The Effects of Polish Special Economic Zones on Employment and Investment: Spatial Panel Modelling Perspective.

Cizkowicz, Piotr and Cizkowicz-Pekala, Magda and Pekala, Piotr and Rzonca, Andrzej

Warsaw School of Economics, National Bank of Poland

20 March 2015

The Effects of Polish Special Economic Zones on Employment and Investment: Spatial Panel Modelling Perspective.

(March 2015)

Piotr Ciżkowicz†, Magda Ciżkowicz-Pękała‡, Piotr Pękała*, Andrzej Rzońca**

Abstract: We estimate the set of panel and spatial panel data models of employment and investments for 379 Polish counties over the period 2003-2012. We take advantage of a unique firm-level dataset for Polish Special Economic Zones (SSEs), which includes about 30,000 observations. We find that SSEs have substantial positive effects on employment: jobs in a given SSE create jobs outside the SSE in hosting county and even more jobs in neighbouring counties. Effect of SSEs on investments is weaker, but still positive. Investments in a given SSE neither crowd out nor crowd in investments outside the SSE. Thereby, they add one to one to capital stock in hosting county. Our findings are robust to changes in estimation methods, sample composition, set of explanatory variables and spatial weight matrix.

JEL Classification: H25, H32, R3, C210, C230

Keywords: special economic zones, regional economic development, economic policy tools, panel data models, spatial panel data models

†Warsaw School of Economics, al. Niepodległości 162, 02-554 Warszawa, PCizko@sgh.waw.pl
‡Warsaw School of Economics, NBP, Magda.Cizkowicz-Pekala@nbp.pl
*Warsaw School of Economics,p.pekala2@gmail.com
**Warsaw School of Economics, NBP Monetary Policy Council, Andrzej.Rzonca@nbp.pl

1. Introduction

After the collapse of the communist bloc in 1989, countries in Central and Eastern Europe, including Poland, started a rapid political and economic transformation. In the course of this process, Poland substantially narrowed the development gap against wealthier economies of Western Europe (see, e.g. BALCEROWICZ et al., 2013). However, differences in economic performance between particular regions within Poland remained a persistent feature of Polish transition (see, e.g. CIŻKOWICZ et al., 2014). As soon as 1994, Polish government implemented special economic zones (hereafter: SSEs - pol. *Specjalne Strefy Ekonomiczne*[1]) as a place-based policy aimed at mitigating these differences by *inter alia* attracting investment and creating new jobs. Increasing reliance on SSEs has been mirrored in both the gradual expansion of SSEs' territory and the extensions of their operating time horizon[2]. Support for enterprises operating in SSEs involves substantial fiscal costs[3], so the problem of SSEs' effectiveness as a policy tool becomes vital. The problem may be divided into two questions:

- firstly, what explains considerable differences in first round effects, i.e. why some SSEs attract more firms than the others;
- secondly, what is the impact of firms located in SSEs on economic outcomes outside SSEs territory.

Our research seeks to answer the second question[4]. We estimate the set of panel and spatial panel data models of employment and capital outlays for 379 Polish poviats (eng. counties; LAU-1, previously NUTS-4 regions) over the period 2003-2012. To assess the impact of SSEs we include employment and investment of SSE-based firms in the set of explanatory variables in the models. We apply an approach proposed by LESAGE and PACE (2009) in order to correctly interpret spatial effects resulting from the estimates.

Our main findings are as follows:

Firstly, SSEs have substantial positive effect on employment. Every 100 jobs in a given SSE create, on average, about 72 jobs outside the SSE in hosting county and 137 jobs in neighbouring counties. Secondly, effect of SSEs on investments is weaker, but still positive. Investments in a given SSE do not crowd in investments outside the SSE, but do not crowd them out either. Thereby, investments in SSEs add one to one to capital stock in hosting counties. The findings are

[1] In the remainder of this paper we use acronyms "SSEs" to indicate the Polish special economic zones created by the Act of 1994, and "SEZ" to indicate the broader set of geographically-targeted investment incentive schemes in general.
[2] In 2013, SSEs operations were extended until 2026.
[3] Until the beginning of 2012, the value of public aid extended to companies operating in the SSEs amounted to PLN 10.5 bn. On top of that expenditures on infrastructure development and marketing were close to PLN 3.0 bn (MINISTRY OF ECONOMY, 2013).
[4] In CIŻKOWICZ et al. (2015) we seek to address the first part of the question.

robust to changes in estimation methods, sample composition, set of explanatory variables and spatial weight matrix.

The paper makes three main contributions to the literature on the topic.

Firstly, while SSEs in Poland have been functioning for over 20 years, a precise, robust and comprehensive analysis of SSEs impact on regional economic outcomes is still lacking[5]. We seek to fill this gap using a unique firm-level dataset for Polish SSEs, which to our best knowledge has not been exploited by other researchers. The scope of the dataset encompasses all companies operating in SSEs between 2003 and 2012 and amounts to about 30,000 observations. The dataset contains information about individual companies' investments outlays, retained and newly created jobs and the sectors in which particular firms operate. We combined the information with regional data from the Central Statistical Office describing various characteristics of counties in which SSEs are located. The dataset allows to expand the analysis beyond the - typically studied in the literature - direct employment and investment creation that takes place on the SSEs territories and to account not only for the cross-sectional, but also dynamic and spatial effects of SSEs' functioning.

