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Impact of Special Economic Zones on domestic market: Evidence from Russia

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ABSTRACT

Place-based policies can be an effective instrument for governments to encourage the economic development of a country. A Special Economic Zone (SEZ) is a place-based policy aimed at attracting FDI, employment growth, and supporting new economic reforms. In addition, for emerging economies an SEZ could be a potential catalyst for development; foreign investors can have a drastic impact on the productivity of domestic firms, revenues, and market shares through the implementation of new technologies and the creation of new firms. However, the effects of SEZs on the domestic market at the firm level are largely understudied. In this research, I leverage the large-scale SEZ policy implemented by the Russian government in 2005 that aims to attract foreign investors to specific parts of the country by offering tax relief. The primary objective of this research is to quantify the effects of the Russian SEZ policy on local firms. To examine the effects, I use the generalised Difference-in-Difference methodology and apply it to a panel of firms in Russia for the 2006–2019 period. The data includes time-varying SEZ treatment on firms, firm characteristics, and accounting data. The primary outcome variables of interest are revenues, profits, and total factor productivity. The research findings could contribute to the urban economic literature on place-based policies and may be helpful to policymakers in determining the effectiveness of SEZ place-based policies.

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Special Economic Zones; total factor productivity changes; place-based policies; FDI

1. Introduction

Governments usually attract FDI by implementing tax deductions for foreign investors and stimulating policies on a federal or regional level. The SEZs were established in India, China, Sub-Saharan African countries, Poland, and other countries. SEZ policy demands substantial government expenditures on infrastructure, developing institutions, and providing privileges for investors. Thus, the effectiveness of SEZ policy is vital for the whole economy (Cizkowicz et al., 2015). The SEZs can have a drastic impact on the productivity of the domestic market, revenues, and market shares of firms through the implementation of new technologies and the creation of new firms. Foreign firms, on average, are more productive than domestic firms (Ebenstein, 2012). Thus, their presence induces productivity growth in the domestic market. On the one hand, domestic firms could

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benefit from research and development (R&D) spillovers from foreign firms and the growth of productivity. On the other hand, the revenues of domestic firms after policy implementation could decrease because of higher market competition and lower market share. Therefore, the weakest firms could be forced to leave the market. Nevertheless, the strongest firms could survive, have growth productivity, and profit growth.

The current literature shows mixed effects from SEZs as one of the instruments for FDI attraction on the productivity of the domestic market: Abraham et al. (2010), ITO et al. (2010), Wang (2013), Alder et al. (2016), Lu et al. (2019), Zhaoying (2021) show a positive spillover effect on productivity for domestic market, Lin et al. (2009) find no effect, and HU and Jefferson (2002) find a negative effect. However, the sign of the effect could depend on the quality of institutions, infrastructure, government monitoring, and evaluating instruments of SEZ policy (Brautigam et al., 2010). Moreover, the initial number of SEZs could impact SEZ performance. According to Zeng (2016), Sab-Saharan African countries with 10 or 20 zones, in the beginning, received worse effects for the domestic economy in comparison with SEZs in China that had 4 zones at the beginning.

In 2005, the Russian government started creating SEZs to attract foreign investors with special privileges: free customs zone regime, profit tax rate deduction, and exemption from land and transport taxes from 5 to 15 years.[1] By 2020, twenty-eight SEZs had been created in eighteen Russian regions with different specialisations: industrial (15 regions), technological (6 regions), touristic and recreational (5 regions), and logistic (1 region). SEZs are located mostly in the central and western parts of Russia.

The effects of SEZs on the domestic market in Russia are largely understudied. A thorough review of the literature reveals that only one paper studies the effects of SEZ policy in Russia: Frick et al. (2018) estimate the effect of different factors on the economic growth of an individual SEZ in 22 emerging countries, including Russia. The sample consists of 346 zones for 2007 till 2012 period. The authors use the nightlights as a proxy for economic growth outcome because of limited data availability. From the data analysis, the authors find that the average growth of SEZs in Russia is faster than the national growth for the years 2007–2012. However, the SEZ area grows slower than the surrounding area in Russia. However, to my knowledge, the effects of SEZ policy on productivity and revenues are not studied yet on firm-level data.

In my research, I estimate the direct effects of SEZs on the revenues and factor productivity of domestic firms with the generalised Difference-in-Difference (DID) technique, which could shed more light on the domestic market changes after SEZ policy implementation. I use the panel data from 2006 to 2019, collected from the publicly available sources, the Federal State Statistics Service of Russia, the Federal Tax Service of Russia, and the Russian Special Economic Zones website, and from a commercial source, Spark Interfax. The data includes time-varying SEZ treatment on firms, firms' characteristics, and accounting data. Different years of SEZ policy participation for firms give an exogenous variation for causal inference. Specifically, in the same region and industry exist firms that are residents of SEZ (the area inside the region) and non-residents after SEZ policy implementation. The primary outcome variables of interest are revenues and total factor productivity. In the sample, I have 12 regions affected by SEZ policy and 177 business activities (each of the activity belong to the particular code of Russian Classifier of Types of Economic Activity) treated by SEZ policy. The research findings could

contribute to the urban economic literature on place-based policies and can be helpful to policymakers in Russia and other countries looking to create or change SEZ policy.

The research findings of my paper show significant and positive effect of SEZ policy implementation in Russia on firm productivity and firm revenues in the domestic market. The results are robust to including one and three leads and lags, control variables (logarithm of capital and logarithm of labour), and fixed effects for firms, regions, business activities, and time. The parallel trend assumption holds for one lead and lag specification of the model and three lead and lag specification of the model.

