Административно-управленческие проблемы налоговых реформ

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METHODS OF ASSESSING OF TAX INCENTIVES EFFECTIVENESS IN SPECIAL ECONOMIC ZONES: AN ANALYTICAL OVERVIEW

ABSTRACT. Tax incentives and the tax policy as a whole are components of a system of solutions that are aimed at the economic climate improvement while establishing special economic zones (SEZ). The most common instruments of the tax policy are tax exemption, lower tax rates and tax concessions. One of the key issues of SEZs' performance is the effectiveness of tax advantages applied in particular zone. The purpose of this study is to examine methods of assessing of tax incentives effectiveness in special economic zones. The study includes overview of existing approaches to tax incentives assessing in SEZs, which have been divided into the following groups: estimation of tax incentives effects on individual territorial development indicators, and comprehensive estimation of tax incentives effectiveness in a SEZ. The authors identified subjects of estimations, described each methodology and summarized the results. The authors focused their attention on and classified econometrical and statistical methods among the numerous approaches to assessing of tax incentives effectiveness in SEZs, which were built upon a variety of economic, and mathematical research techniques. The paper describes a method known as "difference in differences" that is widely implemented by scholars to estimate the effect of tax incentives in SEZs on individual territorial development indicators. This work also covers an effect of using tax incentives when conducting a comprehensive evaluation of tax advantages. It is also proposed a classification of quantitative indicators of tax incentives effectiveness in special economic zones. The study makes it possible to implement obtained results in assessing tax incentives effectiveness in the further development of Russian territories.

KEYWORDS. Special economic zones; effectiveness of tax incentives; methods of assessing the effectiveness of tax incentives.

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АНАЛИТИЧЕСКИЙ ОБЗОР МЕТОДОВ ОЦЕНКИ ЭФФЕКТИВНОСТИ НАЛОГОВОГО СТИМУЛИРОВАНИЯ ОСОБЫХ ЭКОНОМИЧЕСКИХ ЗОН

АННОТАЦИЯ. Налоговые льготы, как и налоговая политика в целом, являются частью комплекса мер, направленных на улучшение инвестиционного климата при создании особых экономических зон (ОЭЗ). При этом наиболее распространенными инструментами налоговой политики являются освобождение от уплаты налогов, применение пониженных налоговых ставок и предоставление налоговых льгот. Один из важнейших вопросов функционирования ОЭЗ — эффективность предоставляемых налоговых льгот. Цель исследования — изучение методов оценки эффективности налогового стимулирования в таких зонах. В статье проводится анализ практик оценки налогового стимулирования ОЭЗ, которые были разделены на группы: исследование влияния налоговых льгот на отдельные показатели развития территорий и комплексные оценки эффективности налогового стимулирования в ОЭЗ. Выделяются объекты исследования, описывается методология его проведения и обобщаются результаты. Сре-

ди множества подходов к оценке эффективности налогового стимулирования ОЭЗ, базирующихся на самых разнообразных методах экономико-математических исследований, изучены и классифицированы эконометрические и статистические методы. В работе описывается метод «разность разностей», активно используемый исследователями для оценки влияния налоговых льгот в ОЭЗ на отдельные показатели развития территорий. Кроме того, исследуются эффекты применения налоговых льгот при комплексной оценке налогового стимулирования, классифицируются показатели количественной оценки эффективности налоговых льгот на территориях ОЭЗ. Проведенное исследование позволит использовать полученные результаты для оценки эффективности налоговых льгот на территориях опережающего развития в России.

КЛЮЧЕВЫЕ СЛОВА. Особые экономические зоны; эффективность налоговых льгот; методы оценки эффективности налоговых льгот.

Relevance of the study

Special economic zones had become popular instrument of spurring development and attracting foreign investment in the past few decades and found a wide application globally. According to the International Labour Organization, the number of special economic zones grew from 176 in 46 countries in 1987 to 3 500 in 130 countries in 2007. The success of economic transformations in Singapore, South Korea and Hong Kong are often attributed to SEZs [1]. The most common instruments of the tax policy are tax exemption, lower tax rates and tax concessions. The success of the East Asian countries inspired many developing countries, including some countries in Africa, to establish various types of enterprise zones. However, some zones discrepant results. Tax incentives were often criticised for destroying tax base and shrinking budget revenues without any significant effect on investment inflow. This gives rise to numerous approaches to assessing the effectiveness and impact of various factors on the operational performance of SEZs.