Secondly, the vast majority of the empirical research is based on dummy variable indicating zone existence in a particular region and time period. The variable is incorporated into (cross-section or panel data) standard model of regions' GDP, employment or investment and the estimates are interpreted as the average impact of SEZ on economic outcomes of a hosting region. Instead, we use measures of first round effects of SSEs functioning – the level of employment and capital outlays by the companies operating in SSE in particular county and time period. This approach, which to our best knowledge has not been used previously in the literature, enables us to avoid some principal limitations of dummy variable approach. Firstly, we are able to distinguish between first round effects of SSE's creation (i.e. scale of activity of firms located on the SSEs' territory) from induced effects (i.e. the impact of companies located in the SSE's territory on economic outcomes of firms located in the hosting region, but outside this territory). Based on this decomposition, important conclusions might be drawn with regard to the existence of crowding-in/crowding-out effects and spillovers from SSEs functioning. This type of reasoning, which is the core of our analysis, is not possible with the use of dummy variable. Secondly, dummy variable approach assumes that all SSEs are homogenous, while in fact they differ with respect to the scale of financial incentives, quality of infrastructure, available area, etc. This heterogeneity results in considerable differences (both in time and cross-section dimension) with respect to the number, scale and characteristics of firms located in SSEs territories. Dummy variable approach averages out these differences, which may result in biased estimates of SSEs' impact on economic outcomes of hosting region. Our approach, on the contrary, fully exploits these differences. Thirdly, using SSE-based

[5] See Section 2 for the analysis of related literature.

employment and investment as explanatory variables allows us to estimate models with fixed effects which capture unique characteristics of particular regions. In the dummy variable approach fixed effects are indistinguishable from the effects of SSE functioning.

Thirdly, we use spatial panel data models. They allow us to distinguish three types of induced effects of SSE on employment and investments: effects outside SSE in hosting counties, externalities to neighbouring counties and feedback loop effects from neighbouring counties to SSE-hosting counties. To our best knowledge those effects have not been analysed so far in any research on SSEs and SEZs in general. However, accounting for them is necessary for correct cost-benefits analysis of SEZs. As demonstrated by LESAGE and PACE (2009) ignoring them may result in bias and inconsistency of the estimator due to omitted variable problem.

The remaining of the paper is organised as follows. Section 2 presents main conclusions from hitherto literature. Section 3 presents main features of SSEs giving special attention to the financial and non-financial incentives provided by SSE to prospective investors as well as the territorial and institutional evolution of the scheme. Section 4 includes a presentation of the dataset followed by a brief overview of main stylized facts related to SSEs functioning in Poland. Section 5 presents analytical framework of the study indicating main channels through which SSE can influence employment and investments as well as estimation strategy including comparison with strategies used in most other studies on the topic. Section 6 presents results of econometric modelling and elaborates on their economic implications and policy conclusions. Section 7 verifies the results' robustness. Section 8 concludes.

2. Related literature.

In the theoretical literature there is no hot debate on positive first round effects of SEZs (or tax incentives in general) on employment and investment (see, e.g. HOUSE and SHAPRIO, 2006; EDGE and RUDD, 2010). However, the theoretical literature on their possible externalities is much less conclusive (see, e.g. FINDLAY, 1978; BLOMSTROM and WANG, 1992, RODRIGUEZ-CLARE, 1996; GLASS and SAGGI, 1998; MARKUSEN and VENABLES, 1997; JOHANSSON and NILSSON, 1997; LIU, 2008; LIN and SAGGI, 2005 and GE, 2012). It points out that the attraction to a given region of new companies that use more advanced technology or possess superior know-how (as in the case of most FDIs) than the ones present in that region can spur employment and investment in that region. However, in certain cases, some less competitive companies might be driven out of their markets or never be formed (crowded-out) by those new companies.

The empirical studies on SEZs' effects can be grouped according to the methodological approach they use. The first group of research includes mainly descriptive case studies concerning the evolution of particular SEZs. This strand of research gives special attention to the first round effects of SEZs. The studies of the second group conduct more formal econometric analyses. They usually make use of dummy variable or conceptually similar methods (e.g. difference-in-differences estimators) to evaluate the differences between SEZ-hosting and non-hosting regions. However, these studies most often do not differentiate between first round and induced effects of SEZs.