2. Review of relevant literature and background

2.1. Theoretical background of SEZs

SEZs are areas where a government chooses to have different rules from the rest of the country in administrative, regulatory, and fiscal regimes (Farole, 2011). SEZs could operate in various forms: export or economic processing zones, free zones, or foreign trade zones (Akincl & Farole, 2011; Farole, 2011). The type of special economic zones depends on the development objective, typical size, typical location, activities (sectors), markets (domestic, re-export,export) (Akincl & Farole, 2011). For example, Bangladesh, Vietnam, Mauritius, Mexico are traditional export-processing zones with size less than 100 hectares. In comparison, Russian SEZs cover move than 1000 hectares and do not have market restrictions (only export or domestic).

SEZs could incentivise economic development as it is based on innovations, technologies, and creating an attractive environment for businesses (Baciuliene et al., 2021). The SEZ policy implementation could boost regional development by attracting FDI, new technologies, and skilled labour.

SEZs policy generates spatial concentration of firms and could yield technological and knowledge spillovers, productivity growth from agglomeration economies associated with moving goods, labour, and ideas (Jacobs, 1969; Krugman & Obstfeld, 2003; Marshall, 1920; Newman & Page, 2017). The spillover effects in SEZs could be classified into intra-industry (specialisation) or complementary, depending on the type of SEZs (single or multi-industry), known in the literature as Marshallian and Jacobian externalities (Jacobs, 1969; Marshall, 1920). Russian SEZs represent specialised clusters that could face Marshallian externalities. According to (Otsuka & Sonobe, 2006), an industrial cluster attracts traders, parts-suppliers, skilled workers, and engineers. With time inside the industrial cluster competition pushes firms to start contracts with suppliers inside the cluster, to trigger innovations, new marketing channels, to increase the quality of the product, and to absorb unsuccessful enterprises (Otsuka & Sonobe, 2006). Moreover, competitive firms could collaborate to overcome market constraints (Newman & Page, 2017; Schmitz, 1995). As a result, the production efficiency improves in the industry (Otsuka & Sonobe, 2006).

2.2. SEZ effects in current research

The creation of SEZs is a popular policy instrument for attracting FDI implemented in countries including China, Poland,[2] India,[3] and other countries. The main objectives of

establishing SEZs are attracting FDI, unemployment decrease with creating new job places from foreign employers, supporting new economic reforms strategy, and acting as experimental laboratories for the application of new policies and approaches (Farole, 2011; Pastusiak et al., 2018; Zeng, 2016). Also, SEZs is a potential catalyst for development, especially for emerging economies (Alder et al., 2016; Grant, 2020). Dorozynski et al. (2018) show the overall growth of the economy after creating SEZs and emphasise the major role of investors in SEZs (72% of new jobs, 50% of investment projects, 81% of investment stock), using the example of Poland. Zeng (2010) estimates the effect of SEZs in China on the whole economy and finds growth in new job places (30 million, the relative growth is unknown), national GDP (22%), FDI (46%), and exports (60%). In Bangladesh, SEZs attract $2.6 billion (relative growth is unknown) in foreign investment and create 350,000 new jobs (Zeng, 2016). By 2015, 14 SEZs operated in Poland and attracted 33% of total FDI inflows in 4 years. Most African SEZs, except Mauritius and the partial initial success of Kenya, Madagascar, and Lesotho, failed to attract significant investment, promote exports, and create sustainable employment relative to other countries (Brautigam et al., 2010; Farole & Moberg, 2014) because of the lack of basic infrastructure and SEZ regulation, insufficient strategic planning, poor choice of location and poor internal coordination (Brautigam et al., 2010). For the Dominican Republic, SEZs allowed the economy to move from agricultural reliance to manufacturing, creating more than 100,000 manufacturing jobs (Akinci & Farole, 2011). Industrialization and job creation after SEZ policy implementation were in Mauritius, the Republic of Korea, Taiwan, China, Honduras, El Salvador, Madagascar, Bangladesh, and Vietnam. The Klaipeda free economic zone (FEZ) in Lithuania for 15 years (2006–2020) attracted 634 million euro (that corresponds to 60% of all FDI in Klaipeda city and almost 45% in Klaipeda county) and employed 3427 employees for 14 years (2006–2019) (Baciuliene et al., 2021).

In the recent literature, the authors also discuss the productivity effects on the domestic market from foreign firms after SEZ policy implementation. The productivity effects arise from the learning behaviour of domestic firms from foreign, when firms outside SEZs become more efficient after foreign investment (Zeng, 2016). According to ZENG (2016), positive productive spillover effects could be in the form of new technology transfer or innovation, growth of economic productivity, increase in economic diversification, or welfare effects for the domestic population.

However, empirical evidence of spillover effects from foreign technology on the domestic market with SEZ policy implementation is controversial. Abraham et al. (2010) find positive spillovers from foreign firms in their studying of the influence of FDI on the performance of domestic firms and the impact of SEZs on Chinese firms. Additionally, ITO et al. (2010) report positive spillover effects on total factor productivity (TFP) of domestic firms within and across industries. Greenstone et al. (2010) show productivity growth after SEZ policy implementation in the United States but only in the same county of SEZ location. Wang (2013) compares the changes among municipalities that created SEZs, and the impact of SEZs on the whole economy and on the productivity of domestic firms in China using the OLS. The author finds that SEZs increase the TFP of local firms and the earnings of local workers. Kline and Moretti (2013) find a mixed effect from the policy: gains from the policy are accompanied by losses in other parts of the country from the policy. In contrast, Lin et al. (2009) do not find any spillover effects on productivity from

foreign firms. And HU and Jefferson (2002) show negative spillover effects of R&D and technology transfer from foreign firms.

The sign of spillover effects from foreign firms could depend on the structure of the market, on time or the conjecture of the market (Zeng, 2016). According to Zeng (2016), strong government support, institutions, a strategic location, commercial viability, and willingness to address environmental concerns in SEZs could make SEZ policy experience successful. In Singapore, the Republic of Korea, and Malaysia, the requirements were satisfied before policy implementation, thus, positively affect the domestic firms in productivity (Zeng, 2016). Moreover, for successful policy implementation and domestic production growth, a country should have the channels of technology and R&D transfers, e.g. business incubators, conferences, innovation platforms (online or offline), and talent-recruiting programs (Zeng, 2016).