Literature review

The present study of the problem of assessing of tax incentives effectiveness in special economic zones includes an overview of existing approaches to tax incentives assessing in SEZs, which were built upon a variety of economic and mathematical research methods. The scholarly investigation of tax advantages in SEZs was divided into the following parts: estimation of tax incentives effect on individual territorial development indicators, and com-prehensive evaluations of tax incentives effectiveness in SEZ. Studies of tax incentives effect on individual development indicators are presented in Table 1.

Research by A. Klemm and S. Van Parys [2] proves that investments respond to tax incentives and tax reductions as a result of competition between countries. The scholars employ a spatial lagged model with fixed effects estimated using instrumental variable assessment considering the distance between neighboring countries. The analysis use macroeconomic and institutional data. The authors analyze relative effect of corporate income tax rate reductions versus tax holidays or investment allowances offered by developing countries. They prove that the tax incentives encourage financial competition. The study takes account of the distance between the countries and the effect of tax regimes in the neighboring countries. The findings suggest that countries react to changes in corporate income tax rates or tax holiday terms that have been offered by other countries, rather than to tax credits.

The second model was employed by the authors to analyze the effect of three tax incentives — the reduced CIT rate, tax holidays and investment tax credits — on private investment and foreign direct investment. None of the variables affect private investment, while FDI crowds out domestically-financed investment. The analysis uses macroeconomic and institutional data as well as effective tax rates (Chen and Mintz [10]). The authors used a dynamic panel model that includes an estimator derived by the generalized method of moments in order to

identify the spatially lagged dependent variable. The tax incentives proved to be more effective in Latin America and the Caribbean countries than in Africa, and the authors concluded that the institutional environment was important for promoting investment [11].

S. Van Parys and S. James [3] analyzed the effect of tax incentives in the tourism sector and noted that the study did not look at the cost of capital or the impact of tax incentives on welfare [6]. The authors obtained data from the Price Waterhouse Coopers worldwide summaries of corporate taxes, macroeconomic and FDI data by sector by the Eastern Caribbean Central Bank (ECCB). They employed econometric panel data analysis technique known as 'difference in differences' with country-fixed effects.

The study of A. Caiumi [4] is notable because along with assessing the effect of

Table 1

Studies of tax incentives effect on individual development indicators in territories

Study	Subject	Findings
A. Klemm and S. Van Parys, 2010 [2]. Model 1: 47 developing countries, for the period 1985–2004	Tax incentives / Lower corporate income tax rate / Tax holidays / Investment tax credit	Lower corporate income tax rates ad tax holidays make an impact on the countries, while tax credits don not
A. Klemm and S. Van Parys, 2010. Model 2: 47 countries, 1985–2004	Private investment / Foreign Direct Investment (FDI) / Lower corporate income tax / Tax holidays / Investment tax credit	A 10 percentage point increase of the CIT rate lowers FDI by 0,3 percentage points of GDP. Over ten years of tax holidays increase FDI by 0,7 % of GDP. Tax credits have no effect on FDI. None of the three variables increases private investment
A. Klemm and S. Van Parys, 2010. 80 countries, 2005–2008	FDI / Income tax rate	Lower effective tax rate increases FDI, especially when the business climate improves
S. Van Parys and S. James, 2010 [3]. 7 Caribbean countries, 1997–2007	Tourism investment / Corporate tax exemptions for 5 to 25 years in Antigua and Barbuda	The extension of corporate tax exemptions in Antigua and Barbuda provided a significantly bigger increase in tourism investment than in other countries
A. Caiumi, 2011 [4]. Italy, Piedmont	Investment / Productivity / Regional investment tax credit	Positive effect on investment. Positive impact on productivity at the firm level
J. Kolko and D. Neumark, 2009 [5]. USA, California	Employment / Tax incentives, especially hiring tax credits	Positive employment effects in some areas. Generally speaking, the tax incentives does not encourage job growth. The authors suggest an improvement to fiscal incentives
D. Bondonio and R. Greenbaum, 2006 [6]. USA, 11 states	Employment, investment, sales and payroll per employee / Tax incentives	Increases in employment in new establishments are offset by losses in established firms
D. Bondonio and R. Greenbaum, 2012. Italy, Piedmont	Employment / Cash subsidies	An increase in employment. Bigger subsidies encourage job growth
P. Givord et al, 2011 [7]. France	Employment / Business creation / Tax exemption on income, property, local taxes and social insurance	A low impact on employment is attributed to the relocation of businesses to distressed areas as small firms
R. Chirinko and D. Wilson, 2008 [8]. Tax credits / Investment	State investment tax credits, investment	Tax incentives in bordering states offsets or reduces the limited positive effect
D. Artana, 2013 [9]. The free zones in Costa Rica, El Salvador and Dominican Republic, 2005–2012	Comparison of firms with and without fiscal incentives through analysis of three variables: the level of earnings, inter-annual growht, and the profit level	Companies enjoying tax incentives did not exhibit improved productivity in comparison with firms that did not have them. Empirical evidence suggests that the opposite is true for small firms