A large part of the literature on Polish SSEs belongs to the first group and focuses on descriptive analyses based on case studies, evaluating the efficiency of SSEs in attracting new investment (in particular foreign direct investments (FDI)) without formal (quantitative) verification of the findings. The main conclusion drawn from this research is that SSEs increases the employment and investments (e.g. KRYŃSKA, 2000; KOZACZKA, 2008; ZASĘPA, 2010; RYDZ, 2003; SMOLEŃ, 2010; GWOZDZ and KWIECIŃSKA, 2005; BYCZKOWSKA and KACZMAREK, 2010). However, these studies do not isolate the impact of SSE creation from the impact of exogenous economic conditions in the analysed regions. Moreover, although some authors indicate that the effects of SSEs vary across zones, they do not identify the factors behind these differences (e.g. CIEŚLEWICZ, 2009) or only list potential factors but do not analyse them quantitatively (e.g. GODLEWSKA-MAJKOWSKA and TYPA, 2008; PILARSKA, 2009; JARCZEWSKI, 2006; SMĘTKOWSKI, 2002; TROJAK and WIEDERMANN, 2009). A notable exception on that score is the study by JENSEN and WINIARCZYK (2014) who estimate the regional economic impact of SSEs with the use of panel data models base on dummy variable approach.

Most empirical studies on SEZs in other countries, in particular in the US, France and the UK, belong to the second group. Their results are hardly conclusive, irrespective of the country under the study. Estimated effects rang from positive (see, e.g. CRISCUOLO et al., 2007; DEVEREUX et al., 2007; GIVORD et al., 2011; GIVORD et al., 2012 or MAYER et al., 2013), neutral (see, e.g. GOBILLION, 2012 or NEUMARK and KOLKO, 2008) to even negative ones (see, e.g. BILLINGS, 2009). As indicated in, the predominant view is that they are positive albeit weak (see the literature review by, e.g. HIRASUNA and MICHAEL, 2005). Some analyses suggest that their strength depends on both pre-existing regional economic conditions (e.g. GOSS and PHILLIPS, 2001; MAYNERIS and PY, 2013), as well as particular features of the zones (BONDONIO, 2003).

The research on potential externalities from FDI, predominant type of SEZs investment, is similarly inconclusive. Some empirical studies point to the positive externalities (e.g. HASKEL et al., 2002; GORG and STROBL, 2001), while others identify negative spillovers (e.g. AITKEN and HARRISON, 1999; DJANKOV and HOEKMANN, 2000) and still others find no spillovers at all (e.g. KOKKO et al., 1996). The meta-analysis by GORG and STROBL (2001) suggests that the differences in the results obtained may be partly of a methodological background. Other authors indicate that the strength of positive externalities may depend on many variables such as the level of human capital in the region (BORENSZTEIN et al. 1998), the technology gap between domestic and foreign companies (HAVRANEK and IRSOVA, 2011) or the competitiveness of local market (BLOMSTROM et al., 2000).

The ambiguity of empirical results points to the need of thorough analysis of channels through which SEZs influence regional economic performance. In particular, until now the first round and induced effects of SEZs have not been comprehensively analysed in separation. While the existence of positive first round effects of SEZs is not debated, the occurrence and sign of induced effects may depend on pre-existing conditions in the regions where SEZs are located. Ignoring these effects can lead to biased estimates of benefits from SEZs.

3. Special economic zones in Poland as a regional development policy tool.

SEZ in Poland can be classified into three separate groups: (i) *Specjalne Strefy Ekonomiczne*, (ii) industrial and technological parks, (iii) duty-free zones and duty-free warehouses[6]. Only the first group (SSEs) is the subject of the following analysis.

Specjalne Strefy Ekonomiczne (SSEs) are defined as administratively separated areas where investors are granted preferential conditions. SSEs are aimed at accelerating the development of selected parts of Poland primarily by creating new jobs, developing technologies, enhancing the competitiveness of produced goods and promoting exports. The main incentive offered by SSEs is income tax exemption on income earned from the business activity conducted within SSE, granted under condition of continuing operations and retaining employment for at least 5 years. Moreover, when applying for SSE designation or for a SSE-designated plot, companies declare the number of new jobs they plan to create and investment outlays they intend to realise. If the declarations are not met, the company might lose the SSE designation and be forced to return the financial aid granted. The level of tax exemption is determined by the amount of eligible costs (the qualified cost of a new investment or value of labour costs of new employees incurred over a 2-year-horizon) and so called maximum intensity of regional aid (amounting from 15% to 50% depending on the zone). Additionally, investors planning to locate in SSE are offered fully-equipped plots on preferential conditions and in some cases – depending on the decision of community (NUTS-5 aggregation level) – real estate tax exemptions.

SSEs as a policy tool underwent a major evolution over its lifespan. The evolution pertained to every aspect of SSEs functioning, including the territorial span of the scheme as well as size and conditionality of financial aid granted to SSE-based companies. Table 1 summarizes this evolution.

---

[6] **Industrial parks** are groups of separated real estates with technical infrastructure left after the restructuring or liquidation of an enterprise that enables the conduct of business operations, especially for SMEs. In turn, a technology park is a separated group of real estates with technical infrastructure created to stimulate the flow of knowledge and technology between science institutions and enterprises. The areas of industrial and technological parks are small compared to those of SSEs. In fact, some of the parks lay within the boundaries of SSEs, making additional tax incentives available for the park investors. **Duty-free zones** and **duty-free warehouses** are separated areas of Polish customs territory in which, regarding import duties and trade policy instruments, imported goods are considered to be outside the customs territory of Poland. They are created in order to facilitate the international transit of goods, especially in seaports, airports and areas adjacent to border crossings.

