ESPON

EUROPEAN UNION

Co-financed by the European Regional Development Fund

Inspire Policy Making with Territorial Evidence

POLICY BRIEF //

European Special Economic Zones

Research spin-off project of “The World in Europe: Global FDI flows towards Europe (ESPON FDI)”

Appendix // November 2020

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Abbreviations

ARCA	Additive index of revealed comparative advantage
EFTA	European Free Trade Association
EGTC	European Grouping on Territorial Cooperation
ESPON	European Spatial Planning Observation Network
EU	European Union
Ha	Hectares
FDI	Foreign direct investment
FEZ	Free economic zone
FTZ	Free trade zone
GDP	Gross domestic product
GVFA	Gross value of fixed asset
IIFZ	Integrated industrial free zone
NRCA	Normalised index of revealed competitive advantage
NUTS	Nomenclature of territorial units for statistics
PAIH	Polish Investment & Trade Agency
PZM	Private zone management
R&D	Research and development
RCA	Revealed comparative advantage
SDM	Spatial Durbin model
SEZ	Special economic zone
TDI	Territory development index
VAT	Value added tax
ZEC	Canary Islands Special Zone

1 Appendix A: Methodology for choosing and conducting SEZ case studies

We broadly categorize special economic zones (SEZs) into two different types: **free trade zones (FTZs)** and **integrated industrial free zones (IIFZs)**. These definitions are based on the UNCTAD's World investment report 2019.

FTZs are defined as separate areas considered as different customs territories than the rest of the country. The main benefits from operating in these zones are suspension and/or exemption of customs duties, other import duties and VAT. Exemption from duties in the EU only applies to the import of non-Union goods that are re-exported outside of the EU. Imported goods subsequently released for free circulation within the EU are still subject to import duty and other charges. In many cases, FTZs also offer warehousing and logistic services as well as trade-facilitating services related to trans-shipping and re-exporting.

IIFZs are separate areas aimed at industrial and/or regional development in which also non-trade related fiscal incentives are offered. Incentives are typically more far-reaching in IIFZs than in FTZs as they also cover publicly financed incentives, e.g. tax credits. Under EU state aid rules, such incentives can, for instance, be allowed to promote regional development in the so-called economically deprived or assisted areas.

In addition to the special economic zones, some countries have established so-called **industrial- and science parks**. These are not included in this overview because they generally do not offer special fiscal incentives. Instead, they typically aim to attract firms with the prospect of benefiting from cluster effects.

The Hungarian Free Economic Zones (FEZs) are considered IIFZ-type SEZs, which is why IIFZs are the main interest in this study in order to provide quality case studies that the Hungarian Government can use in their revision.

There are two sections to Appendix A, following our methods for the two tasks in the Terms of Reference:

- Task 1: Collecting information on European SEZs and selection of case studies
- Task 2: Analyses of the selected case studies

1.1 Collecting information on European SEZs and selection of case studies

In task 1, we collected as much public information as possible on European SEZs in EU and EFTA countries. We collected the information in a Microsoft Excel file in a structured table. The file provides a (non-exhaustive) overview of special economic zones (SEZs) established within the EU and EFTA. This Excel file is attached to the deliverable of the report & these appendices.

The SEZs in the list were identified through a research of relevant literature and other publications. The list of zones reported to the European Commission by the Member States served as a natural starting point for this exercise. We then gathered information on the relevant SEZs from their respective webpages, academic articles and/or governmental documents to fill out information in the list. If the respective information was not available, this is marked with "n/a".

We gathered information on the objectives (raison d'être) of the SEZs, the governance structure of the SEZs, the sizes and locations, results (employment, investments attracted etc), as well as general information about the country's SEZs or the individual SEZ. A central element of this table is the available incentives in the SEZ, which we split on

1. financial demand incentives, for example tax rebates
2. supply incentives, for example assistance in delivering supply of labour, qualified labour, utilities, training, etc.

In addition to this list, we collected publicly available literature on economic impact assessments of the European and other SEZs. We also collected more reports and academic papers assessing the economic impacts of SEZs in general.