tax incentives on investment it also looks at how they impact productivity. She employs the difference-in-differences method using tax return data. Despite positive effect that locally provided investment tax credits have on investment and production, the author draws pessimistic conclusion that the state loses are significantly more in terms of tax revenues than it gains by attracting investment.

J. Kolko and D. Neumark [5] study the impact of various non-tax factors in 42 enterprise zones in California. The authors employ the «difference-in-differences» method for two factors with a variety of control groups and overdetermined regressions, drawing upon data from a survey of companies. The study proves that fiscal tools didn't spur employment in general, but there was some positive impact on employment in certain areas. The authors proved that the job-creating impact was more significant in enterprise zones that had a relatively low share of manufacturing employment, while enterprise zones were more likely to boost employment when local administrators devoted relatively more effort to marketing and outreach activities.

D. Bondonio и R. Greenbaum [6] studied the impact of hiring incentives that companies in the north of Italy had received for three years through the European Promotion Programme. The authors employ the «difference-in-differences» method and data from a European Promotion Program-sponsored census. The authors find that the impact on employment increases with the amount of the subsidy: from approximately two additional workers per firm with benefits below 10 000 euros to seven workers per firm with benefits greater than 70 000 euros.

P. Givord [7] examines the impact on employment of tax incentives that are provided to businesses in the economically distressed regions of France. The author uses the estimation strategy of «difference-in-differences» regressions that draw upon census data and fiscal databases. Tax incentives included five-year exemption from income tax, property tax, local business taxes and social security contribu-

tions. The author observes that tax rebates had a modest effect on employment and concludes that the introduction of incentives spurred the relocation of companies from other regions of France.

D. Artana studies the impact of tax incentives offered to companies in Costa Rica, El Salvador and Dominican Republic on three variables: the level of sales of firms, the level of inter-annual growth they had, and the profit level [9]. The author uses a dynamic panel data model with dependent variables. The estimation shows that companies which receive tax incentives do not exhibit higher productivity than non-incentivised firms.

Analysis of comprehensive assessments of tax incentives effectiveness in SEZs is shown in Table 2. Jin Wang [10] tracks the evolution of China's municipality level economics before, during and after the expansion of special economic zones. The author classifies 326 municipalities into four groups based on their timing of carrying out the SEZ experiment. Group 1 is composed of municipalities which were exposed to the SEZ reform in the early 1980s (1980–1985). Group 2 is composed of municipalities which had the SEZ experiment in the late 1980s (1986–1990). Group 3 is composed of municipalities which were granted the SEZ experiment in the early 1990s (1991–1995). Group 4 includes municipalities which has been implementing the SEZ reform since the late 1990s. To estimate the impact of SEZs on the development of municipalities, information on GDP, investment, employment, foreign direct investment, exports were used and a digital GIS map of the Chinese municipalities was drawn up according to the year when SEZ was created. The findings suggest that SEZs not only attract investment, but also bring in advanced technology and ensure economic growth. The SEZ policy also increases foreign direct investment per capita by 58 %, mainly in the form of foreign investment and export-oriented industrial enterprises; it does not crowd out domestic investment and domestically owned capital stock and increases total factor productivity growth rate by 0,6 percentage points [10].