The first SSE in Poland, in Mielec, was established in 1995. Currently, SSEs form 14 groupings roughly covering all voivodeships of Poland (each grouping may operate in several voivodeships) and managed by separate administrators. The act of 1994 which introduced SSEs in Poland did not limit the overall territory of SSEs. However, during pre-accession dialog with the European Commission in 1999 Poland committed itself not to increase the SSE area above the already utilised territory of 6,325 ha. In 2004, a new solution was adopted. According to amended rules, the area available for SSEs was increased by 1,675 ha to 8,000 ha. The new investment plots under SSE designation were offered to investors planning capital expenditure exceeding EUR 40 mn or generating employment of at least 500 persons. In 2006 the upper limit of SSE area was set at 12,000 ha and the conditions constricting the availability of new SSEs to large investment projects were removed. The limit has been increased again to 20,000 ha in 2008 and remains in force today. As of December 31, 2012 the utilised area of SSEs amounted to 15,800 ha (MINISTRY OF ECONOMY, 2013). What is important, SSE designation can be extended to plots owned both publically (by local governments) or privately (by companies). Until 2008, companies seeking a SSE designation on privately owned plots did not need to meet any additional criteria. Since 2008, SSE designation can be extended to private plots only if the company operates in one of innovative industries, plans to start production of new or substantially improved products or plans to substantially increase employment. In the last case, the number of newly created jobs required from a company is dependent on the level of unemployment rate in the county relative to Poland's average. If the upper territorial limit set in the Act on SSE is not exhausted, a new SSE may be created by Ministry of Economy decree after consultations with the relevant voivodeship and community administration. However, the Ministry of Economy requires a certain level of SSE designations utilisation at all times. In consequence, when a new SSE designation is to be extended and if, in consequence, the level of utilisation of SSE designated plots would fall, a previously extended and non-utilised SSE designation need to be revoked.

***** Table 1 here *****

4. Data and stylized facts

The data we use come from two main sources:

(i) Ministy of Economy company-level dataset on SSE-licensed firms' operations. The dataset comprises in particular: annual data on newly created jobs, and retained employment (from the period prior to SSE creation) as well as capital expenditure. On top of that, the dataset covers the information on the sectors to which particular companies belong (based on Polish NACE equivalent classification) and area of each zone. The data included covers the period 2003-2012. Despite not covering the overall SSEs lifespan (beginning in 1995), the dataset is the most detailed existing source of information on economic activity in the SSEs. The disaggregated data include ca. 30,000 individual observations (individual company data in a given year). For the purpose of this study, the information contained in the Ministry of Economy dataset has been aggregated at the counties level (NUTS-4 classification[7]). This way of data aggregation aims at three goals. Firstly it allows to conduct the study at a territorial level at which heterogeneity within analysed units is much smaller than between units. This is especially pertinent from the point of view of labour market analysis for which other levels of data aggregation have serious limitations. For voivodeships level it is their large territorial size and consequently high diversity of economic conditions within their borders, while for community level - the limited availability of data concerning economic activity. Secondly, this level of data aggregation allows to distinguish balanced numbers of SSE hosting regions and regions without SSE in the analysis (e.g. in 2012 SSEs operated in 169 out of 379 counties, in 58 out of 66 subregions and in all voivodeships). As a consequence, it results in more precise estimates of SSEs impact at the given territorial level. Finally, the chosen aggregation level allows a direct analysis of differences in economic performance between SSE hosting and non-hosting counties as well as the spatial effects of SSEs operations which constitutes a significant contribution to the literature. After aggregating the data over counties we obtain 3790 annual observations.

(ii) Regional macroeconomic data from the Central Statistical Office. The data includes in particular subsets of variables describing: (i) demographics (total population, number of persons in working age population, number of persons in post-productive age), (ii) labour market (employment, total unemployment, long-term unemployment, average wage in the corporate sector), (iii) corporate sector structure (number of registered companies, employment shares by main economic sectors – manufacturing, market and non-market services), (iv) local government finances (revenues, spending by main purpose – investment/social policy, budget balance). All data in this dataset either directly pertains to territories of counties or is aggregated from data for smaller administrative units of communities (NUTS-5 aggregation level). Unfortunately, given the territorial aggregation, data describing economic output in a comprehensive manner (GDP) is not available. The macroeconomic regional data described above cover the whole period for which SSE-based company-level data are available, in the same, i.e. annual, intervals.

The initial data inspection leads to drawing the following stylized facts:

(i) The SSE designation is an appealing investment incentive both for the authorities and prospective companies. In 2012, 1430 companies were located in SSEs created in 190 counties. The distribution of SSEs does not exhibit any significant concentration in a particular region of Poland, but is dispersed quite evenly in space (see Figure 1). The SSE-based employment rose fast, from 61 th in 2003 to 247 th in 2012, pointing to high attractiveness of SSE for investors and willingness of local governments to use this tool.

