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Do operations in SEZs improve a firm's productivity? Evidence from Poland

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Abstract

Special economic zones (SEZs) play a significant role in global, national and regional trade flows. Given the insufficient number of empirical contributions regarding firm-level consequences of operation in SEZs, an analysis in which implications for firms' standings is undertaken. With the use of different estimation approaches, applied to a unique dataset comprising 155 SEZs firms and 155 non-SEZs firms (matched sample) obtained from various sources, the author investigates if SEZs firms obtain a competitive advantage through higher productivity compared to non-SEZs firms. The results prove that SEZ firms differ in this regard. However, the sign of its contribution is conditioned by the type of productivity analysed.

Keywords: Special economic zones; SEZ; polish economy; productivity differentials; firm heterogeneity.

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1. Introduction

Special economic zones (SEZs) have a long-term and well-established position as regards global foreign trade. Cities, for example, Gibraltar, Hamburg and Singapore, have continued their successful existence through the ages by granting similar privileges to those now offered by some SEZs (including, the possibility of duty-free exports and imports). On the other hand, the first modern industrial zone was established in 1959 in Shannon, Ireland.

Originally, SEZs existed mainly in industrialised countries. However, as early as the 1970s, zones emerged also in East Asia and Latin America, which were supposed to stimulate the influx of foreign capital into highly labour-intensive sectors (Farole & Akinci, 2011). Soon, these preferred areas became the foundation of the trade and investment policy followed by countries shifting from an import-oriented trade policy to an export-oriented one, based on deeper integration with global markets.

Since the 1980s, we have observed both an increase in the number of SEZs (and similar preferred areas, i.e., duty-free areas, special industrial and export zones) and an increase in their size (Lang, 2010), which reflects their growing impact on the global economy and individual national economies. Despite the lack of adequate statistical data, attempts made to estimate the number of zones indicate the dynamic growth observed, mainly over the past two decades. For example, in 1975, 1986 (Aggarwal, 2012), 1995 and 2006 (Boyenge, 2007), there were 79,176, 500 and at least 300 SEZs, respectively. The number of countries that introduced privileges for investors was growing at an almost equally high pace, i.e., it increased from 29 in 1975 to 130 in 2006. In addition, employment was estimated in 1997 at 22.5 million staff, which increased to 66 million in 2006 (Milberg & Amengual, 2008). On the other hand, the value of estimated annual exports generated in the zones worldwide totaled USD 851 billion (FIAS, 2008). In 2015, the number of SEZs exceeded 4,300, while the number of countries in which such zones operate was 73.

The available analyses refer to operations of preferred areas, including SEZs, on selected markets, amongst others, in terms of support for entrepreneurship, concentration of economic activity within clusters (Zeng, 2011), economic growth (Litwack & Qian, 1998; Schrank, 2001; Zeng, 2010), acceleration of transformation processes (Ahrens & Meyer-Baudeck, 1995; Ge, 1999; Zeng, 2011), promotion of industrialisation in developing countries (Chaudhuri & Yabuuchi, 2010), inflow of investments (Cheng & Kwan, 2000), increase of employment (Curtis, Hill & Lin, 2006; Madani, 1999), development of export-oriented activities (Farole, 2011; Farole & Akinci, 2011; Johansson & Nilsson, 1997; Nazarczuk & Umiński, 2018b), support for economic openness (Baissac, 2011; Ge, 1999) and impact on local economies (Nazarczuk, 2013; Nazarczuk & Umiński, 2018a; Wang, 2013).

