tax subsidy rates for SMEs may be lower than those of large firms, where countries offer R&D tax incentives and enterprise income tax incentives for SMEs (such as China and Croatia), with the amount of tax deductions related to the corporate income tax rate. In general, there are large differences in the rates of R&D tax subsidies in different countries.

Data from the World Bank show that tax support ranks third among all measures to support SMEs in the context of coronavirus (out of 1,149 SME policy instruments used worldwide, 439 relate to debt financing (loans and guarantees), 280 to employment support and 217 to tax support) [26].

Analysis of the global experience of tax support for innovative SMEs in the context of COVID-19 (Table 4).

Table 4

Forms of tax support for innovation activities of small and medium-sized enterprises in the context of COVID-19

Country	Deferral of Income / corporate tax	Deferral of Value Added Tax	Deferral of Social security and pension	Deferral of Rent / local tax
Switzerland	✓	✓	✓	
Sweden	✓	✓	✓	✓
USA	✓		✓	
Netherlands	✓	✓		
United Kingdom	✓	✓		✓
Finland	✓	✓		
Denmark	✓	✓		
Germany	✓			
Israel		✓	✓	✓
Korea				
Ireland	✓	✓		
Japan	✓			✓
France	✓		✓	✓
Canada	✓	✓		✓
Luxembourg	✓	✓		
Norway	✓	✓	✓	
Iceland	✓	✓		
Austria	✓		✓	✓
Australia	✓			
Belgium	✓	✓	✓	✓
Estonia	✓		✓	
New Zealand	✓			✓
Czech Republic	✓			✓
Spain	✓		✓	✓
Italy	✓	✓	✓	✓
Slovenia	✓			✓
Portugal	✓	✓	✓	
Hungary	✓		✓	✓
Latvia	✓			
Slovakia	✓			
Lithuania	✓			✓
Poland	✓		✓	
Greece	✓	✓	✓	
Turkey	✓	✓	✓	✓
Chile	✓	✓		✓
Mexico				

Source: compiled by the authors based on World Bank data.

In order to ease liquidity restrictions, OECD countries have introduced measures to defer income taxes, VAT, social payments, local taxes and tax reliefs. In some cases tax incentives or a moratorium on debt repayment are applied. One of the most common types of tax preferences for innovative businesses is income tax exemption. The following forms of tax support (Fig. 4) may have direct or indirect significance for businesses. In the first case, the tax burden is reduced in various ways, and in the second case, the general conditions for conducting economic activities are improved.

In order to avoid further decline in the liquidity of innovative SMEs, most countries have introduced measures to defer tax payments. Deferral is more often used when paying corporate income tax, less often countries provide deferral of Value-Added Tax (VAT), social security and pension contributions. In addition, in some countries, utility bills, mortgages, and rentals for small businesses and citizens have been temporarily suspended. Local authorities also postponed the payment of property taxes. The scope and duration of deferral measures vary by country. In some countries, along