Based on the collection of information related to SEZs, we selected four potential case study candidates: the Lithuanian FEZs, the Canaries Island SEZ, the Polish SEZs, and the Southern Italian SEZs. This selection of SEZs were either relatively similar to the Hungarian FEZs, or had impact assessments or ex-ante impact analyses made for their SEZ. In addition, we suggested four additional cases (the Latvian SEZs, the Madeiran SEZ, the Bulgarian case, and the now terminated Irish SEZ). Based on a discussion with the Hungarian Government and ESPON EGTC, we decided on a final selection of case studies to analyse in task 2:

1. The Latvian Special Economic Zones
2. The Lithuanian Free Economic Zones
3. The Polish Special Economic Zones
4. Other cases of SEZ impact assessments in other countries

The first three case studies are country specific, whereas the last covers impact studies in other European countries.

1.2 Analyses of the selected case studies

In task 2, the case studies were each examined in three parts.

1. Firstly, we examined the different aspects of the SEZs in terms of history, objectives, governance structure, role of the state and incentives applied, as well as general information on the SEZ. These aspects were examined both from a national perspective and for potential differences between the individual SEZs within the country.
2. Secondly, we went through the economic impact assessments found in the literature to provide inputs to the evaluation of the SEZs.
3. Thirdly, we compared the situation to the Hungarian case, both in terms of the SEZ setup and in relation to the results found in the impact assessments in the literature, and whether these can be transferred to the Hungarian case.

For the analysis of step 1 and step 2, we used the information gathered in task 1. Furthermore, we searched for additional information in both English and local language, and we contacted the SEZs, FEZs, relevant ministries, and some academic institutions to gain further inputs on the SEZs including any impact assessment we may have missed in our literature search etc. This led to approximately 15 responses and talks, of which several provided useful inputs to the analysis.

When relating the impact assessments in the case studies to the Hungarian case, it is not feasible to directly replicate the results to a Hungarian setting due to different confounding situations in the case study countries and in Hungary. Nevertheless, the results give us some indications of what works and what does not work. Neither of the impact assessment found for this study investigate specific reasons why the case studies

perform well/poorly (e.g. in relation to demand and supply incentives, governance structure, etc.). Therefore, we treat the “replication” to the Hungarian with caution; both because of different confounding situations in Hungary and in the case studies and the lack of specific in *which factors* actually drive the economic impact results of the SEZs.

In the policy brief, we do not go in-depth with the methodologies applied in the different impact assessments to keep the policy brief as focused on the topic and results as possible. These are instead described in Appendix B for the most relevant papers.

2 Appendix B: Technical literature analysis

In this appendix, we go through the methodology of some key articles mentioned in the policy brief. These are grouped by case study and then by alphabetical order of the author's name(s). We do not go through all literature methodologies mentioned in the policy brief, as several papers and analyses use relatively simple methodologies (e.g. surveys and simple measures of employment, investments etc.). The references mentioned in this appendix can be found in the policy brief reference list.

2.1 Latvia

2.1.1 Gulbis (2018)

The author uses data on two Latvian SEZ, Rēzekne and Liepaja,[1] and compares the results from these SEZs with SEZs in other countries. The SEZs of the Dominican Republic, China and Jordan are included as merit leaders for SEZs, whereas Panama, Serbia and Poland are selected as "most similar" to the Latvian SEZs based on parameters such as education level, GDP per capita, placement in the World Bank's *Ease of Doing Business* index. Furthermore, Serbia and Poland are also considered because of their geographical proximity to Latvia. The author argues that is difficult to obtain statistically similar data to compare with the Latvian SEZs, both because the data collection differs, and because there may be different confounding factors behind the effects.

The author defines certain prerequisites for the SEZs to qualify as a regional development tool. They must: employ a significant number of people, attract large investment values, provide knowledge spill-over effects in the region, and promote industries cluster effects.