Meanwhile, the literature pertaining to the issue of SEZs operations has increasingly discussed the future of various preferred areas (mainly in developing countries) (Aggarwal, 2012; Engman, Onodera & Pinali, 2007; FIAS, 2008), including amongst others, SEZs. Such zones are criticised due to the high costs of attracting investments (in particular, foreign investment), non-permanent location of enterprises given that tax exemptions offered are limited in terms of time and economic discrimination of the surrounding areas (Porter, 1996). Most of the applicable tax exemptions benefit entities which would commence operations there without any tax incentives and the usefulness of those preferred zones is limited (Madani, 1999). Their operations are sensitive to the domestic, economic policy followed, institutional conditions (FIAS, 2008) and investment climate and, therefore, the zones do not bring the intended results in all countries (Aggarwal, 2012; Nel & Rogerson, 2013). Additionally, given the existence of different types of preferred areas globally (e.g., export processing zones, free zones, free trade zones, industrial parks, free ports, urban enterprise zones) as well as the various internal and external conditions of individual countries, it is hard to transfer tested solutions directly to other markets.

The available analyses are usually based on data collected with regard to the national economy or, less frequently, regions. There are an insufficient number of analyses covering individual companies availing of public aid in SEZs, which would allow us to understand factors actually determining the operations of the zones, identify the actual effectiveness of that instrument as well as to better recognise the microeconomic

effects of SEZs-led programmes by firms. To sum up, the literature lacks a sufficient number of studies addressing the influence of SEZs in terms of their microeconomic effects on firms.

Therefore, the aim of the article is to depict one of the aspects related to SEZs: their effects on a firm's productivity. With the use of data on financial standings, coupled with registry information and survey analysis, the author examines to what extent the SEZ-granted privilege affects a firm's productivity. The results shed new light on the real effects of firms' zonal operations, with particular attention placed on the possible comparative advantage that firms gain in contrast to non-SEZs firms. To depict productivity differentials among SEZs and non-SEZs firms, a probability density function is estimated separately for different kinds of productivity. In the last section, having gathered information on 155 firms in SEZs and compared with 155 non-SEZs firms (picked as a matched sample), and using different estimation approaches, the sole effect of firms operating in such zones is comprehensively investigated.

2. Some Stylised Facts on SEZs Versus non-SEZs Firm Productivity

The estimation of the probability density function (Epanechnikov, 1969) has been applied to visualise the distributions of selected productivity indexes among two groups of firms (operating in SEZs and outside SEZs). The choice of the Epanechnikov kernel density function was based on the desirable properties of this function, namely the minimisation of mean integrated squared error as well as smooth densities being the outcome.

The series of comparisons between SEZs and non-SEZs firms give an unambiguous view of the functioning of SEZs in Poland. According to the available data, SEZs firms (in most cases) differed substantially in terms of their productivity, compared to non-SEZs firms, having similar structural characteristics. The comparisons of distributions of kernel density functions among two groups of firms enable the examination of distribution patterns of selected productivity variables, i.e., the mean value and dispersion from the mean (Figure 1).

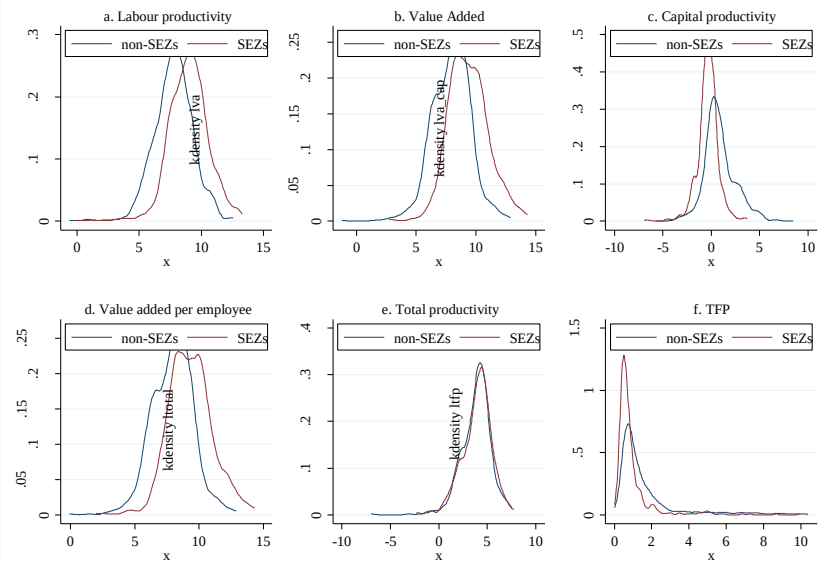

Figure 1. Kernel densities of different forms of productivity between SEZs and non-SEZs firms in the pooled dataset
Source: Own compilation.