[7]NUTS-3 level geographical aggregation in Poland covers 66 sub-regions. The sub-regions are formed of smaller administrative units called *poviats* (eng. counties). As of 2012 there were 379 counties in Poland.

***** Figure 1 here *****

(ii) The SSE development was not even in time. Most of employment and investments in SSEs were created after Poland joined the EU in 2004. The upper limit of SSEs territory has been expanded accordingly.

(iii) SSEs development was accompanied by inflow of FDI to Poland. In 2012, 81% of capital stock in SSEs came from foreign investors, and only 19% of capital was owned by Polish investors. German companies were the most important group of foreign investors, accounting for 16% of capital, followed by American firms – 12%, and investors from the Netherlands – 11%. Unlike Poland all those countries are at technological frontier.

(iv) Counties hosting SSEs are very heterogeneous in terms of number of persons employed in SSE-based companies. In 2012, the SSE-based employment ranged from 1 (sic!) to nearly 13 000 and its share in overall number of persons employed in the hosting counties varied from close to 0.0% to 23.9%.

(v) SSEs attract mainly manufacturing companies. In 2012 they accounted for 96% of capital invested in SSEs. About two-thirds of the capital invested in SSEs were owned by low and medium-low technology companies, about 30% by medium-high technology firms and only 1% by high-tech companies (see Table 2). However, there are large differences between technology intensity profiles of particular regional groupings of SSEs (groups of SSEs managed by separate administrators).

***** Table 2 here *****

(vi) The development of SSE in very similar counties can differ substantially. A comparison of two neighbouring (and economically very similar) counties, hosting a SSE – Jastrzębie-Zdrój and Żory – provides an insightful example. While SSE in Żory increased the number of hosted companies and employment considerably between 2003 and 2012, the SSE in Jastrzębie-Zdrój saw a reduction in employment (see Table 3). Interestingly, the differences in economic performance during that period between Jastrzębie-Zdrój and Żory were not simple reflection of the differences in the SSEs' development.

***** Table 3 here *****

(vii) However, counties hosting SSE seem to have outperformed in economic terms counties in which SSE has never existed. In 2003, when most of the SSE were still in their infancy, the former counties did not differ substantially in terms of economic performance from the latter counties (see Table 4). In particular, both groups of counties had similar unemployment (inclusive of long term unemployment) and labour participation rates. By contrast, in 2012 they differed on that score.

***** Table 4 here *****

5. Analytical framework and estimation strategy.

The mechanisms through which SEZs influence regional economic performance can be decomposed into four channels (see Figure 1):

A. **First round effects**[8]: the impact of SEZ incentives on companies' decisions to invest and create or retain employment in the SEZ designated territory;

B. **Induced effects**: the effects induced by the functioning of SEZ-based companies in a delimited (geographically or administratively) region of SEZ location, but outside the SEZ territory itself. These effects can be attributed to a number of economic processes, which can give rise to both positive and negative impact on the overall economic performance of the region. On the one hand, the induced effects can include clustering of similar companies and vertical integration (backward and forward linkages). On the other hand, SEZ-based companies may crowd-out existing firms or prevent formation of new ones.

C. **Spatially induced effects**: externalities to neighbouring regions. These induced effects might in principle take the same forms as the induced effects within the region of SEZ designation but materialise outside that region. Examples include hiring employees from outside hosting region.

D. **Reverse inductions**: as the economic performance in regions neighbouring to the SEZ location can be altered by the economic zone designation, some induced effects (again positive and negative) from the neighbouring regions to the SEZ region might occur.

***** Figure 2 here *****

As indicated in Section 2 vast majority of the literature examines only channel A and B using dummy variable indicating zone existence in a particular region and time period. The variable is incorporated into (cross-section or panel data) standard model of regions' employment or investment and the estimates are interpreted as the average impact of SEZ on the economic outcomes of a hosting region. Our study analyses channels B, C and D. We use employment and investments of firms located in SSE (i.e. first round effects or channel A) in particular county as explanatory variables in models describing counties respective economic activity. This approach, which to our best knowledge has not been used previously in the literature, enables us to avoid some principal limitations of dummy variable approach. Firstly, we are able to distinguish between first round (channel A) and induced (channel B) effects. This is not possible with the use of dummy variable. Secondly, dummy variable approach assumes that all SSEs are homogenous, while in fact they differ with respect to the scale of financial incentives, quality of infrastructure, available area etc. These results in considerable differences (both in time and cross-section

---

[8] The effects of channel A are called "direct impact" in the most of the literature. However in the following paragraphs we use methodology developed by LESAGE and PACE (2009) to interpret estimates from spatial panel models. They use the term "direct impact" to define the effects of channel B and D. To avoid confusion we label effects of channel A as "first round effects".

dimension) with respect to the number, scale and characteristics of firms located in their territory. Dummy variable approach averages out these differences, which may result in biased estimates of SSEs' impact on economic outcomes of hosting county. Our approach, on the contrary, fully exploits these differences. Thirdly, using SSE-based employment and investment as explanatory variables allows us to estimate models with fixed effects which capture unique characteristics of particular counties. In the dummy variable approach fixed effects are indistinguishable from the effects of SSE functioning.