Firstly, the author present results for the Latvian SEZs based on data from the Central Bureau of Statistics of Latvia and Investment and Development Agency of Latvia, in 2017. The author finds that:

- The Rēzekne SEZ employs 2.7% of the population in Rēzekne, corresponding to 0.29 % of the population in the Latgale region.
- The Liepāja SEZ employs 2.6 % of the population in Liepāja, corresponding to 0.80 % of the population in the Kurzeme region.
- Combined, the two zones employ 0.14 % of Latvia's population and 0.33 % of the total employment
- The two Latvian zones have received 2.6 % of the total FDI in Latvia's

Secondly, the author also compares the Latvian SEZ data with other countries. The data is incorporated this into a profitability model where the investment and employment in the SEZs are measured relatively to the land size of the SEZ. The author finds that in general, the Latvian SEZs underperform relative to SEZs in Poland, China, Jordan, Serbia, Panama, and the Dominican Republic in terms of employment and investments attracted in the SEZs, both in absolute numbers and relative to the size of the region and the SEZs.

[1] The author argue that the results found for Rēzekne and Liepāja can be used for the Latvian SEZ as a whole, as the SEZ are similar in size and have been operating for the same period of time, except for the Latgale SEZ.

2.2 Lithuania

2.2.1 Investuok Lietovoje (Invest Lithuania) (2018)

The report's main analyses are

1. A socio-economic cost-benefit analysis of the FEZs
2. The FEZs' impact on public finances

For the analyses, the authors have data on the FEZs from 2002-2017. Since infrastructure investments are expected to last 20-30 years, and some of this was installed during the time of the publishing of the report, the period examined to cover the period 2002-2043 (i.e. 25 years after 2018).

Profits, value added, and taxes generated by existing companies, and companies that plan to invest, are indexed according to the nominal GDP growth forecasts to forecast these numbers towards 2043. For employment, the authors use the firms' employment plans. For start-us in the FEZs, the investment plans are used. Labour costs are projected using the planned number of employees multiplied by the labour cost per employee. Furthermore, depreciation of fixed assets are included using the average rate of depreciation in the FEZ companies historically, while profits (before depreciation and amortization) are calculated using a 9% return rate on equity.[2] Investment and employment plans for the FEZ companies were collected as part of the analysis.

The cost-benefit analysis

The historical value-added values in the cost-benefit analysis were found in the Lithuanian SoDra data from the State Social Insurance Fund Board under the Ministry of Social Security and Labour. The value-added contains staff costs, depreciation, amortization, and profit before tax. However, not all small firms summit financial statements to this database. For these firms, the depreciation and profit numbers are set to zero. These firms are considered to be a negligible share of the economic impact of FEZ in Lithuania.

The cost-benefit analysis was made on already implemented investments and future expected investments. The authors follow guidelines from European Commission (2014): *Guide to Cost-Benefit Analysis of Investment Projects*. These guidelines list what a cost-benefit analysis contains, what discount rates to use etc. This also means that taxes are not included in the cost-benefit analysis as taxes are simply a transfer of financial resources from one societal group to another and therefore neither a cost nor a benefit according to these guidelines. Also, job creation is not considered a benefit in the cost-benefit guide, as higher demand for people leads to increase costs for businesses.

A key factor of the cost-benefit analysis is that the authors assesses the additionality of the Lithuanian FEZs. This is done by not including the part of the economic activity that would be produced regardless of the FEZ. Some of the firms were already established before the FEZs were established in Lithuania. These firms' performances are therefore not exclusively due to the FEZs. For foreign firms, the presence and incentives of the FEZs were decisive for investing in Lithuania.[3]

[2] Based on a report from Invest Lithuania (2016): *Investicijų grąža (Return on Investment)*

[3] Based on the experience of Invest Lithuania.

All companies in the FEZ were asked about their performance in the FEZ and whether the FEZ was a decisive factor for investing in Lithuania. Based on this, each FEZ company was assigned a *FEZ influence value*. These values can be different across employment, taxes, value added etc. For example, the share of employees attributable to the FEZ was 59% on average in 2017 and for taxes the share was 54%.

The authors consider supply chain effects. The companies in the FEZ purchase some of their intermediate goods from local suppliers and employees at the FEZ firms also spend part of their income on Lithuanian products and services creating a multiplier effect.[4]

The "*cost*" part of the analysis relates to the preparation of the sites, such as investments in utility infrastructure and investments in accessibility. Pollution is considered an indirect cost of the FEZs and is therefore included, using pollution taxes as a proxy for the pollution costs. The authors do not consider costs of noise and congestion, as these are expected to be low since most FEZs are located in the outside the Lithuanian cities and thus are expected to have low impact on congestion and noise.