2.3. Factors affecting SEZ effects

SEZ policy is an effective instrument for FDI attraction and productivity growth for the economy. However, SEZ policy effects could differ for low- and middle-income economies. The low-income economies could have a poor level of institutions, infrastructure, government monitoring, and evaluating instruments. Problematic legal, regulatory and institutional frameworks, poor business environment, strategic planning, and adoption of demand-driven approaches to business should be improved to increase the probability of SEZ policy implementation success (Zeng, 2016).

The initial number of zones could impact SEZ effect on the domestic market. China started from four zones in different locations and some Sab-Saharan African countries had 10 or 20 zones at the beginning (Zeng, 2016). In Russia, on the first step of SEZ policy implementation 5 zones were created in 2005, then from 2006 till 2010 were created 6, and during 2011–2020 were created 17 zones. The gradual policy implementation could give additional time for the government to monitor and evaluate the effects of the policy, and correct the policy if needed.

Frick et al. (2018) estimate the effect of different factors on the economic growth of an individual SEZ in 22 emerging countries[4] across 346 zones from 2007 till 2012, including Russia. The authors use the nightlights as a proxy for economic growth outcome from the Defense Meteorological Satellite Program for the years 1992–2012 because of limited data availability. From the data analysis, the authors find that the average growth of SEZs in Russia is faster than the national growth for the years 2007–2012. However, the SEZ area grows slower than the surrounding area in Russia. The results of estimation using OLSs indicate a positive significant effect of SEZ size, distance to largest cities from SEZs, proximity to large markets, percent of SEZ industry in GDP of the country on SEZ growth. The authors find negative significant effects of SEZ years of operation, foreign ownership requirement on SEZ growth. And no significant effect of subsidised utilities in SEZs, national one-stop-shop, independence of zone regulator, and rule of law in SEZs on SEZ growth.

Studies of SEZs usually consider the direct and spillover effects of SEZs policy on domestic firms and domestic market of China, India, and Poland using different estimation methods and data (Abraham et al., 2010; Cieslik & Ryan, 2005; Cizkowicz et al., 2015; Ebenstein, 2012; Hyun & Ravi, 2018; Nazarczuk & Uminski, 2018; Pastusiak

et al., 2018; Y, 2019; Zhaoying, 2021). Various studies consider the overall economic development effects of SEZ policy implementation or different types of SEZs (Auruskeviciene et al., 2007; Baciuliene et al., 2021) instead of direct and spillover effects on domestic firms and market. However, the research findings could not be implemented to SEZ policy effects in Russia, because the environment is different. First, SEZs in Russia exist since 2005 and in China from 1978, in India from 2000. In China, the government could adjust the performance and effects from SEZs after the longtime experience. In India, SEZs arose from EPZs that had industrial clusters before SEZ policy implementation. In Russia, SEZ policy was implemented without industrial clusters, the zones were established from the scratch. Second, the research findings for productivity growth are mixed, depending on estimation strategy, the data, the infrastructure, institutions of countries, and the whole environment and business climate. Thus, Russian SEZs should be considered as separate case of SEZ effects. Also, to my knowledge, the effects of SEZs on the domestic market in Russia have not yet been studied. Only Frick et al. (2018) study the SEZ growth including Russia and find that the average growth of SEZs in Russia is faster than the national growth for the years 2007–2012, but the SEZ area grows slower than the surrounding area in Russia. In my research, I study the effects of creating SEZs on the revenue and productivity of the domestic market in Russia using the generalised Difference-in-Difference (DID) technique with panel data from 2006 to 2019.

3. Data

I use the panel data from 2006 to 2019, collected from the Federal State Statistics Service of Russia (FSSS), the Federal Tax Service of Russia (FTS), Russian Special Economic Zones website, and Spark Interfax. From the FSSS and FTS, I scrapped firms' individual tax numbers (INN) to collect firms' characteristics and accounting data from Spark Interfax. With the Russian SEZ website,[5] I obtained all information about SEZ participants, years of entering and exiting the SEZs. The data include time-varying SEZ treatment on firms, firms' characteristics (the region, the business activity), and accounting data. The primary outcome variables of interest are revenues and total factor productivity. The treatment group consist of firms that are located in SEZs and the control group consist of firms from the same industries as the treated firms but located outside SEZs in the same region and industry.

After collecting all the data for 2001–2019, it turns out that the data is highly unbalanced with many missing values. There were almost no data for the period 2001–2005 in the database; thus, this period was excluded from the studying. Also, I exclude Moscow (compared to region) as firms are different from this region compared to other regions. Moreover, Moscow has two SEZs with similar business activities of firms that could generate synergetic spillover effects in comparison with other regions. Additionally, I exclude regions with few firms or without firms (in these regions SEZs established recently and not enough time has passed for firms to appear in these SEZs) in the SEZs and firms with outcome variable data availability of fewer than 8 years. In the sample, I have 12 regions,[6] 177 business activities (each of the activity belongs to the particular code of Russian Classifier of Types of Economic Activity).