We analyse the impact of firms located in SSEs on two different measures of counties economic activity: total (including SSE-located companies) employment ($\mathrm{emp_{it}}$) and total investment ($\mathrm{cap_{it}}$)[9,10]. As creating jobs and attracting investment in distressed areas are the main goals of SSE functioning, this approach allows us to check if SSEs fulfil their role as a place-based policy. We start with two panel data models covering 379 counties in the period of 2003-2012 (3790 observations) of the form:

$$\mathrm{emp_{it}} = \alpha_i^{emp} + \beta^{emp}\,\mathrm{emp\_sse_{it}} + \mathbf{X_{it}}\boldsymbol{\gamma^{emp}} + \varepsilon_{it} \qquad (1)$$

$$\mathrm{cap_{it}} = \alpha_i^{cap} + \beta^{cap}\,\mathrm{cap\_sse_{it}} + \mathbf{Z_{it}}\boldsymbol{\gamma^{cap}} + v_{it} \qquad (2)$$

where $\mathrm{emp\_sse_{it}}$ and $\mathrm{cap\_sse_{it}}$ describe activity of firms located in SSE (respectively, total employment and investment) in *i*-th county in year *t;* $\mathbf{X_{it}}$ and $\mathbf{Z_{it}}$ are sets of control variables which determine, respectively, employment and investment in *i*-th county in year *t* but are not directly related to SSE functioning ; $\beta^{emp}, \beta^{cap}, \boldsymbol{\gamma^{emp}}, \boldsymbol{\gamma^{cap}}$ are structural parameters; α_i^{emp} and α_i^{cap} are fixed effects, which capture unique characteristics of *i*-th county; ε_{it} and v_{it} are IID error terms. Variables in vectors $\mathbf{X_{it}}$ and $\mathbf{Z_{it}}$ are either standard determinants of regional employment and investment or the indicators capturing differences between SSE hosting and non-hosting counties identified in preliminary data inspection (see Table 4). In particular, vector $\mathbf{X_{it}}$ consists of variables describing counties demographic structure (share of working age population in total population - $\mathrm{work\_age_{it}}$, share of individuals aged18-24 and share of individuals aged 55-59/64[11] in working age population - $\mathrm{young_{it}}$ and $\mathrm{old_{it}}$, respectively) and corporate sector characteristics (number of registered companies - $\mathrm{firms_{it}}$, manufacturing production per inhabitant - $\mathrm{ind\_prod_{it}}$ and investments of firms located outside SSE – $\mathrm{cap\_non\_SSE_{it}}$). Vector $\mathbf{Z_{it}}$ contains variables characterizing county's economy (share of population living in rural area in total county's population – $\mathrm{rur\_pop_{it}}$), corporate sector ($\mathrm{ind\_prod_{it}}$ and $\mathrm{firms_{it}}$) and labor market (employment outside SSE **-** $\mathrm{emp\_non\_SSE_{it}}$).

Estimates of β^{emp} and β^{cap} based on Model 1 and Model 2, respectively, allows to examine induced effects of SSE functioning described by **channel B** (see Figure 2) and should be interpreted as follows:

[9] It would be interesting to examine the impact of firms operating in SSEs on GDP, however the measure of output is not available at the county territorial disaggregation level.

[10] Detailed description of variables is presented in Table 5.

[11] The upper age limit in this respect is different for men (64) and women (59).

- $\beta^{emp} < 1$ ($\beta^{cap} < 1$) - SSE generates crowding-out effects in the hosting county replacing to some extend employment (investment) outside SSE with employment (investment) in SSE; if estimates of the parameter is not significantly different from zero than full crowding out takes place i.e. SSE employment (investment) is generated at the expense of employment (investment) in the hosting county, but outside SSE territory - the net effect of SSE designation for the hosting region is null;
- $\beta^{emp} = 1$ ($\beta^{cap} = 1$) – SSE creates employment (attracts investment) to the hosting counties, but it does not have any additional impact (neither positive nor negative) on employment (investment) of companies located in this county but outside SSE territory;
- $\beta^{emp} > 1$ ($\beta^{cap} > 1$) - SSE generates crowding-in effects in the hosting county which means activity of firms located in SSE exerts positive impact on employment (investment) of firms located in this county but outside SSE.

Models 1 and 2 allows to examine induced effects of **channel B** but ignores possible impact of **channels C** and **channel D** which is equivalent to the assumption that the spatial effects of SSEs functioning are restricted only to the hosting counties. These assumptions seems very restrictive and counterintuitive: for example, firms located in SSEs may hire employees from neighboring counties and clustering or vertical integration of firms may spur investments in those counties. As indicated by LESAGE and FISCHER (2008), ignoring spatial dependence of this type may result in biased and inconsistent estimates due to omitted variable problem[12].