In general, SEZs firms had higher labour productivity, value added and value added per employee. The total productivity was quite similar in the two groups of firms and TFP (to some extent) as well, but SEZs firms had substantially lower capital productivity. The most significant positive differences

were noticeable in the case of labour productivity (proxied as the net incomes from sales per employee), value added and value added per employee. These can shed light on the strategies firms operating in SEZs adopt, stemming from the intense utilisation of labour inputs.

On the other hand, lower capital productivity may be the effect of a size of firms operating in SEZs have (approx. their fixed assets were six times bigger as in the non-SEZ firms), i.e., from the automotive, chemical or industrial processing sectors. The uneven distribution of productivity differential deserves therefore more in-depth analysis.

3. The Dataset and Estimation Approach

The data used in the study were obtained from different sources (registry information, financial standings and survey data) and merged together in one consistent dataset. The necessity of such a hybrid approach to data acquisition stemmed from difficulties in obtaining firm-level information in Poland, especially for small and medium enterprises. The 155 firms were randomly picked among 1,274 operating in 2014 in SEZs in Poland (as a proportional sample according to the structure of the whole population in relation to a firm's size, branch of economic activity, presence of foreign capital and export behaviour), to which a proportional sample of 155 companies was randomly selected (in accordance with the structure of the SEZs sample: economic activity, size, presence of foreign capital) from a large InfoCredit database amounting to more than 125k firms.

Following the work undertaken by Petrin, Poi and Levinsohn (2004), the total factor productivity is calculated with the method of Levinsohn-Petrin and presented in logs. The frequent missing data on the number of employees in firms have seriously limited the ability to calculate the labour productivity for the majority of the companies in all of the years of the study. However, to comprehensively examine the issue, different forms of productivity are investigated (labour, capital, value added, value added per employee, capital productivity and total productivity). Labour productivity is calculated as the net income from sales divided by the number of employees. Capital productivity is the outcome of value added per fixed assets, while total productivity was obtained as a geometric mean between the value added per employee and the value added per fixed assets. All of the level variables were log transformed.

The descriptive statistics are presented in Table 1. One can notice data that are missing for the majority of the available variables, related especially to the log of: total productivity, TFP, value added, capital productivity, value added per employee and labour productivity. The time span covers the years from 2007 to 2014, though in the last year of the study, missing data are more frequent.

Table 1. Descriptive statistics

Variable	Description	Observations	Mean	SD.	Min	Max
id	Firm id	2,480	3.738735	3.345024	2782	858051
year	Year of the study	2,480	10.5	2.29175	7	14
SEZ	SEZ dummy	2,480	0.4354839	0.4959202	0	1
llab_prod	Log of labour productivity	2,293	8.289417	1.703223	-0.6143163	13.29233
exp	Exporter dummy	2,480	0.5879032	0.4923116	0	1
imp	Importer dummy	2,480	0.6048387	0.4889839	0	1
lwnp	Log of intangible assets	2,480	0.1788636	4.765468	-4.60517	12.32119
lva	Log of value added	1,774	8.506031	1.786834	-1.206777	14.30714
lva_cap	Log of capital productivity	1,764	0.3946204	1.564482	-6.883164	8.478601
lva_emp	Log of value added per employee	1,759	8.494804	1.774846	-0.0681932	14.31165
ltfp	Log of Total Factor Productivity	1,730	1.323127	1.510917	0.0065029	10.39387
ltotal	Log of total productivity	1,588	2.543781	1.061969	-3.320645	6.74564
lage	Log of firm's age	2,480	2.693138	0.5380491	1.386294	4.770685

Source: own compilation.