The total public development costs of the FEZs amounted to **€69 million** in the period 2002-2017, of which 64% were EU funded. Similarly, the additional value added amounted to **€740 million** for the period 2002-2017.

Considering the whole period 2002-2043, the benefits of the FEZ are 47 times larger than the cost, when including future investments in the FEZ and discounting the cash flows (see below). The forecasted economic impacts are expected to increase due to new expected investments in the FEZs and that much of the development costs have already been held.

Impact on public finances

The tax data is based on Interdepartmental Tax Data Repository, Sodra, STI, the Center of Registers. Information on FEZ incentives was collected from the EU support portals, the Competition Council database and Invest Lithuania.

As with the cost-benefit analysis, the impact on public finances only includes the additional effects. Only taxes paid by FEZ companies that started or expanded their activities due to the FEZ are included in this analysis using the *influence values*.

The authors also consider that some taxes are not received due to the financial incentives (i.e. no or low corporate income tax, property tax, etc.). This amounted to €20 million in lost tax revenue from 2002 to 2017. This loss of tax revenue is assessed only for the firms that still would have existed without the FEZ, but now are not paying tax (or paying less tax) because they are beneficiaries of the FEZ incentives.

Indirect effects of taxes are not assessed, such as

- Less unemployment benefits from increased employment in the FEZs. This effect is expected to be low as most people are expected to find employment elsewhere.
- Expenditures on public infrastructure, services, social guaranties etc. from retaining more people in Lithuania, working in the FEZ

[4] This can be done in a supply chain analysis, for example using input-output models.

Job creation is also assessed to measure the impact from corporate taxes from employment in the FEZ. This is done according the formula:

$$\mathrm{VGP} = \mathrm{TP} * (1 - \mathrm{PSL}) * \mathrm{KPVR} * \mathrm{Multiplier}$$

where:

- VGP: total net employment impact
- TP: direct employment impact
- BD: insignificant part
- PSL: employment shift
- KPVR: adjustment for domestic sales

The **insignificant part** relates to excluding the part of the employment that is not additional due to the FEZs, as explained above. Thus, only additional employment is included.

The **employment shift** factor is found to be 30%, based on European Commission (2007). This factor contains the share of the FEZ employment of people who previously were employed in other companies before being employed in the FEZ. A shift of 30% means that for every 100 jobs in the FEZ, 30 jobs are 'taken' from other companies and 70 jobs arise in Lithuania from people previously being unemployed getting employed or people moving to Lithuania to get employed in the FEZ.

Also, there is an **adjustment for domestic sales**. The FEZ sales to the Lithuanian market is a small share of the overall sales (25%). Domestic sales may affect the local market in terms of increased competition, but also as potential crowding out of imports. These effects are taken into account by adjusting by the share of FEZ taking over of imports, i.e. the FEZ that takes over existing domestic sales are not included in the results. The share of imported goods in Lithuania account to 54%, thus the results are multiplied by:

$$75\% + 25\% * 54\% = 89\%$$

This means that 11% (100% - 89%) of the activity in the FEZ are expecting to crowd out domestic production. The rest is exported (75%) or crowding out imports.

At last, the **multipliers** are based on the most recent statistics:

- Employment multiplier: 1.80, i.e. one employee in manufacturing supports an additional 0.8 jobs in the supply chain
- Value added multiplier: 1.95
- Tax multiplier: 1.93

The average multiplier of the Lithuanian manufacturing sector is used for the impact of FEZ on public finances in the supply chain.

Customs duties were not included due to lack of data, but are expected to be a low, based on the general level of public revenue from customs duties. Value added taxes were not included, because they are taxes paid on end-use.

The results show that there is a positive impact from the FEZs on public finances which is 6.6 times greater than the public costs of investments in infrastructure, land, and tax reliefs (for the period 2002-2043) and that total taxes paid from FEZ companies and employees were **€227 million** in the period 2002-2017.