4. Empirical strategy

For the empirical strategy, I follow the approach of Granger (1969), Angrist and Pischke (2009) for estimating the SEZ policy effects, when treatment starts at a different time for firms. I use a generalised Difference-in-Difference approach including lags (time before treatment) and leads (time after treatment) in the model:

$$Y_{it} = \alpha_i + \lambda_t + v_j + \gamma_r + \sum_{\tau=0}^{m} \delta_{-\tau} D_{i,t-\tau} + \sum_{\tau=0}^{q} \delta_{+\tau} D_{i,t+\tau} + X_{it}'\beta + \in_{it}$$

Where: Y_{it} is an outcome variable (logarithm of earnings); α_i is firm fixed effects; λ_t is time-specific fixed effects; v_j is business activity fixed effects; γ_r is region-specific fixed effect; $D_{i,t}$ is a dummy variable for treatment (if firm enters the SEZ it will be unity and zero otherwise), at $\tau = 0$ switches to treatment; $\delta_0$is the contemporaneous treatment effect; δ_{-1} is the medium-term effect; $\delta_{+\tau}$ if treatment in the future affects Y, now-reverse causality from the future to the past. I include fixed effects to take into account non-time varying differences in infrastructure and institutions among regions, non-time varying differences in internal business processes among firms, also non-time varying differences in the structure of business activities and time-varying differences to $_{\text{include}}$ other characteristics.

Variation in the year and industry of SEZ policy implementation yields exogenous variation for identifying a causal effect. Specifically, in the same region and industry exist firms that are residents of SEZ (the area inside the region) and non-residents after SEZ policy implementation. However, a firm could decide to be a resident of SEZ not in the year of SEZ establishment but later. The residents of SEZ in Russia could be foreign investors or domestic.

In the next section, I discuss the estimation results of the linear regression model including leads and lags, fixed effects, and the controls. In all the specifications, I cluster standard errors on the level of multiplication region and business activity because of the studying design that treatment is also clustered on region and activity level. I include two controls in studying: labour and capital of firms because other possible controls have many missing values. Initially in the database, the labor variable was an interval for labor force, e.g. 0–5 meaning that the firm has from 0 to 5 workers. For a higher number of workers, the interval could be from 100 to 150. However, I do not have information about the precise number of workers in the firm, that is why I smooth the differences of the intervals with calculating the new variable of labor:

$$Labor_{it} = \frac{\log Min_{it} + \log Max_{it}}{2}$$

Where Min_{it} is a minimum of the labour interval and Max_{it} is a maximum of the interval.

For capital, I also use the logarithmic form to be consistent with the linear form of the Cobb-Douglas production function:

$$F(K, L) = AK^{\alpha}L^{1-\alpha}$$

Where: A is technology parameter; K stays for capital; L is labour and α is the parameter of the return to scale. The initial value of capital is presented in rubles and stays for 'equity

capital' in the firms' accounting forms. In the logarithmic form Cobb-Douglas production function has the formula:

$$\log F(K, L) = \log A + \alpha \log K + (1 - \alpha) \log L$$

To maintain the causal relation of SEZ treatment on firm earnings, I use the instrumental variable approach. I construct the instrument from the interaction of two variables: the SEZ industry share in the overall gross regional product in 2000 and the growth rate of the same industry on the country level. The multiplication of the instrument components gives the time-varying instrument variable. The data for the instrument variable was collected also from the Federal State Statistics Service of Russia. The SEZ location should be connected with agglomeration clusters or dominant industries in the regions as in the cases of SEZs in China and India. Also, the SEZ location should be connected with regions where the particular industry dominates on the country level and the growth rate of the particular industry. However, the instrument variable should not be connected directly with the outcome variable because firms have not got the direct impact of the industries on a country level or regional basis on the earnings. Thus, the relevance and exclusion restriction should hold. Moreover, instrument variable and outcome variable describe different periods: the instrument variable is based on the industry share of gross regional product in 2000 and outcome variable is based on 2006–2019 data. The time-varying part of the instrument connected with growth rate of the industries on the country level and outcome variable is for firm-level data. As a consequence, the exclusion restriction should hold.

5. Results

Table 1 presents the results of estimating the multi-way fixed effects model (without lags and leads). The outcome variable for all regressions, (1) - (6), is the logarithm of firm earnings. The explanatory variable for the regressions (1) - (3) is a dummy variable for SEZ treatment. The regressions (1) - (3) differ in the fixed effects ((1) is without fixed effects; (2) is with firm, year, and region fixed effects; (3) is with all fixed effects). The explanatory variable for the regressions (4) – (6) is the logarithm of labour and the logarithm of capital. The regressions (4) - (6) also differ in the fixed effects ((1) is without fixed effects; (2) is with firm, year, and region fixed effects; (3) is with all fixed effects). The regressions with fixed effects absorb effects that are not changing over time for firms, business activities and regions, as well as effects that change over time (time fixed effects).

The treatment coefficient indicates a positive significant effect of creating SEZs on firm revenues in the baseline specification (1) and the specification with fixed effects ((2), (3)). Moreover, the SEZ treatment coefficient stays positive and significant in the specifications with control variables ((7) – (9)). However, including the interaction variables of SEZ and logarithm of labour and SEZ and logarithm of capital decrease the significance of the coefficient but leave it positive. The labor coefficient is significant and negative in all the specifications where it is included ((4) – (12)). The sign of the coefficient could be connected with the form of marginal earnings for one unit of labor, where a firm could have enough labor and an additional unit of labor will decrease the earnings. Moreover, according to (Dced Report, 2021), growth of productivity could lead to a decrease in employment in the short run, as new technologies reduce labor requirement. The logarithm of capital is positive and significant in all specifications

Table 1. Multi-way fixed effects model.