Table 2

Comprehensive study of the effectiveness of special economic zones

Study	Subject	Findings
J. Wang, 2009. 326 China's municipalities between 1978–2007	GDP, investment, employment, FDI, exports, labor productivity	SEZs not only drives capital flows, but also spurs innovation. The share of FDI and export-driven businesses increased by 58 % per capita
S. Alder, L. Shao, F. Zilibotti, 2015. 276 Chinese cities between 1988–2010	The effect on SEZs on economic development of municipalities	During the first ten years of the operation of the SEZ the city GRP per capita grew by 13 % and by 18 % in subsequent years. There was a positive effect on productivity, investment, and human capital. The impact on neighboring municipalities tend to intensify in the course of time

S. Alder, L. Shao, F. Zilibotti [12] study the effect of special economic zones on the economic development of 276 China's municipalities between 1988 and 2010. The authors carry out a «difference-in-differences» estimation. They find that the establishment of a SEZ is associated with an increase in the level of GDP of about 20 % and boosts total factor productivity, investment and human capital. The authors point to the critical role of the state in ensuring success of SEZs through market liberalisation, promoting investment and introducing innovation. The government's industrial policy that included tax incentives was a catalyst for the development of cutting-edge production facilities in China, which had a positive effect on the national economics as a whole. The authors also find positive spillover effects of SEZs on neighbouring regions and cities.

Proposed methodology and its novelty

Even in case of a successful application of tax incentives, the cost of tax advantages (tax expenditures) might exceed benefits of attracting investment. Before studying the effectiveness of tax incentives in a SEZ, one should estimate their effects. When conducting a comprehensive assessment of SEZ tax incentive policy, scholars identify effects of tax incentives on economics, tax revenues, welfare and infrastructure [10–12]. Depending on the area of application, I. A. Mayburov differentiates between the effects of tax incentives on tax revenues, welfare, economics, public funds, and the environment [13, p. 169]. Each indicator of tax incentives effectiveness could serve as a criterion for deciding on the effective-

ness (or ineffectiveness) of a tax incentive. However, for the tax incentive to be considered effective, it seems sufficient to have only one type of effects, i.e., to observe a growth of one of the indicators to a level that exceeds tax expenditures, which will constitute a positive effect [14].

The author notes that distinguishing the effect on the environment might be disputable due to quantification issues, but seems inevitable in the future.

To assess the effectiveness of tax incentives, their effects are presented as quantifiable indicators (Table 3).

Table 3

Effects of tax incentives for purposes of comprehensive assessment of SEZ incentive policy

Effect	Indicator
Economics	Gross regional product annual growth; Foreign direct investment growth; Output growth; Labour productivity growth; Fixed investment dynamics, etc.
Tax revenue	Public income growth driven by tax incentives; Subsequent tax revenues exceed current tax expenditures; Tax expenditures cost less than provision of state subsidies; Public revenue shortfalls over the previous and current periods etc.
Welfare	Higher average wage; Growth in new jobs; Higher employment rate; Better education level; Income inequality reduced, etc.
Infrastructure	More km of roads per square km of area ratio; Electricity and gas supply networks; Expansion of transportation and communication systems, etc.

The effect on economics is shown by economic development indicators and financial and economic indicators of tax-payers' operational performance. The welfare effect reflects the social implications of tax incentives in SEZ. The effect on public revenues indicates the impact of tax incentives on the government budget. The effect on infrastructure reflects the development and reliability of infrastructure in the area.

It is possible to estimate the effectiveness of a tax incentive by looking at the degree of its projected effect. If it exceeds the tax expenditures, i.e., if the effect is positive, or if all indicators have increased in monetary terms, it means the tax incentive has been effective. Another factor of effectiveness is the quality of institutional environment in the region and the effectiveness of oversight authorities. Unfortunately, these indicators are not subject to regular statistical surveys in Russia's regions. However, there appears to be a considerable diversity among the Russian regions in terms of their institutional characteristics. The Corruption Perceptions Index published by Transparency International places Russia at the 119th place (among 168 countries) [15]. There are no indicators that would take into account political (transparency, election), economic (liberalization, corruption), and social factors (media independence, maturity of civil society, culture and local government) in each region of Russia.

The effectiveness of tax incentives in special economic zones is difficult to quantify. Four different types of direct costs are distinguished when performing a comprehensive assessment of tax incentives in SEZs:

– tax revenue shortfalls due to tax incentives (tax expenditures);

– resource allocation costs (additional investment in creation competitive markets that increases government expenditures;

– enforcement and compliance costs (tax administration costs);

– costs associated with corruption and lack of transparency (manual control over tax incentives in SEZs drives up costs associated with corruption) [11].