Discount rates

Since the infrastructure investments are expected to last for many years, the period considered is 2002 to 2043, using a 7.4% social discount rate for the cost-benefit analysis for both the benefits and the costs that occurred in the 2002-2043 period. This consists of a 5% general real social discount rate from the cost-benefit guidelines and the compound annual growth rate (CAGR) of the construction price of civil engineering works, which was 2.3% on average from 2006 to 2017, i.e.

$$(1 + 5\%) * (1 + 2.3\%) - 1 = 7.4\%$$

The authors also use and a 6.4% financial discount rate for the impact on public finances. The financial discount rate consists of a 4% discount rate determined in the methodological guidelines and CAGR of the construction price of civil engineering works, i.e.

$$(1 + 4\%) * (1 + 2.3\%) - 1 = 6.4\%$$

2.3 Poland

2.3.1 Ambroziak & Hartwell (2018)

The authors examine whether the inflow of capital into an SEZ has an additional effect on the employment in the region, the amount of gross value of fixed asset (GVFA) per company, and the number of business entities.

In their methodology, the authors set up counterfactual impact evaluations for all subzones of the 14 SEZs. The problem with drawing causal inference is that it is impossible to observe the same object in two situations, i.e. with and without the intervention (which in this case is the SEZ and its incentives) and measure several metrics in and compare to the actual numbers for:

- Gross value added of fixed assets per company
- Number of entrepreneurs in a region
- Unemployment rates

In general counterfactuals are done by identifying a perfect clone for each intervention SEZ region. No such clone exists for a single individual region, and therefore the authors identify two groups: Beneficiaries and non-beneficiaries which are identical in as many pertinent aspects as possible except for the intervention treatment (i.e. the existence of a SEZ in the region). Ideally, this means that the only thing that is different between the groups is the intervention, such that differences in the different metrics can be interpreted as ***SEZ impact on regional development***.

The authors established an **experimental treatment group** of all regions with an SEZ and a **control group** of the rest of the Polish regions without any SEZs. One problem with this is that the borders for the Polish SEZ have changed several times historically. The authors overcome this problem they go the level of *poviats*, equivalent to NUTS4 regions, which is more detailed level, than in previous research. The authors argue that they are not going to a more detailed level, as the companies in the SEZ may attract labour from the regions surrounding the SEZ. The authors then try to select the poviats for the two groups, which are statistically equivalent, i.e. that they

- Identically respond to a SEZ intervention
- Are identically influenced by other external factors and other interventions
- Are identical in terms of characteristics for demographic and economic data

Differences between the two groups from external factors are dealt with by controlling for different characteristics such as regional aid intensity and the relative regional development in Poland. This is done by using a regional development scale according to GDP per capita (relative to the EU average). They further disaggregate the treatment groups across investment intensity. These divisions resulted in seven control groups and 21 treatment groups, covering 376 territorial units; 211 treatment territories and 165 control territories.[5]

Then the authors started their comparison between the treatment and control group using data for the period 2005-2013 from the Ministry of Economy and local bank data from the Central Statistical Office of Poland on a NUTS4 level. This was done using a double difference (difference in difference) method, which is a deduction the outcome difference before and after the intervention in the control group from the same difference in the experimental group, i.e. (simplified):

$$\Delta\text{Outcome}_{\text{Experimental group}} - \Delta\text{Outcome}_{\text{Control group}}$$

[5] See Ambroziak & Hartwell (2018), table 1

The authors find that in the period covered by the study (2005-2013), the regions with significant SEZ investment intensities (the SEZ cover more than 5% of GVFA in the region) experienced a statistically significant increase in GVFA per company.[6] They conclude that SEZ might have a positive impact of the overall value of investment per capita in the region, especially in the relatively poorer regions.

However, the authors do not find statistically significant evidence that SEZs have let to absolute increases stock, relative to the control groups. This is partly due to the initial level of investment stock, which were much lower in relatively poorer regions.

At last, the authors find increases in employment for the SEZ located in relatively poor areas, whereas the effect is not significant for other areas.