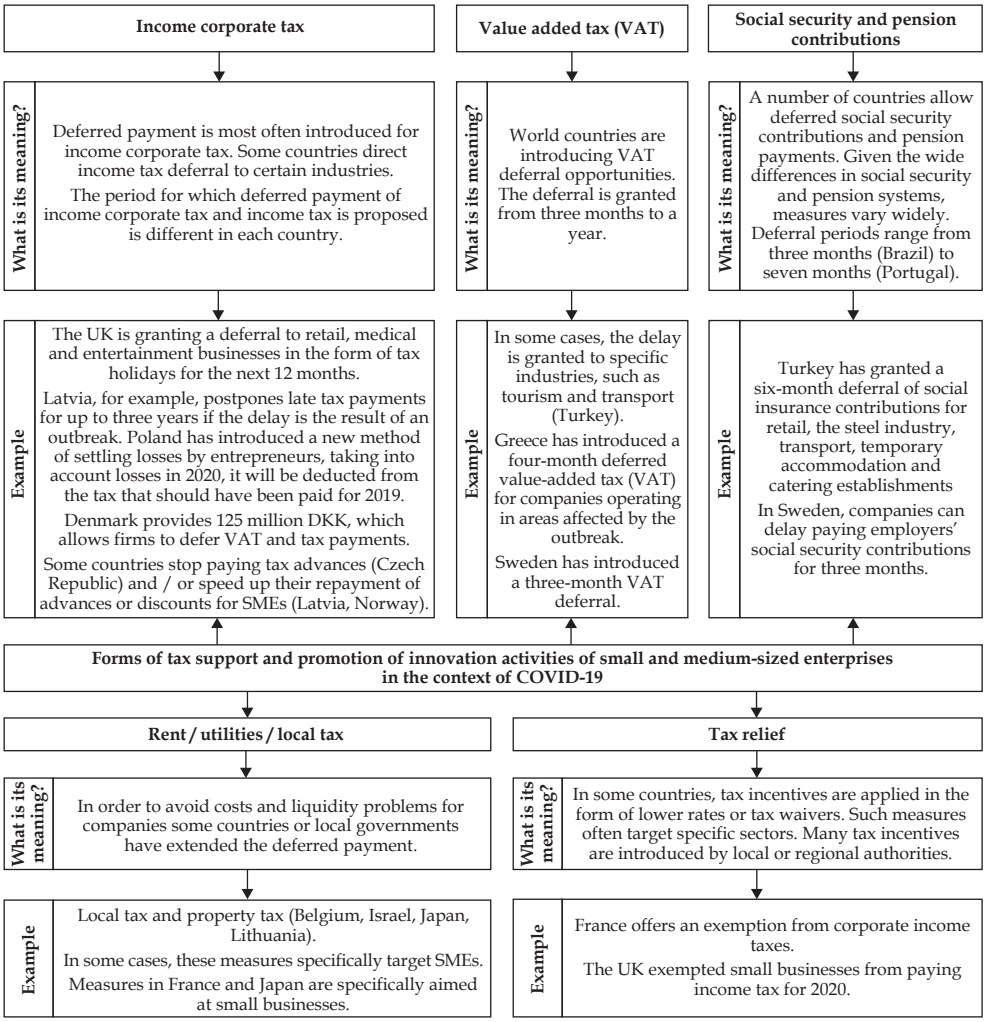

Fig. 4. **Forms of tax support and incentives for the development of innovative activities of small and medium-sized enterprises in the context of COVID-19**

Source: compiled by the authors based on World Bank data

with tax deferral, a tax incentive is also granted (Fig. 5).

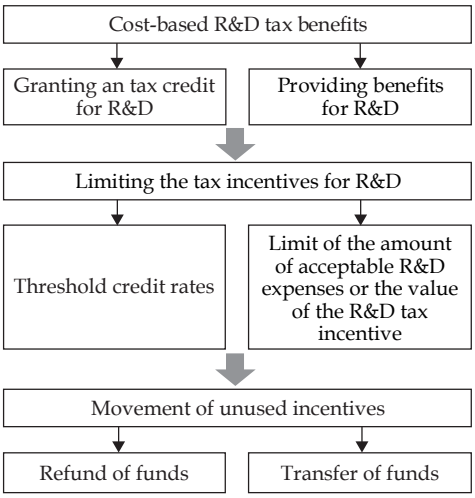

***Fig. 5.* Main features of R&D tax incentives for SMEs in the context of COVID-19**

Source: compiled by the authors based on World Bank data

Tax incentives are provided by reducing rates or refusing to pay tax. Such measures often target specific sectors. Many tax incentives are introduced by local or regional authorities.

4.2. Assessment of the effectiveness of tax support for innovative SMEs

The correlation matrix shown in Table 5 does not show a strong relationship (>0.6) between the variables. This means that there are no problems with the collinearity of variables.

Table 5

Correlation matrix of the variables described in the model

Variable	X_1	X_2	X_3	X_4	X_5	Y
X_1	1.00	–0.28	–0.24	–0.12	0.10	0.18
X_2	–0.28	1.00	0.02	0.36	0.27	0.26
X_3	–0.24	0.02	1.00	0.26	0.04	0.32
X_4	–0.12	0.36	0.26	1.00	0.27	0.15
X_5	0.10	0.27	0.04	0.27	1.00	0.50
Y	0.18	0.26	0.32	0.15	0.50	1.00

Note: X_1, Deferred income tax payment; X_2, Deferred payment of Value Added Tax; X_3, Deferral of social security and pension contributions; X_4, Deferral of local taxes; X_5, Tax incentives Y, Global Innovation Index.