Being one of the common ways of assessing the effectiveness of incentive policies in SEZs, method of cost-benefit analysis implies that the costs of implementing a SEZ project are estimated in terms of the volume of investments that were made thanks to tax incentives, revenue foregone, and direct financial subsidies. Studies that employed the approach do not provide a true measure of efficiency, because they measure only the costs, and not the jobs created, technology transfer, etc.

To measure costs and benefits associated with investment, the following indicators are taken into account:

– the volume of investment that could potentially be undertaken if investors do not receive any incentives;

– «leakages» from the tax base induced by tax incentives, or the relocation of tax payers to tax-free zones;

– tax revenue from tax payers that continue to benefit from tax incentives beyond the period of exemption, or from other activities [16].

The method of cost-output analysis is essentially identical to the method of cost-benefit analysis, but its main difference lies in the use of physical rather than monetary units for measuring benefits. The results of the analysis are easy to interpret.

The main approaches to improve the quality of the estimation of tax incentives in SEZs include creation of tax incentive budgets and tax expenditure reports [17]. In order to compile a unified tax incentive budget, a single coordinated approach is needed to identify all expenditures on public authorities that are involved in SEZ governance (SEZ projects approvals, investment monitoring services, tax control services etc.). The majority of countries, taxation authorities are not responsible for designing and administering tax incentives program in special economic zones. As a rule, among public authorities that are in charge of approving SEZ projects and monitoring investment are several departments Ministry of Economics, foreign investment agencies etc. Main goal of these services is to make sure that investors are coming in, rather than to protect the tax base and ensure tax revenue. A tax

expenditure budget makes it possible to carry out general analysis of direct and indirect tax expenditures on a SEZ project.

Analysis of study results

The effectiveness of tax incentives in SEZs is directly related to the investment climate in the country, as well as to economical and political issues, inadequate protection of property rights, or a poorly functioning legal system. SEZs have proved to be ineffective in the majority of African countries due to ineffective infrastructure and ineffective institutions [18].

Studies conducted in India find that the number of SEZs in the region had negligible effect on economic growth [19]. Moreover, there is significant risk that the national income might shrink following the establishment of SEZs. In 2000, the Indian government cancelled tax incentives for exporters, and granted exemption only to residents of special export-oriented economic zones. That spurred mass tax evasion. Despite insignificant decrease in sales, exporters' profits before tax halved, while their subsidiaries which were registered in SEZs reported a 100 percent increase in profits.

Studies seeking to establish a direct link between the tax burden and FDI prove that taxes have a considerable impact on the volume of investment in SEZ in developed countries. A study by A. Klemm and S. Van Parys that covered 47 developing countries between 1985 and 2004 finds that 10 percentage point increase of the CIT rate lowers FDI by 0,3 percentage points of GDP. Over ten years of tax holidays FDI increase by 0,7 % of GDP. Similar investigations in developing countries generally reveal less correlation between Indicators above [3; 20]. One of the key reasons for that are unattractive conditions for investing that scared away multinational companies: underdeveloped infrastructure, low living standards, lack of political and economic stability, lack of legal transparency, weak judicial system etc. In such cases it is difficult to make up for the unfavorable business climate by providing tax incentives. Yet tax incentives remain one of the most effective

development instruments for low-income economics [16].

The effective application of tax incentives in SEZs is measured by taking account of associated costs and considering whether the project has reached its goals. An increase in investment, including FDI, is usually a necessary but not a sufficient prerequisite for development. The effectiveness of tax incentives is a result of taxes imposed by the SEZ, but also of a tax burden in other countries, including the investor's home country and neighboring regions. Our review of foreign literature on the subject of tax incentives in special economic zones shows that when assessing the effectiveness of tax incentive policies in special economic zones the following estimation methods are used:

– econometric models;

– statistical methods of effectiveness assessment.

The statistical estimation techniques are simple methods of quantitative evaluation of SEZs. One can recommend them for use at the early stages of analysis. Among the most commonly used indicators of statistical estimation methods are:

– calculation of mean values;

– time series: absolute change, relative change, growth rate, change trends;

– combination and grouping of economic indicators by certain features;

– competitive comparison over a time span;

– inflation indices (deflators);

– graphical methods.