2.3.2 Ciżkowicz et. al (2015)

The authors use panel data for 379 Polish counties consisting of firm-level data from the Polish Ministry of Economy for the Polish SEZs. The dataset contains 30,000 observations per year for the period 2003-2012 on a county-level (NUTS4). This allows the authors to take county heterogeneities into account and to have a more specific focus on SEZ that (until 2018) were located in small dedicated areas to better distinguish regions with and without a SEZ. The data contains information on the number of new created jobs, retained employment, capital expenditures and sector classification of the firms.

The authors also use regional macroeconomic data from the Central Statistical Office, including demographics, labour market information, corporate sector structures, and local government finances on a country-level. These are used as controls in the analysis.

The authors argue that the potential economic effects of the Polish SEZ can arise through four channels:

1. **First round effects**: Companies' decisions to invest, create, and retain employment in the SEZ
2. **Induced effects**: The effects on the county that the SEZ is located in, but outside the SEZ territory. These effects arise from forward and backwards linkages through vertical integration, and competition with local firms (e.g. crowing out) and can affect the county's economy positively or negatively
3. **Spatially induced effects**: Economic externalities to neighbouring counties. These are similar to the induced effects but arise outside the county of the SEZ
4. **Reverse inductions**: The effects from the spatially induced effects may reverse back into the county with the SEZ (positively or negatively)

The study analyses effects 2, 3, and 4. The authors argue that they cannot just use dummies for the SEZs, as the SEZs are not homogeneous with respect to scale of fiscal incentives, quality of infrastructure, available area etc. and therefore would have large variating effects on employment and investment levels. Therefore, they study the induced effects for employment are modelled as (similar approach is used for the investment.):

$$emp_{it} = a_i^{emp} + \beta^{emp} empsez_{it} + \mathbf{X_{it}}\boldsymbol{\gamma^{emp}} + \epsilon_{it}$$

[6] See Ambroziak & Hartwell (2018), table 3

Where *emp* and *empsez* are the county employment and SEZ employment, respectively in the county *i* and year *t*, and **X** contains control variables. β^{emp} is the estimate of the induced employment effect. If β^{emp} is less than 1, then the SEZ employment crowds out the employment in the region. If it is 1, then the SEZ created employment in the county, but is not additional (neither positive nor negative). If β^{emp} is greater than 1, then there are crowding-in effects in the hosting county, meaning that there are positive effects on the employment in the county, also outside the SEZ.

The authors find that $\beta^{emp}$is 1.86 and is statistically significant, meaning that there are crowding-in effects on employment in the region of the SEZ, which are also confirmed by the robustness tests. The results show that 100 jobs in a Polish SEZ generate 72 additional jobs in the county (but outside the SEZ) and 137 jobs outside the county.

The β-parameter for investments is 1.114 and is not significally different from 1. The authors conclude that the investments in the SEZ are neither crowding-in nor crowding-out investment in the county or neighbouring counties.

The authors also find that the fourth effects of reverse induction are negligible for both employment and investments.

To take into account the inter-regional effects for the third and fourth effects, the authors considers spatial dependence. Therefore, the authors model a Spatial Durbin Model (SDM), taking into account employment in other counties, using a weigh matrix of all Polish counties. This gives spatial autoregressive coefficients of the spatial lags of the dependent variables for employment in the counties and in the SEZs.[7] The authors run specific tests to ensure that the SDM properly describes the data, or if there is a spatially autocorrelated error term. Similar concerns are addressed regarding the weight matrix and the interpretation of the results. In addition, the model controls for fixed effects and they use the Driscoll and Kraay non-parametric covariance matrix estimator that corrects for the error structure spatial dependence.[8] The findings are robust to changes in the estimation method, different sample compositions and explanatory variables and the choice of special weight matrix.

2.3.3 Jensen & Winiarczyk (2014)

The authors use panel data for the period 1995-2011 on powiat/county areas (NUTS4) and gmina areas (NUTS5). The panel data encompasses (to some extend) the time perspective to observe changes that cross-sectional data does not.