In order to evaluate the role of SEZs on a firm's productivity, a series of regressions is estimated with the following general form:

$$lndep_{it} = \beta_1 lndep_{it\text{-}1} + \beta' X_{it} + \lambda_i + u_t + \varepsilon_{it} \quad (1)$$

where $Indep_{it}$ is one of the productivity dependent variables (in log): labour productivity, value added, value added per employee, value added per fixed assets, TFP, (the total productivity is excluded from the further analysis due to similar distributions among SEZs and non-SEZs firms and the fact it is the geometric mean of the other productivity variables)

$Indep_{it-1}$ is the lagged dependent variable (in logs),

X_{it} is a matrix of j explanatory variables for i firm in year t.

λ_i – non-observed firm-specific effect,

u_t – non-observed time-specific effect,

ε_{it} – error term.

Since the data for financial standings are available for 2007–2014 (with some missing data), the author uses a two-step dynamic panel approach to obtain consistent results – namely the Arellano–Bond estimator. This estimator was designed for a large number of panels with a few data periods (Arellano & Bond, 1991), as is the case in this study. It can handle lagged dependent variables as repressors, which are correlated to the unobserved panel-level effects, which makes standard estimators inconsistent. Since the two-step GMM generates more efficient estimates than a one-step procedure, in this paper a two-step approach is preferred. The standard error bias is corrected according to the Windmeijer (2005) correction approach.

However, in the Arellano–Bond approach it is necessary to first difference the variables, which eliminates the firm-specific effect and the cross-firm information in levels. The first differences GMM estimators are also likely to perform poorly when the timespan is short and time series are persistent (Blundell & Bond, 1998). This is mainly due to the fact that the lagged levels of the variables provide only poor instruments for the first-order differential equations.

Therefore, in contrast to first differences GMM, the system GMM estimator (Arellano–Bover/Blundell–Bond) (Arellano & Bover, 1995; Blundell & Bond, 1998), implemented in STATA is also used and compared. This estimator, which is based on orthogonality conditions and level equations, uses moment conditions. It does not need any exogenous instruments to cope with the endogeneity issue, relying on the increments of the dependent variables as well as the lagged values as instruments. Similar to the differenced GMM approach, the two-step estimator is also used in this case.

4. The Effect of SEZs on a Firm's Productivity

In Table 2, the estimation results are provided for different productivity-related variables with two estimation techniques. Starting from column 1 to 5 a differenced GMM two-step estimator is used to evaluate the differences among SEZs and non-SEZs firms. The results with the application of the two-step system GMM estimator are presented in columns 6–10.

The role of SEZs in determining levels of productivity was found statistically significant in the case of three of five productivity-related dependent variables, indicating significant disparities among SEZs and non-SEZs firms in this regard. A positive sign was found in the case of labour productivity, while a negative sign was found in the event of capital productivity. In the remaining cases, SEZs proved to have insignificant effect on productivity.

Table 2. Estimation results between SEZs and non-SEZs firms in terms of productivity