PANEL A	(1)	(2)	(3)	(4)	(5)	(6)
SEZ	2.841***	0.632***	0.632***			
	(0.273)	(0.142)	(0.142)			
Logarithm of labor				−0.301***	−0.028***	−0.028***
				(0.017)	(0.006)	(0.006)
Logarithm of capital				0.661***	0.344***	0.344***
				(0.015)	(0.012)	(0.012)
constant	15.473***	15.487***	15.487***	6.697***	10.167***	10.167***
	(0.050)	(0.001)	(0.001)	(0.374)	(0.220)	(0.220)
Number of observations	101,122	101,100	101,100	77,949	77,758	77,758
PANEL B	(7)	(8)	(9)	(10)	(11)	(12)
SEZ	1.795***	0.462**	0.462**	1.069	2.737*	2.737*
	(0.151)	(0.170)	(0.170)	(1.362)	(1.174)	(1.176)
Logarithm of labor	−0.296***	−0.028***	−0.028***	−0.300***	−0.030***	−0.030***
	(0.017)	(0.006)	(0.006)	(0.017)	(0.006)	(0.006)
Logarithm of capital	0.660***	0.344***	0.344***	0.660***	0.347***	0.347***
	(0.015)	(0.012)	(0.012)	(0.015)	(0.012)	(0.012)
SEZ x Logarithm of labor				0.297***	0.143***	0.143***
				(0.044)	(0.031)	(0.031)
SEZ x Logarithm of capital				−0.059	−0.177**	−0.177**
				(0.071)	(0.063)	(0.063)
constant	6.667***	10.163***	10.163***	6.686***	10.135***	10.135***
	(0.375)	(0.220)	(0.220)	(0.378)	(0.219)	(0.219)
Number of observations	77,949	77,758	77,758	77,949	77,758	77,758
PANEL C	(13)	(14)	(15)			
SEZ	3.298***	0.806**	0.806**			
	(0.271)	(0.250)	(0.251)			
constant	9.599***	9.615***	9.615***			
	(0.050)	(0.002)	(0.002)			
Number of observations	101,122	101,100	101,100			
Lags	No	No	No	No	No	No
Leads	No	No	No	No	No	No
Firm fixed effects	No	Yes	Yes	No	Yes	Yes
Year fixed effects	No	Yes	Yes	No	Yes	Yes
Region fixed effects	No	Yes	Yes	No	Yes	Yes
Business activity fixed effects	No	No	Yes	No	No	Yes

Notes: Standard errors in parentheses: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard errors are clustered on the level of multiplication region and business activity. Dependent variable: logarithm of earnings ((1) – (12)); logarithm of earnings-to-capital ratio ((13) – (15)).

where it is included ((4) – (12)). The sign of the capital coefficient is expected because under constant return to scale, more input should lead to more output and more earnings. Table 1 Panel C presents the multi-way fixed effects model with labor factor productivity as an outcome variable, calculated as an earnings-to-capital ratio. The regressions (13) - (15) also differ in the fixed effects. The SEZ coefficient is significant and positive. Thus, the SEZ treatment leads to a growth of earnings per one unit of labor. However, the result contradicts previous results in Table 1, Panel A and B for the relation of labor productivity. The possible explanation of the result is the lack of control variables in this specification.

The results of positive TFP growth after SEZ policy implementation are shown in the papers by Abraham et al. (2010), Ito et al. (2010), Greenstone et al. (2010) in different countries which established SEZs. Thus, my research findings are consistent with previous studies of SEZs in other countries. Zeng (2016) mentions that the effects of the SEZ policy could depend on the time or conjecture of the market. A positive sign of SEZ policy

implementation in relation to the earnings of firms and productivity could indicate the favourable conjecture and environment for SEZ policy implementation, e.g. a strategic SEZ location, willingness to address environmental concerns in SEZs and government support.

Table 2 presents estimation results including one lead and one lag and Figure 1 illustrates graphically these estimation results. Figure 1 has confidence intervals and coefficients from Table 2 with one lag and one lead, control variables and fixed effects. The vertical bands represent ±1.96 times the standard error of each point estimate. On horizontal line with zero starts the SEZ treatment. On the left side, before the treatment, we see that the coefficient is indistinguishable from zero that is why the pre-trends assumption holds. The coefficient for SEZ dummy variable is robust because it is still significant and positive in all specifications ((1) – (6) of Table 2). The labour coefficient is negative and significant in the specifications where the control is included ((2) - (3), (5) –

Table 2. Multi-way fixed effects model with one lag and lead.

	(1)	(2)	(3)	(4)	(5)	(6)
SEZ	0.469***	0.452**	0.603***	0.469***	0.452**	0.603***
	(0.120)	(0.141)	(0.162)	(0.121)	(0.142)	(0.162)
Logarithm of labor		−0.053***	−0.032***		−0.053***	−0.032***
		(0.008)	(0.007)		(0.008)	(0.007)
Logarithm of capital			0.347***			0.347***
			(0.012)			(0.012)
Lag	Yes	Yes	Yes	Yes	Yes	Yes
Lead	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Business activity fixed effects	No	No	No	Yes	Yes	Yes
constant	15.451***	16.178***	10.057***	15.451***	16.178***	10.057***
	(0.001)	(0.056)	(0.220)	(0.001)	(0.056)	(0.221)
Number of observations	88,347	70,039	68,365	88,347	70,039	68,365

Notes: Standard errors in parentheses: * p < 0.05, ** p < 0.01, *** p < 0.001. Standard errors are clustered on the level of multiplication region and business activity. Dependent variable: logarithm of earnings.

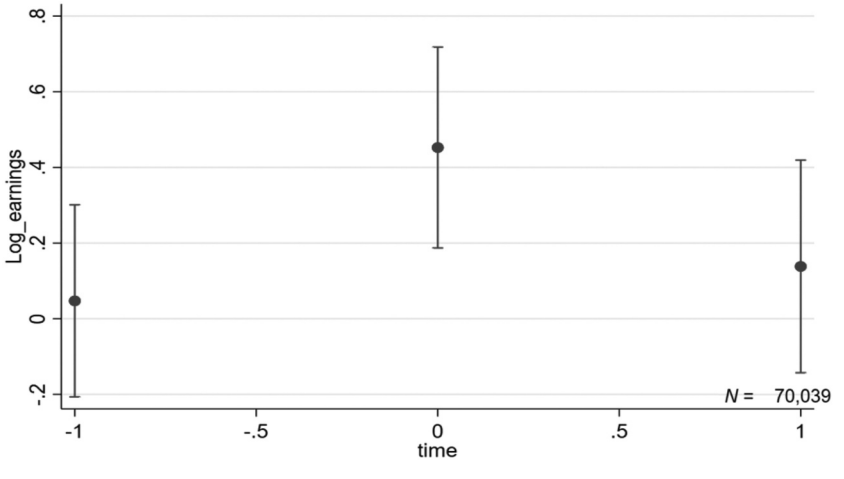

Figure 1. Time passage relative to the year of the SEZ treatment. Notes: on the graph grey points are the point estimates; lines below and above point estimates are 95% confidence interval.