The authors use an econometric difference-in-difference method, where the SEZs are the treatment group and other regions are control groups. First, a simple difference-in-difference is run, see below for different variables, y (e.g. employment). The statistic gives an average effect over time running the SEZ treatment.[9]

$$y_{jt} = \alpha_0 + \alpha_t SEZ_j + \epsilon_{jt}$$

[7] See equation (3) to (6) in the paper. See pages 17-21 of the report for an in-depth description of this methodology and tests.

[8] Driscoll and Kraay (1998)

[9] With *j* being the region and *t* being the year.

The authors also include controls (*X*) to reduce the problem of the omitted variables bias and to check how much the variables are affected by other factors. These include education level, dependency rates, state ownership, general subsidies, and urban/rural area.

$$y_{jt} = \alpha_0 + \alpha_t SEZ_j + \beta X_{jt} + \epsilon_{jt}$$

Now, the authors do more advanced panel data analysis to reduce the potential heterogeneity in the model to reduce problems of serial correlation. This is done by estimating the random or fixed effect model. Therefore, the models are expanded controlling for time and region, see below:

$$y_{jt} = \alpha_0 + \beta x_{jt} + \sigma_j + \tau_t + \epsilon_{jt}$$
$$y_{jt} = \alpha_0 + \alpha_1 SEZ_j + \beta x_{jt} + \sigma_j + \tau_t + \epsilon_{jt}$$

The authors also consider a two-stage fixed effects model, as they suspect that there are underlying structural factors determining the impact of the economic variables. This is often the case in regional datasets. They therefore use the two-stage fixed effect model proposed by Kripfganz and Schwarz (2012). This is to solve the problem of collinearity between the fixed effects and the SEZ dummy.

In the first stage, the model is run without the SEZ dummy:

$$y_{jt} = \alpha_j + \lambda_t + \beta x_{jt} + \epsilon_{jt}$$

Using this model, the authors obtain estimates of territorial unit's fixed effects for the *y* variable. In the second stage, the authors investigate if the fixed effects differ across areas with and without an SEZ:

$$\alpha_j = \alpha_0 + \alpha_1 SEZ_j + \epsilon_j$$

The difference-in-difference results show that regions with SEZs have above national average numbers for employment, and they find that there has not been any dynamic development over time. Contrarily, the fixed effects estimator suggests the opposite i.e. that the SEZ have *been ineffective in generating employment*. Therefore, the authors argue that the zones have not fully managed to lift the poorer regions out of the relative poverty.

2.3.4 Nazarczuk & Umiński (2019)

The authors find that there is a higher degree of export concentration for firms within the SEZs, which is a consequence of SEZ firms specialising in products for exports. This is found based on a revealed comparative advantage (RCA) index and as well as other indices from Balassa (1965) in a so-called standard form, adapted for the SEZ situation:

$$RCA^i_{SSE} = \frac{\frac{X^i_{SSE}}{X^i_{PL}}}{\frac{X_{SSE}}{X_{PL}}}$$

Where:

- RCA^i_{SSE}: revealed comparative advantage of the SEZ in export of product *i*
- X^i_{SSE}: export of product *i* by SEZ businesses
- X^i_{PL}: export of product *i* by Poland

- X_{SSE}: total exports generated by SEZ businesses
- X_{PL}: total exports generated by Poland

This index can be interpreted as the SEZ contribution to exports of product *i* from Poland, when compared to all exports generated from Poland. The problem with this index is that it may artificially overstate or understate the products that typically are not traded as much or products that are traded much.

Therefore, the authors also use other indices

- The additive index of revealed comparative advantage (ARCA), based on Hoen & Oosterhaven (2006)
- The normalised index of revealed competitive advantage (NRCA), based on Yu, Cai, & Leung (2009)

These indices are characterised by the symmetry of values, where the values greater than 0 mena that the SEZs have a comparative advantage for export of a given product. The indices are calculated as:

$$ARCA_{SSE}^{i} = \frac{X_{SSE}^{i}}{X_{PL}^{i}} - \frac{X_{SSE}}{X_{PL}}$$

$$NRCA_{SSE}^{i} = ARCA_{SSE}^{i} * \frac{X_{SSE}}{X_{PL}}$$

The ARCA index is comparative-advantage neutral, meaning that possitive values indicate a revealed comparative advantage and negative values indicate a revealed comparative disadvantage in the SEZs. It is possible to compare between groups because of the indices additive properties. It can be difficult to compare between countries with the ARCA index. Therefore, the NRCA index is useful as it nomalises the values. The index is supplemented with the weights of participation of SEZ exports in the Polish exports.