Source: authors' own calculations.

To assess the importance of tax support tools for SME innovation activities used in the framework of anti-covid economic policy, we use a linear regression model. The basic model is as follows:

$$Y = \hat{a}_0 + \hat{a}_1 \cdot X_1 + \hat{a}_2 \cdot X_2 + \\ + \hat{a}_3 \cdot X_3 + \hat{a}_4 \cdot X_4 + \hat{a}_5 \cdot X_5. \quad (2)$$

Using the least squares method, we will estimate the value of the tools of tax support for innovation activities of SMEs used in the framework of anti-covid economic policy, which are presented in the form of coefficients X_1–X_5 for regression variables. The study was conducted in the Statistica program, starting with the basic form of the model, we consistently rejected the variables with the highest P-values. The results of the regression analysis are shown in Table 6.

Table 6

Regression results for the dependent variable Y

Variable	Dependant variable	
	Y	
	(1)	(2)
X_1	0.29	
	0.15	
X_2	0.26	
	0.15	
X_3	0.40***	0.29**
	0.15	0.14
X_4	–0.11	
	0.15	
X_5	0.41***	0.49***
	0.14	0.14
Observations	36	36
R_2	0.44	0.35
Adjusted R_2	0.35	0.3
F-statistic	4.7 (5.3)	8.51 (2.33)

Note: X_1, Deferred income tax payment; X_2, Deferred payment of Value Added Tax; X_3, Deferral of social security and pension contributions; X_4, Deferral of local taxes; X_5, Tax incentives Y, Global Innovation Index.

Source: authors' own calculations

During the analysis, negative values were obtained for deferred payment of local taxes (X_4), which indicates the opposite relationship. This may be due to the fact that in the case of the deferral of local taxes is used very rarely.

The largest values for X_3 – deferred social security and pension contributions – countries with a high level of innovative development use this tax incentive quite often; X_6 – tax benefits.

So, the model has the form:

$$Y = 0,29 \cdot X_3 + 0,49 \cdot X_5. \quad (3)$$

Regression analysis revealed that the use of tax incentives for innovative SMEs is a powerful public policy tool that provides not only solutions to private economic problems, but also increases the competitiveness of the national economy, which is important in times of crisis. The hypothesis about the effectiveness of applying tax incentives among other tax support tools is confirmed.

Tax incentives that contribute to technological progress are most relevant for taxpayers and for the implementation of state economic policy. The chosen innovative vector of economic development requires the mobilization and investment of significant financial resources in the national economy. Tax incentives can play a significant role in this case, as they increase the financial potential of investors by reducing payments to the budget and stimulate its use in the direction necessary for the state.

Let us consider the feasibility of using income tax incentives and social security and pension contributions incentives for the state and innovative small and medium-sized businesses. Since an innovative business is considered more profitable, this allows you to reduce the tax rate without losing budget revenues. Also, the amount of wages for innovative small and medium-sized businesses is higher, so it will be advisable to reduce the amount of social security and pension contributions in order to de-shadow high wages and stimulate the development of innovation activities.

The model for determining the preferential income tax rate is shown in Fig. 6.

At the entrance of the model, the "innovative SMEs" block is presented, which accumulates equity at the expense of saved profits as a result of receiving a tax incentive. Next, profit is generated by multiplying equity by profitability, from which budget revenues are subtracted (multiplying by the tax rate). The "budget" block is also presented as a storage of budget revenues.

The results of modeling the model at different levels of profitability are shown in Fig. 7.