Variables	(1) llab_prod	(2) lva	(3) lva_cap	(4) lva_emp	(5) ltfp	(6) llab_prod	(7) lva	(8) lva_cap	(9) lva_emp	(10) ltfp
	Difference GMM					System GMM				
SEZ	0.317***	0.189	−0.542**	0.296	−0.324	0.229**	0.0482	−0.413**	0.00788	−0.382
	(0.113)	(0.131)	(0.224)	(0.201)	(0.204)	(0.109)	(0.124)	(0.196)	(0.205)	(0.246)
exp	0.108	−0.0234	−0.0308	−0.0882	0.0111	0.111	−0.0132	−0.0243	−0.0964	−0.0173
	(0.0753)	(0.108)	(0.124)	(0.122)	(0.0680)	(0.0755)	(0.118)	(0.126)	(0.127)	(0.0623)
imp	0.181***	0.106	0.106	0.103	0.0442	0.167***	0.128	0.121	0.0844	0.0367
	(0.0634)	(0.0760)	(0.0740)	(0.0800)	(0.0495)	(0.0624)	(0.0929)	(0.0832)	(0.109)	(0.0485)
lwnp	0.0185***	0.0120	0.00559	0.00942	0.00248	0.0200***	0.0121	0.0113	0.0128	0.00393
	(0.00573)	(0.00753)	(0.00963)	(0.00822)	(0.00646)	(0.00545)	(0.00830)	(0.0105)	(0.00940)	(0.00604)
L.llab_prod	0.581***					0.765***				
	(0.0678)					(0.0660)				
L.lva		0.488***					0.754***			
		(0.111)					(0.0894)			
L.lva_cap			0.460***					0.550***		
			(0.0781)					(0.0918)		
L.lva_emp				0.486***					0.918***	
				(0.123)					(0.0640)	
L.ltfp					0.453***					0.326**
					(0.131)					(0.141)
lage						0.731***	0.909**	0.240**	0.213	0.612***
						(0.234)	(0.353)	(0.0999)	(0.224)	(0.137)
Observations	1,644	1,241	1,227	1,224	1,208	1,962	1,498	1,486	1,480	1,459
Number of id	306	242	241	241	239	307	243	243	243	240
No. of instruments	25	25	25	25	25	31	31	31	31	31
Wald Chi2	149.3	55.85	38.72	32.52	15.43	18103	4184	60.98	4494	39.98
AR(1)	−3.666	−3.547	−4.590	−3.250	−1.842	−3.984	−4.295	−4.543	−4.389	−1.736
p-val AR(1)	0.000246	0.000390	4.42e-06	0.00115	0.0655	6.77e-05	1.75e-05	5.53e-06	1.14e-05	0.0826
AR(2)	−0.409	1.084	0.584	1.122	0.123	−0.393	1.200	0.704	0.941	−0.104
p-val AR(2)	0.683	0.278	0.559	0.262	0.902	0.694	0.230	0.481	0.347	0.917

Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. *L* stands for a lagged by one period variable.

Despite the different techniques used, the results in the case of the role of SEZs contributing to labour productivity and capital productivity. Firms in SEZs compared to non-SEZs had lower capital productivity and higher labour productivity. The roles of the remaining factors were contingent on the case of the dependent variable being analysed. This suggests also the positive role of intangible assets, age and foreign trade activity on productivity.

5.Conclusion

The increasing number and role of SEZs around the world has recently attracted great interest. Given the lack of evidence on the firm-level effects of zonal operation, the author tried to fill the existing gap in the literature by analysing one of the aspects of the potential effects of privileged areas on firm-level behaviour and strategies.

The aim of this paper was to depict the differences among SEZs and non-SEZs firms with respect to their productivity and used data available for 310 firms in Poland. Using the differenced GMM and system GMM approach, the author evaluated the potential role of SEZs on the operations of firms and the implications stemming from the strategies adopted by such firms. The comparison of two groups of firms has revealed significant differences in the level and type of productivity analysed. SEZs have facilitated a more intense use of labour input, and therefore anticipated higher labour-related productivity ratios (especially with respect to the net incomes from sales per employee). In contrast, SEZs had lower capital productivity.

The findings provide some insights on the behaviour of SEZs firms in contrast to non-SEZs. SEZs firms tend to choose their location within zones with the intention to more intensively use labour resources, which clearly shows the strategy that firms starting a business in SEZs adopt. These are mainly multinationals, seeking cheap access to labour, as one of the main inputs being utilised. Since the size of SEZ entities is bigger (measured by fixed assets) compared to non-SEZ firms, one may anticipate a lower productivity per value added. The second possible solution indicates the relatively low value added activity carried out in SEZs (like in an assembly shop where relatively costly parts are mounted together). The argument presented here is frequently deliberated as a debating point for the importance of the quality of capital that inflows to SEZs, which should be more innovative.

One should also bear in mind that the outcomes presented in the paper are based on the sample of the whole population of SEZs firms in Poland. The control group was also picked randomly from a bigger dataset of entities operating in the whole national economy with a sound statistical procedure utilised. However, access to a balanced (and more numerous) dataset could result in more robust findings, as well as enable more in-depth analysis of the potential SEZs' impact on firm productivity (including causality and its direction).

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