2.3.5 Pastusiak et al (2018)

The model examined in Pastusiak et al (2018) estimates the aggregate net cash inflow. The authors use P. Warr's enclave model from 1983 that describes the economic zone as a closed economy that to a small extent cooperates with the surround economy. The model, as expressed by the equation below, has been modified to reflect the conditions of the Polish SEZs taking into account benefits and shadow (alternative) cost of public investments in SEZs:

$$N_p = \left(R_{kw} + E_x + CIT + S_{k_{SSE}} - I_{mp} - P_{publ} - I_{\mathrm{inf}r} + W_{SSE}\right) -$$
$$\left(R_{kw} + E_x + CIT^* + S_{k_{SSE}} - I_{mp} - P_{publ} - I_{\mathrm{inf}r} + W_{SSE}\right) * S_F^*$$

Where:

- N_p: net benefit
- R_{kw}: annual wage costs
- E_x: export of enterprises in SEZ
- *CIT:* income taxes paid by companies in the SEZ
- *CIT**: income taxes paid by firms in the economy without SEZs. This is identical to the taxes paid in the economy with SEZ, but corrected for public assistance
- $S_{k_{SSE}}$: value of sales of domestic production to the zone
- I_{mp}: value of import of zone enterprises
- P_{publ}: public support offered by the state
- $I_{\mathrm{inf}r}$: infrastructure investments incurred by municipalities, management of SEZ and media providers
- W_{SSE}: performance results of the SEZ management companies
- S_F^*: *shadow cost* indicator

The model considers SEZ exports, import, domestic sales, taxes, public aid, infrastructure expenditures, administration costs, currency risks, and wages paid to the people employed in the SEZ and the consumption generated from this. Lower tax payments are expected in the regions of the SEZ due to the incentives. The model can also consider resources for production in the zone, for example raw materials and energy, which would be useful as many firms in the zones are manufacturing firms which consume a vast amount of energy.

More importantly, the model takes into account opportunity costs, i.e. alternative choices for the public investments in the zones. This includes creating employment for unskilled unemployed people, which is likely to be much more expensive.

In total, the authors estimate the effects in net present value of discounted cash flows of more than $116 billion (approximately €100 billion [10]) for the period 2001-2012.

[10] Based on exchange rate on October 14, 2020.

2.4 General and country specific impact assessments of SEZs

2.4.1 Regione Calabria (2017)

This report is an ex-ante analysis of the potential impact of starting a SEZ in the Calabria region in Italy. The results are based on forecasted simulations of two scenarios: One with an SEZ and one without.

To estimate the impact on employment and exports of the Calabrian SEZ, the authors simulate the development of exports by businesses and the employment over a time horizon of 10 years (2018-2028).

For the SEZs, the simulations are based on estimates on how SEZs impact exports and employment identified in the literature.[11] In the scenario without the SEZ, the authors assume yearly average growth rates for exports and employment based on the development over the previous ten years.

Then, they compare businesses that are within the proposed area of the SEZ and those that are outside of it (i.e. Calabrian businesses that will not be eligible for benefits even if the SEZ is established). The estimates suggest that exports will **more than triple** within the ten years for companies located within the SEZ whereas they will increase very little for companies outside the SEZ. The same is the case if the SEZ is not established at all.

The authors estimate additional **16,000 jobs** are created in the SEZ scenario, which is almost seven times more than the scenario without an SEZ.

[11] These estimates are based on two studies estimating the impact of SEZs in China and India on exports and foreign direct investment; see Wang (2013) and Leong (2013). Note that the use of these estimates from China and India might not be directly transferable to European SEZs. Moreover, the results of the impact of the Calabrian SEZ imply rather high average yearly growth rates of exports and employment for SEZ companies and one should therefore be cautious about interpreting the results.

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