Statistical methods are essentially about studying the statistics economic effects along with the amount of tax expenditures in SEZs, establishing the volume and frequency of obtaining a certain economic result and producing the most reliable prediction. The statistical methods draw upon big data and require preliminary grouping of facts by shared attributes. For example, simple linear regressions comprise a large number of lagged variables; large amount of information also requires to conduct series of treatments. Simple linear regressions that are designed to reveal the impact of taxes on the economics are subject to identification problems and lim-

itations. The identification problem means that a simple model cannot identify the impact of a discretionary decision of the country government as whether to introduce a tax incentive. This brings about an endogeneity problem in a model when it is impossible to definitely state that fluctuations in tax revenues affect economic dynamics expressed, for example, by GDP, rather than vice versa.

The limitations of such models are due to the fact that it is impossible to take account of shocks in variables that occur outside the model, but have a strong effect on the structure and pace of economic changes. For example, when analyzing tax incentives in a SEZ it is necessary take into account government investment in territorial development. This requires use of complex dynamic models that help mitigate the endogeneity problem and describe economic linkages. Economic processes develop over time, so the issues of analysis and forecasting in time series, including mulita-variate ones, hold an important place in econometrics. The operational performance of SEZs depends on a large number of parameters, which makes it difficult to describe the structure of linkages between these parameters.

In such cases the application of economic and mathematical modelling methods is not only appropriate, but essential. Our overview of approaches to analysing the effectiveness of tax incentives in SEZ shows that the most commonly used estimation methods are dynamic panel regressions, panel data models with fixed effects and the «difference-in-differences» technique.

A big advantage of dynamic panel regression models over simple regressions includes possibility to obtain a large number of observations over a relatively short term horizon by incorporating micro data in calculations. In SEZ investigations, micro data sets are extracted from surveys of enterprise zone based firms.

Panel regression models can take the form of fixed effects models

$$Y_{it} = X'_{it}b + \alpha_i + \varepsilon_{it},$$

random effects models

$$Y_{it} = X'_{it}b + u_{it};$$

$$u_{it} = \alpha_i + \varepsilon_{it},$$

where Y_{it} is the dependent variable; X'_{it} is the deterministic (non-random) variable; ε_{it} is the random (stochastic) component (error term).

In fixed effects models, α_i is the intercept that takes on different values for each unit. The intercept represents the effect of omitted or unobserved variables that describe individual characteristics of units that do not change over time.

In random effects models, α_i, also represents the effect of omitted or unobserved variables that describe individual characteristics of units, but in this case such individual differences are random, their average values are balanced and their variances are identical across samples.

Apart from different interpretations of the intercept, models have different methods of estimating regression coefficients. The fixed effects model allows for data endogeneity, that is, coefficients are estimated when X'_{it} is correlated with α_i. The random effects model implies that explanatory variables in each time period are uncorrelated with the error (exogeneity), which is a fairly strict assumption. Weaker exogeneity of variables in the fixed effects models yields coefficients that are consistent, but ineffective. That means that the estimation method does not produce a minimal variation of coefficients, hence errors as to their statistical significance. This happens because the fixed effects model does not use the entire variation across the data cluster, but only within-entity variation. Between-entity variation is ignored. The random effects model exploits across-cluster variation and produces effective estimations, that might, however be biased in the case of a strong correlation between the error term and explanatory variables [13, p. 165].

Our review of approaches to estimating the effectiveness of tax incentives in special economic zones shows that the «difference-in-differences» technique is often employed for the purpose. This might be due to the difficulty of doing a pure experiment for investigating cause-

and-effect linkages between tax incentives and indicators being studied.

The technique estimates fixed effects in aggregate data. Using the DD method makes it possible to eliminate omitted variable bias by controlling for unobserved omitted characteristics while incorporating observed parameters of entities into the model [21].

J. Wooldridge explains that «the simplest set up is one where outcomes are observed for two groups for two time periods. One of the groups is exposed to a treatment in the second period but not in the first period. The second group is not exposed to the treatment during either period. In the case where the same units within a group are observed in each time period, the average gain in the second (control) group is substracted from the average gain in the first (treatment) group. This removes biases in second period comparisons between the treatment and control group that could be the result from permanent differences between those groups, as well as biases from comparisons over time in the treatment group that could be the result of trends» [22].