(6)). As was mentioned before, the sign of the coefficient could be connected with the form of marginal earnings for one unit of labor, where a firm could have enough labor and an additional unit of labor will decrease the earnings. And coefficient for the capital is significant and positive in all the specifications of the model where the coefficient is included ((3), (6)), thus, the coefficient is robust.

Granger (1969) and Angrist and Pischke (2009) suggest including at least three periods in lags and leads in the standard generalised DID. Thus, Table 3 presents the same specifications as in Table 2 but including three leads and lags and Figure 2 presents graphically the results of Table 3. The results are robust to including 3 leads and lags: SEZ coefficient remains significant and positive in all specifications ((1) – (6)) of Table 3, the capital coefficient remains significant and positive in all specifications where the variable is included ((3), (6)). However, the labour

Table 3. Multi-way fixed effects model with three lags and lead.

	(1)	(2)	(3)	(4)	(5)	(6)
SEZ	0.775***	0.745***	0.906***	0.775***	0.745***	0.906***
	(0.234)	(0.218)	(0.252)	(0.234)	(0.219)	(0.253)
Logarithm of labour		−0.027***	−0.001		−0.027***	−0.001
		(0.007)	(0.009)		(0.007)	(0.009)
Logarithm of capital			0.490***			0.490***
			(0.015)			(0.015)
Lags	Yes	Yes	Yes	Yes	Yes	Yes
Leads	Yes	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Business activity fixed effects	No	No	No	Yes	Yes	Yes
constant	15.251***	15.793***	7.070***	15.251***	15.793***	7.070***
	(0.003)	(0.057)	(0.282)	(0.003)	(0.057)	(0.282)
Number of observations	59,826	45,087	44,662	59,826	45,087	44,662

Notes: Standard errors in parentheses: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard errors are clustered on the level of multiplication region and business activity. Dependent variable: logarithm of earnings.

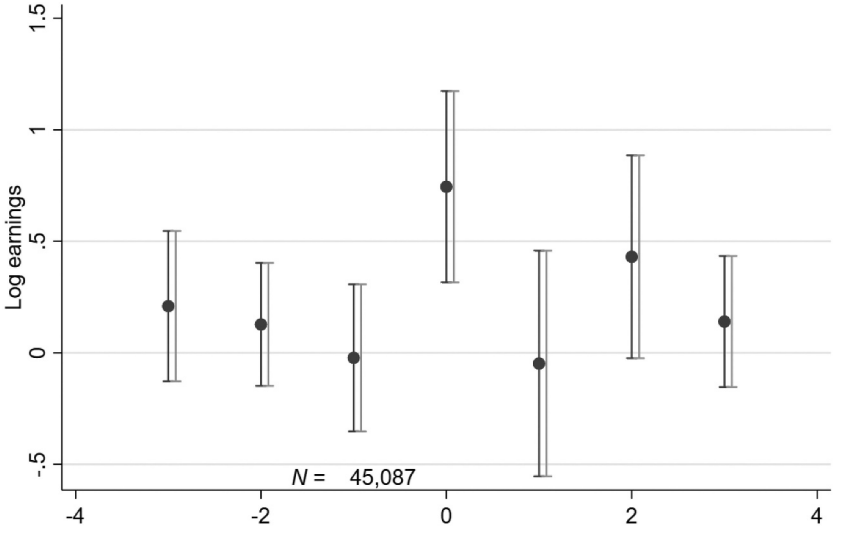

Figure 2. Time passage relative to the year of the SEZ treatment. Notes: on the graph grey points are the point estimates; lines below and above point estimates are 95% confidence interval.

coefficient lose significance in the specifications where all the control variables are included ((3), (6)). Thus, the robustness of the coefficient is not stable and further research and data should be done to detect the robust sign of the coefficient. On the left side of the graph from the treatment time zero in Figure 2, the coefficients are indistinguishable from zero that is why the pre-trends assumption holds.

As a robustness check, Tables A2 and Table A3. in the APPENDIX show the results of Cerulli (2010) method of DID in a dynamic treatment setting. Table A2 includes one lag and Table A3 includes 2 lags. These results measure the SEZ treatment effect for firms with a different start time of SEZ policy implementation or without treatment.[7] For the model with one lag (Table A2), the results for the first treatment group (SEZ coefficient) are robust because the coefficient is positive and significant and for the second treatment group (L1.SEZ – SEZ) are not robust; for the control group, the coefficient (L1.SEZ) is not significant and robust. For the model with two lags (Table A3), the results for the several treatment groups (SEZ; L2.SEZ – L1.SEZ + SEZ) are robust; for several other treatment groups, coefficients (L1.SEZ; L1.SEZ – SEZ; L2.SEZ – L1.SEZ; L2.SEZ – SEZ) are not robust; for the control group, the coefficient (L2.SEZ) is not significant and robust.

To maintain the causal relation of SEZ treatment on firm earnings, I use the instrumental variable approach. The results of reduced form and first stage estimation are presented in Table A1 of the APPENDIX. The results indicate that the decisions for SEZ location are not connected with dominant industries and their growth on region or country level. However, pre-existing industrialisation increase SEZ performance (Frick et al., 2018). Nevertheless, according to Frick et al. (2018), the SEZ location decisions could be done on the basis of different factors: proximity to the ports, large markets, or the main developed markets of the world, the access to the largest cities in the country, to the ports. Most of the SEZs in Russia are located near the biggest cities of the country, Moscow and Saint-Petersburg, and the main developed markets, in Europe and Asia.