In order to take into account the above considerations we estimate panel Spatial Durbin Models (hereafter: SDM) of the form:

$$\mathrm{emp_{it}} = \alpha_i^{emp} + \rho^{emp}(\mathbf{Wemp})_{\mathrm{it}} + \beta^{emp}\mathrm{emp_{sse_{it}}} + \mathbf{X}_{\mathrm{it}}\boldsymbol{\gamma}^{emp} + \delta^{emp}(\mathbf{Wemp\_sse})_{\mathrm{it}} + \varepsilon_{it} \quad (3)$$

$$\mathrm{cap_{it}} = \alpha_i^{cap} + \rho^{cap}(\mathbf{Wcap})_{\mathrm{it}} + \beta^{cap}\mathrm{cap_{sse_{it}}} + \mathbf{Z}_{\mathrm{it}}\boldsymbol{\gamma}^{cap} + \delta^{cap}(\mathbf{Wcap\_sse})_{\mathrm{it}} + v_{it} \quad (4)$$

where **W** is an 379×379 weight matrix[13], $\rho^{emp}$and ρ^{cap} are spatial autoregressive coefficient of spatial lags of dependent variables ($(\mathbf{Wemp})_{\mathrm{it}}$ and $(\mathbf{Wcap})_{\mathrm{it}}$, respectively) and δ^{emp} and δ^{cap} are coefficients of spatial lags $(\mathbf{Wemp\_sse})_{\mathrm{it}}$ and $(\mathbf{Wcap\_sse})_{\mathrm{it}}$.

In Models 3 and 4 we assume that the only explanatory variable with spatial lag is $\mathrm{emp\_sse_{it}}$ and $\mathrm{cap\_sse_{it}}$, respectively. If the assumption is not correct, than estimates of parameters δ^{emp} and δ^{cap} may be biased due to omitted spatial dependence between, respectively, variables in vectors $\mathbf{X_{it}}$ and emp_{it} or $\mathbf{Z_{it}}$ and $\mathrm{cap_{it}}$. In order to control for this issue in Models 5 and 6 the set of spatially lagged variables has been broadened with vectors $\mathbf{X_{it}}$ and $\mathbf{Z_{it}}$:

[12] LESAGE and FISCHER (2008) show that a sufficient condition for seemingly non-spatial linear regression resulting in both dependent and independent variables spatial lags is an omitted variable which follows the spatial autoregressive process.
[13] Construction of **W** has been discussed in details in the following paragraphs.

$$\text{emp}_{\text{it}} = \alpha_i^{emp} + \rho^{emp}(\mathbf{Wemp})_{\text{it}} + \beta^{emp}\text{emp\_sse}_{\text{it}} + \mathbf{X}_{\mathbf{it}}\boldsymbol{\gamma}^{emp} + \delta^{emp}(\mathbf{Wemp\_sse})_{\text{it}} + (\mathbf{WX})_{\mathbf{it}}\boldsymbol{\theta}^{\boldsymbol{emp}} + \varepsilon_{it} \quad (5)$$

$$\text{cap}_{\text{it}} = \alpha_i^{cap} + \rho^{cap}(\mathbf{Wcap})_{\text{it}} + \beta^{cap}\text{cap\_sse}_{\text{it}} + \mathbf{Z}_{\mathbf{it}}\boldsymbol{\gamma}^{\boldsymbol{cap}} + \delta^{cap}(\mathbf{Wcap\_sse})_{\text{it}} + (\mathbf{WZ})_{\text{it}}\boldsymbol{\theta}^{\boldsymbol{cap}} + \upsilon_{it} \quad (6)$$

where vectors $\boldsymbol{\theta}^{\boldsymbol{emp}}$ and $\boldsymbol{\theta}^{\boldsymbol{cap}}$ are vectors containing coefficients of spatial lags $(\mathbf{WX})_{\mathbf{it}}$ and $(\mathbf{WZ})_{\text{it}}$.

There are at least three important methodological aspects of Models 3-6 which should be considered. The first is the validity of SDM specification over many other spatial models developed in theoretical literature. We choose SDM for at least two reasons. Firstly, as noted by e.g. LESAGE and FISHER (2009) SDM nests most of other specifications used in empirical research including those with spatially autocorrelated error term like Spatial Error Model (hereafter: SEM). Secondly, SDM gives unbiased coefficient estimates also if the true data-generation process is SEM (see e.g. ELHORST, 2010). That being said, we check validity of SDM over SEM testing following hypothesis:

$H_0: \beta^{emp} + \rho^{emp}\,\delta^{emp} = 0$ (Model 3),

$H_0: \beta^{cap} + \rho^{cap}\,\delta^{cap} = 0$ (Model 4),

$H_0: \beta^{emp} + \rho^{emp}\,\delta^{emp} = 0 \cap \boldsymbol{\gamma}^{\mathbf{emp}} = \rho^{emp}\boldsymbol{\theta}^{\mathbf{emp}}$ (Model 5) and

$H_0: \beta^{cap} + \rho^{cap}\,\delta^{cap} = 0 \cap \boldsymbol{\gamma}^{\mathbf{cap}} = \rho^{cap}\boldsymbol{\theta}^{\mathbf{cap}}$ (Model 6).