A graphical representation of the relationship between tax revenues and the dynamics of the income tax rate at profitability levels from 0 to 100% shows that reducing the income tax rate is appropriate at high levels of profitability (90% and above) and the optimal value of the income tax rate is 10%, provided that the company leaves the saved profit from the provision of tax incentives for its development. Hypothesis 2 about the

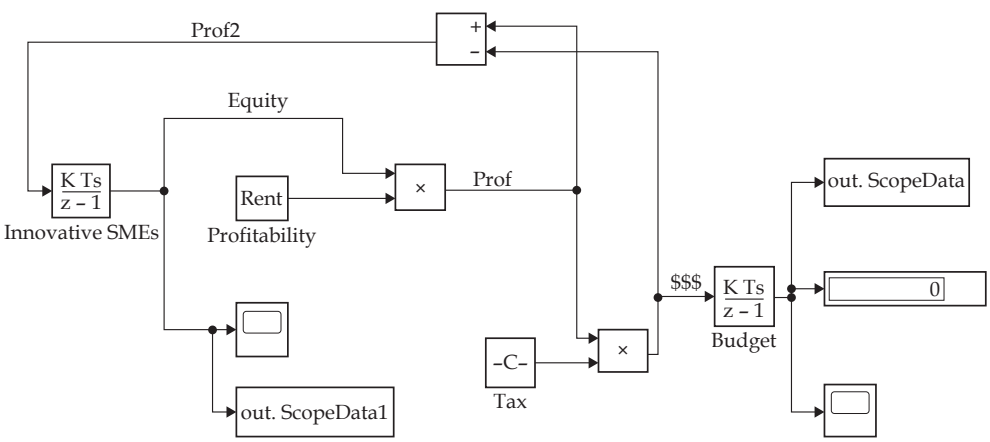

***Fig. 6.* Model for determining the preferential income tax rate**

Source: authors' own calculations

dependence of an enterprise's profitability on the effectiveness of a tax incentive is confirmed.

Regression model for calculating social security and pension contributions for innovative small and medium-sized businesses (Fig. 8).

The "Min_salary" block specifies the minimum wage, which will be increased by the value of the "Step" block. The "ESV" block is the existing social security and pension tax rate, which will decrease by the value of the "ESV1" block with each step of increasing wages.

The graph of the simulation model of tax revenues and wages shows that when using a regressive tax rate on social security and pension contributions, budget revenues continue to increase until the rate is reduced to 12% (Fig. 9).

Let us consider the model of the regression rate of the social security and pension contributions from 22% to 12%, with similar salary amounts (Fig. 10).