SEZs in the south of the country are located near Lake Baikal and SEZs in the south-western part are located near the Black Sea and the Caspian Sea. Industrial zones are located mainly in the European part of the country. The logistic zone in Ulyanovsk Oblast, which was established in 2009, located near Volga River which is the longest river in Europe. Thus, instrument variables could be constructed based on the location with the new data.

6. Discussion

China implemented SEZ policy in 1978, African countries in the late 1990s, Poland in 1995, and India in 2000. In comparison with other countries (China, India, Poland, African countries, and other countries), for Russia SEZ policy is a recent reform and there is no previous experience similar to SEZs, e.g. in India EPZs were replaced by SEZs because of poor performance and low attraction of investors. A thorough literature review reveals mixed results of SEZ policy effects on productivity growth: positive (Abraham et al., 2010; Alder et al., 2016; Ito et al., 2010; Lu et al., 2019; Wang, 2013; Zhaoying, 2021) negative (Lin et al., 2009), and no effect (Lin et al., 2009). The SEZ policy effect on productivity growth and in general SEZ growth could depend on the quality of institutions and infrastructure, incentive packages for investors, proximity to the ports, large markets, or the main developed markets of the world, the access to the largest cities in the country, to the ports, the business climate of the country, government monitoring and evaluating

instruments of SEZ policy, and national one-stop-shops services (Brautigam et al., 2010; Frick et al., 2018; Zeng, 2016). Moreover, the initial number of SEZs could impact SEZ performance. According to Zeng (2016), Sab-Saharan African countries with 10 or 20 zones, in the beginning, received worse effects for the domestic economy in comparison with SEZs in China that had 4 zones at the beginning. Also, productivity growth after SEZ policy implementation could depend on the dominant effect: the first effect arises from higher productivity of foreign firms on the domestic market, when domestic firms could benefit from R&D spillovers from foreign firms and productivity growth; the second effect arises from higher competition after entry of foreign firms and revenues of domestic firms decrease.

The research findings of estimating SEZ effects on productivity growth in China, India, Poland could not be implemented to the Russian case because of several reasons: different types of SEZs (e.g. with different SEZ ownership); different outcome variables (FDI, export, wage); the other conjecture of the market or SEZs (e.g. in India Export Processing Zones were replaced by SEZs because of poor performance and in Poland SEZs were established in regions with serious economic problems); SEZ experience is longer (e.g. in China SEZs were established in 1978); different initiative parties of SEZ policy implementation (e.g. in India could be initiated by the general public in comparison with Russia, where government establish SEZs); the privileges for investors are different (e.g. in India tax exemption for residents lasts 5 years and in Russia from 5 to 15 years, depending on particular SEZ and business activity).

Further analysis of the SEZ effects on the domestic market in Russia could consider the spatial proximity of firms to SEZs because the SEZ neighbouring regions could benefit more from technological spillovers in the same industry. Moreover, the productivity changes after SEZ policy implementation could be studied in formal and informal sectors separately in Russia, because the marginal firm in the informal sector is smaller than in the formal sector (Paula & Scheinkman, 2010). Additionally, the quality of institutions, infrastructure, business climate for the potential investors in SEZs have not been studied yet. Thus, the government could monitor these factors to increase SEZ performance and productivity growth. However, the research could be done with more data on Russian firms.

7. Conclusion

The Russian government started to create Special Economic Zones (SEZs) to attract foreign investors with tax privileges in 2005. Foreign investors can have a significant impact on the productivity of domestic firms, revenues, and their market share through the implementation of new technologies and the creation of new firms.

However, to my knowledge, the effects of SEZs on the domestic market in Russia are largely understudied. In my research, I study the effects of creating SEZs on productivity and revenue growth in Russia using the generalised Difference-in-Difference (DID) technique. I use the panel data from 2006 to 2019, collected from the Federal State Statistics Service of Russia, the Federal Tax Service of Russia, the Russian Special Economic Zones website, and Spark Interfax. The data includes time-varying SEZ treatment on firms, firms' characteristics, and accounting data. The primary outcome variables of interest are revenues and total factor productivity. In the sample, I have 12 regions affected by SEZ policy and 177 business activities treated by SEZ policy. The variation in time and SEZs of

the policy implementation and firms' decisions to enter SEZs give the possibility for estimating the causal effects after SEZ policy implementation.

The results of the paper indicate a positive and significant effect of SEZ policy on firm revenues. All the coefficients are robust to different specification including one or three leads and lags. The labour coefficient is significant and negative that could be in the situation when a firm could have enough labor and additional unit of labor will decrease the earnings. The capital coefficient is positive and significant in all specifications because more input should lead to more output and more earnings. The paper shows positive effect of SEZ policy implementation on firm revenues and capital productivity and the opposite effect for labor. The research findings could contribute to the urban economic literature on place-based policies and can be helpful to policymakers in Russia and other countries.