Technically, the DD method estimates the effect of SEZ projects as a difference between Y (an indicator, e.g., GRP) in two points in time for two groups of regions: the treatment one where the SEZ are being implemented, and the control one where no projects occur ($AC = AB - CB$).

The standard DD model can be expressed as a regression equation:

$$Y_i = \beta_0 + \beta_1 P_i + \beta_2 T_i + \beta_3 P_i T_i + \Sigma j a_j X_{ij} + \varepsilon_i,$$

where i — indexes the region; j — indexes an auxiliary factor variable; Y_i is the indicator; P_i is a dummy that is equal to one for time period 2 (later observation), and equal to zero for time period 1 (calculation period); T_i is a dummy that is equal to 1 for regions from the treatment group, and equal to zero for regions from the control group; X_{ij} are auxiliary factor variables; ε_i is a random (stochastic) component (error term; β_0, β_1, β_2, β_3, a_j are the regression coefficients; β_0 is the mean value of GRP for control group regions during period 1; $\beta_0 + \beta_1$ is the mean value of the indicator for control group regions during period 2; $\beta_0 + \beta_2$ is the mean value of the indicator for treatment group regions during period 1; $\beta_0 + \beta_1 + \beta_2 + \beta_3$ is the mean value of the indicator for treatment group regions during period 2; $\beta3$ d is the difference-in-differences estimate (effect).

The models could include regional-scale fixed effects, which makes it possible to balance the special (first difference) and temporal (second difference) heterogeneity that is unrelated to the regional SEZ. Consequently, DD estimation makes it possible to assess growth determinants that are specific to a particular territory and a particular time frame.

Conclusions

A survey of recent foreign research into tax incentives in special economic zones shows a wide array of approaches to the subject. The effectiveness of tax incentives in SEZs is assessed from the point of view of associated expenditures as well as whether the projects in question meet their objectives. One of the key problems of effect manifestation and estimation has to do with the difficulty of establishing the time lag that is quite unique to each incentive. The effects of tax incentives usually occur in the mid-term or even long-term run. The main problem with estimating tax incentives is carrying out an analysis of the SEZ effectiveness without tax incentives and constructing models that would isolate the effects of tax incentives from the impact of other factors and variables.

By employing the method of cost-benefit analysis for assessing the effectiveness of tax incentives in a SEZ, it is possible to perform a comprehensive analysis of the SEZ and estimate aggregate long-term effect by determining the present value of net benefits by discounting it at a discount rate. The complexity of the method arises from the lack of an objective opportunity to estimate individual effects and outcomes in monetary values. For example, it is difficult to quantify benefits of public expenditures. Additionally, irregular statistical observations make the cost of collecting information unreasonably high.

The «difference-in-differences» method is widely used for analyzing performance of special economic zones in order to assess cause-effect linkages (A. Caiumi, D. Bondonio and R. Greenbaum, P. Givord [4; 6; 7]. Studies by S. Alder, L. Shao, A. Klemm and S. Van Parys show that the econometric methods are fraught with the problem of identifying and taking into account the time lag) [2; 12].

Panel data that are used in the «difference-in-differences» technique make it possible to remove the unobserved heterogeneity in the sample when the omitted variables are fixed in time inside the SEZ. That means that the treatment and control groups should be exposed to the same tax incentives and respond to them «in parallel». For example, when conducting their research, S. Van Parys and S. James used the DD method with country-fixed factors [3]; J. Kolko and D. Neumark used the DD method for two factors in different control groups and overdetermined regressions [5].

In other words, in the absence of an effect from tax incentives in both treatment and control groups of SEZs, the model definitely yields different coefficient estimates, but estimates should change in parallel over time during the considered period. The conditions have to be observed in order to make sure that it was only the effect of tax incentives that could change the trend in the treatment group when compared to the control group.

Panel data ensure higher precision of estimation, make it possible to study the change in dynamics and individual characteristics of the units in the sample; they can identify and measure effects that cannot be traced in time series or spatial data only. For example, research by J. Wang and A. Klemm, S. Van Parys, who use a lagged model with fixed effects that is estimated with instrumental variables, take into account distance between provinces / countries to determine how neighbouring provinces or bordering countries influence one another.

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