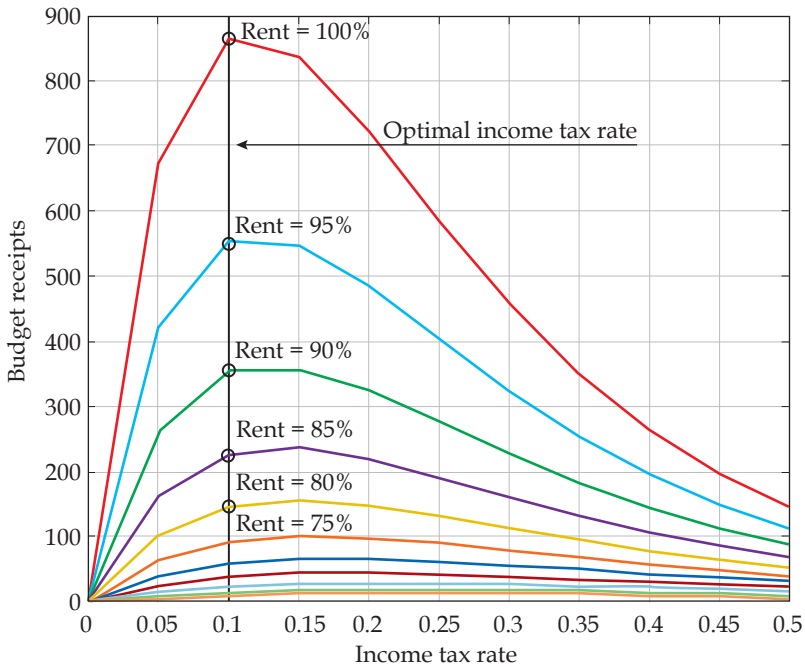

***Fig. 7.* Dependence of changes in budget revenues on the preferential income tax rate**

Source: authors' own calculations

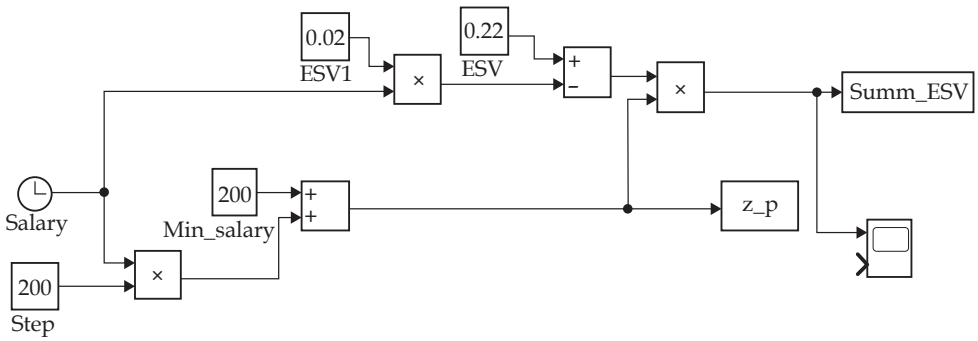

***Fig. 8.* Model for determining the preferential tax rate on social security and pension contributions**

Source: authors' own calculations

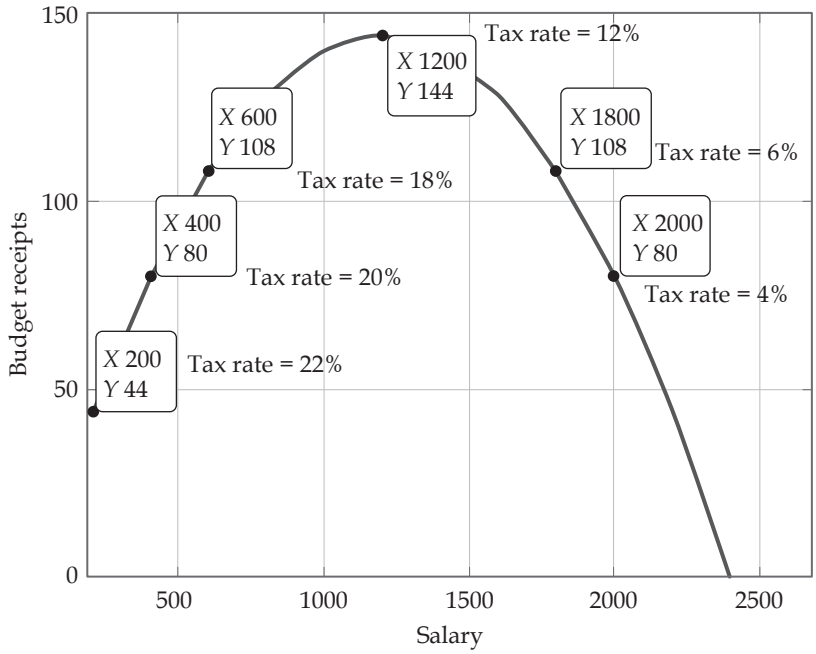

Fig. 9. **Dependence of changes in budget revenues on the preferential regressive tax rate on social security and pension contributions provision with a tax rate from 22% to 0%**