Notes

1. Russian Special Economic Zones. http://eng.russez.ru/ (accessed December 1, 2020).
2. Polish Investment and Trade Agency. https://www.paih.gov.pl/why_poland/investment_incentives/sez (accessed December 1, 2020).
3. Special Economic Zones in India. http://www.sezindia.nic.in/ (accessed December 1, 2020).
4. China, Philippines, Malaysia, South Korea, Thailand, Vietnam, Turkey, Russia, Ghana, Jordan, Kenya, Lesotho, Nigeria, South Africa, Argentina, Chile, Colombia, Dominican Republic, Honduras, Bangladesh, India, and Pakistan.
5. Russian Special Economic Zones. http://eng.russez.ru/ (accessed December 1, 2020).
6. The Republic of Buryatia, the Republic of Tatarstan, Altai Krai, the Irkutsk Region, the Lipetsk Region, the Moscow Region, the Pskov Region, the Samara Region, the Sverdlovsk Region, the Tomsk Region, the Ulyanovsk Region, Saint-Petersburg (comparable to region).
7. If I define SEZ coefficient as α_1, SEZ coefficient with one lag as α_2, SEZ coefficient with two lags as α_3, for the model with one lag (Table 5) the DID coefficient would be α_1 for firms that had treatment in $(t-1)$ but had no treatment in $(t-2)$ and t; $(\alpha_2-\alpha_1)$ for firms that had treatment in t but had no treatment in $(t-1)$ and $(t-2)$; α_2 for firms that had no treatment in t, $(t-1)$, and $(t-2)$. For the model with two lags (Table 6) the DID coefficient would be α_1 for firms with treatment in $(t-1)$, $(t-2)$ and no treatment in t; α_2 for firms with treatment in $(t-2)$ and no treatment in t, $(t-1)$; $(\alpha_3-\alpha_2+\alpha_1)$ $_{\text{for}}$ firms with treatment in $(t-1)$ and no treatment in t, $(t-2)$; α_3 for firms no treatment in t, $(t-1)$, $(t-2)$; $(\alpha_2-\alpha_1)$ for firms with treatment in t, $(t-2)$ and no treatment in $(t-1)$; $(\alpha_3-\alpha_2)$ for firms with treatment in t, $(t-1)$ and no treatment in $(t-2)$; $(\alpha_3-\alpha_1)$ for firms with treatment in t and no treatment in $(t-1)$, $(t-2)$.

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APPENDIX

Table A1. Linear regression with instrument variable.

REDUCED FORM	(1)	(2)	(3)	(4)	(5)	(6)
Instrument	−0.002***	−0.002***	−0.003***	−0.002***	−0.002***	−0.003***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Logarithm of labour		−0.045***	−0.026***		−0.045***	−0.026***
		(0.007)	(0.006)		(0.007)	(0.006)
Logarithm of capital			0.346***			0.356***
			(0.012)			(0.012)
constant	16.568***	17.350***	11.473***	16.568***	17.350***	11.473***
	(0.134)	(0.138)	(0.249)	(0.134)	(0.138)	(0.249)
Number of observations	101,100	79,994	77,758	101,100	79,994	77,758
FIRST STAGE	(7)	(8)	(10)	(11)	(12)	(13)
Instrument	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Logarithm of labour		−0.001***	−0.000*		−0.001***	−0.000*
		(0.000)	(0.000)		(0.000)	(0.000)
Logarithm of capital			0.000			0.000
			(0.000)			(0.000)
constant	−0.002	0.008	0.004	−0.002	0.008	0.004
	(0.004)	(0.005)	(0.008)	(0.004)	(0.005)	(0.008)
Number of observations	145,591	114,053	86,742	145,591	114,053	86,742
Lags	No	No	No	No	No	No
Leads	No	No	No	No	No	No
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Business activity fixed effects	No	No	No	Yes	Yes	Yes

Notes: Standard errors in parentheses: * p < 0.05, ** p < 0.01, *** p < 0.001. Standard errors are clustered on the level of multiplication region and business activity. Dependent variable: logarithm of earnings.

Table A2. Multi-way fixed effects model with one lag.

	(1)	(2)	(3)	(4)	(5)	(6)
SEZ	0.574***	0.510***	0.553***	0.574***	0.510***	0.553***
	(0.137)	(0.142)	(0.164)	(0.137)	(0.142)	(0.164)
L1. SEZ	0.133	0.077	−0.095	0.133	0.077	−0.095
	(0.138)	(0.141)	(0.0156)	(0.138)	(0.141)	(0.156)
Logarithm of labour		−0.056***	−0.036***		−0.056***	−0.036***
		(0.007)	(0.007)		(0.007)	(0.007)
Logarithm of capital			0.328***			0.328***
			(0.012)			(0.012)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Business activity fixed effects	No	No	No	Yes	Yes	Yes
constant	15.547***	16.303***	10.551***	15.547***	16.303***	10.551***
	(0.001)	(0.054)	(0.224)	(0.001)	(0.054)	(0.225)
Number of observations	96,221	76,848	74,609	96,221	76,848	74,609

Notes: Standard errors in parentheses: * p < 0.05, ** p < 0.01, *** p < 0.001. Standard errors are clustered on the level of multiplication region and business activity. Dependent variable: logarithm of earnings.

Table A3. Multi-way fixed effects model with two lags.

	(1)	(2)	(3)	(4)	(5)	(6)
SEZ	0.539***	0.493***	0.512**	0.539***	0.493***	0.512**
	(0.130)	(0.143)	(0.158)	(0.130)	(0.144)	(0.158)
L1. SEZ	0.125	0.101	0.063	0.125	0.101	0.063
	(0.152)	(0.149)	(0.159)	(0.152)	(0.149)	(0.159)
L2. SEZ	0.170	0.105	−0.030	0.170	0.105	−0.030
	(0.140)	(0.119)	(0.132)	(0.141)	(0.120)	(0.132)
Logarithm of labour		−0.052***	−0.035***		−0.052***	−0.035***
		(0.007)	(0.007)		(0.007)	(0.007)
Logarithm of capital			0.297***			0.297***
			(0.013)			(0.013)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Region fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Business activity fixed effects	No	No	No	Yes	Yes	Yes
constant	15.602***	16.334***	11.137***	15.602***	16.334***	11.137***
	(0.001)	(0.054)	(0.233)	(0.001)	(0.054)	(0.233)
Number of observations	90,747	72,021	69,774	90,747	72,021	69,774

Notes: Standard errors in parentheses: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Standard errors are clustered on the level of multiplication region and business activity. Dependent variable: logarithm of earnings.