Source: authors' own calculations

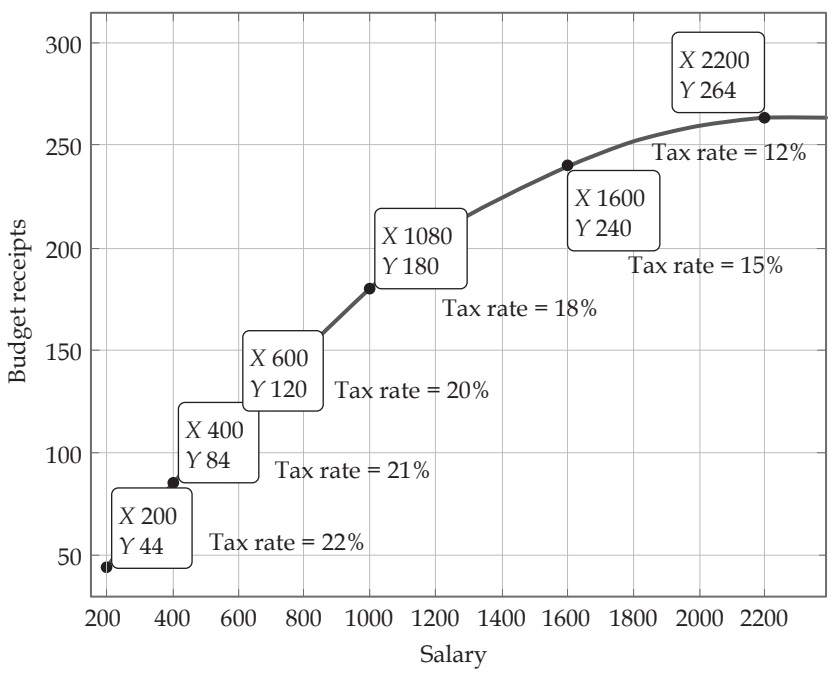

Fig. 10. **Dependence of changes in budget revenues on the preferential regressive tax rate on social security and pension contributions with a tax rate from 22% to 12%**

Source: authors' own calculations

For innovative SMEs, the minimum allowable reduction in the social security and pension contributions is up to 12%. It is at this value that budget revenues will increase. So, the minimum allowable social security and pension contributions rate for stimulating participants in innovation activities is determined by the salary level, which confirms hypothesis 3.

5. Conclusions

As part of the anti-covid economic policy, deferral of income tax, VAT, social insurance payments, rent payments/utility bills/local taxes is most widely used. In some cases, tax incentives or a moratorium on debt repayment are applied. The stage of the outbreak varies greatly from country to country, and political responses are very specific to the economic and social situation, respectively. The analysis showed that the issue of assessing the effectiveness of tax support for innovative small and medium-sized enterprises is insufficiently studied, and in the context of the COVID-19 pandemic, this issue is particularly relevant, because these enterprises are at high risk.

Analysis of the global practice of tax support for innovative small and medium-sized enterprises and the general innovation state of world countries in previous years confirmed hypothesis 1 – that the most effective tool for tax support is tax incentives. It was also found that the most popular tax to which a deferred or preferential rate is applied, income tax, is effective for innovative small and medium-sized enterprises with high profitability, which was reflected in the testing of hypothesis 2. As for the social security and pension contributions, the minimum allowable social security and pension contributions rate for stimulating innovation participants is determined by the salary level, which confirms hypothesis 3.

A limitation of the current study was that it focused on some countries using tax support for innovative small and medium-sized enterprises, and the expansion of the sample could significantly clarify the picture. The study did not use information about the financial condition of enterprises that received tax incentives.

Theoretical provisions have been brought to the level of practical recommendations for substantiating proposals for tax support for innovative activities of small and medium-sized enterprises.

Due to the COVID-19 pandemic, the global economy continues to suffer losses. Small and medium-sized businesses are particularly sensitive to changes in their operations. This requires further study of this topic, given the international experience of supporting innovative small and medium-sized enterprises and the rapidly changing economic conditions that continue to be caused by measures to counter COVID-19.

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For citation

Shapovalova A.O., Ivanov Yu.B., Tyschenko V.F., Karpova V.V. Assessment of the effectiveness of anti-COVID tax support for innovation activities of small and medium-sized enterprises in OECD countries. *Journal of Tax Reform*. 2021;7(1):68–86. DOI: 10.15826/jtr.2021.7.1.091

Article info

Received *January 20, 2021*; Revised *March 21, 2021*; Accepted *April 7, 2021*

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Для цитирования

Shapovalova A.O., Ivanov Yu.B., Tyschenko V.F., Karpova V.V. Assessment of the effectiveness of anti-COVID tax support for innovation activities of small and medium-sized enterprises in OECD countries. *Journal of Tax Reform*. 2021;7(1):68–86. DOI: 10.15826/jtr.2021.7.1.091

Информация о статье

Дата поступления *20 января 2021 г.*; дата поступления после рецензирования *21 марта 2021 г.*; дата принятия к печати *7 апреля 2021 г.*