Rejection of particular hypothesis means that SDM specification properly describes the data. On the contrary, if the hypothesis is not rejected than the spatial dependence is due to spatially autocorrelated error term.

The second issue is the choice of weight matrix structure. We construct **W** as inverse distance matrix based on geographic distance between centroids of every pair of counties. The matrix has been row-normalized so that the sum of all elements in each row equals 1. We imposed a cut-off distance of 80 km beyond which weights are assumed to be zero. It creates sparse connectivity structure which according to LESAGE (2014) is suitable for empirical purposes. Since the average area of a county equals about 1000 km^2 the assumed cut-off distance is equivalent to assuming that firms located in SSE in one county exert impact on employment and investment of first and second-order neighbouring counties. Creating weight matrix based on rather *ad hoc* assumptions may seem unjustified, however as indicated by LESAGE and PACE (2014) it is a common mistake to believe that the estimates of spatial regression model depend strongly on the weight matrix specification[14].That said, in Section 7 we check the robustness of results to changes in distance cut-off level as well as the way the distance between counties is measured.

The third issue concerns valid interpretation of estimates from SDM. As indicated by LESAGE and PACE (2009) point estimates of spatially lagged variables cannot be directly used to test the hypothesis of spatial spillovers existence. In case of Models 3-6 it means that even positive and significant estimates of

[14] The authors show that this view is a byproduct of incorrect interpretation of estimates from spatial regression models.

$\delta^{emp}$and δ^{cap} can not be interpreted as indication that SSE exerts positive impact on employment or investment outside hosting county. Based on LESAGE and PACE (2009) we construct matrices of partial derivative impacts of the form:

$$\frac{\partial \mathbf{emp}}{\partial \mathbf{emp\_sse}} = \boldsymbol{S}^{emp}(\mathbf{W}) = \left(\mathbf{I}_{\mathrm{NT}} - \rho^{emp}(\mathbf{I}_{\mathrm{T}} \otimes \mathbf{W})\right)^{-1}(\mathbf{I}_{\mathrm{NT}}\beta^{emp} + (\mathbf{I}_{\mathrm{T}} \otimes \mathbf{W})\delta^{emp}) \quad (7)$$

$$\frac{\partial \mathbf{cap}}{\partial \mathbf{cap\_sse}} = \boldsymbol{S}^{cap}(\mathbf{W}) = \left(\mathbf{I}_{\mathrm{NT}} - \rho^{cap}(\mathbf{I}_{\mathrm{T}} \otimes \mathbf{W})\right)^{-1}(\mathbf{I}_{\mathrm{NT}}\beta^{cap} + (\mathbf{I}_{\mathrm{T}} \otimes \mathbf{W})\delta^{cap}) \quad (8)$$

and calculate three scalar summary measures for the impacts' interpretation:

- *direct impact* which is the average of diagonal elements of matrices (7) or (8); it measures the change in counties' employment or capital accumulation due to the change in, respectively, employment or investment of firms located in SSE hosted by this county; *direct impact* differs from estimates of β^{emp} or β^{cap} in Models 3 and 5 or Models 4 and 6, respectively; it measures the influence of SSE exerted not only through the **channel B** (induced effects), but also **channel D** (reverse inductions), since it includes also the impact arising from feedback loop: changes of dependent variable in *i*-th county creates an impulse to neighbouring counties, which in turn impacts dependent variable in *i*-th county; the scale of the feedback loop effects may be calculated as the difference between *direct impact* measure and β^{emp} or β^{cap} estimates; despite the difference that *direct impact* estimates includes channel B and D effects, while β^{emp} and β^{cap} - only channel B effects, the values of *direct impact* estimates should be interpreted in the same way as the estimates of β^{emp} and β^{cap} in Models 1 and 2 (i.e. *direct impact*>1: crowding in; *direct impact*<1: crowding out; *direct impact*= 1: neither crowding in nor crowding out);
- *indirect impact* which is the average of the off-diagonal elements of matrices (7) or (8); it measures the cumulated change in employment or capital outlays outside SSE hosting county due to the change in, respectively, employment or investment of firms located in SSE hosted by this county; *indirect impact* measures spatially induced effects of SSE activity described in **channel C**; positive and statistically significant value of the *indirect impact* indicates that the effects of SSE activity are not restricted to hosting county, but spill over to neighbouring counties; on the contrary, negative and significant estimates indicate that SSEs crowd-out employment or investment from neighbouring counties;
- *total impact* which is the sum of *direct* and *indirect impact*; it measures the aggregated impact of SSE functioning exerted through **channels B**, **C** and **D.**

We estimate Models 1-6 using two estimators. We begin with fixed effects (FE), which assumes homogeneous coefficients of the explanatory variables, but allow for a different constant term for particular counties. The results may be biased due to several methodological problems. The first one is a possible cross-section dependence of error terms. In the analyzed model, this is equivalent to the assumption that there are unobserved time-varying omitted variables common for all counties, which impact individual counties differently. If these unobservable common factors are uncorrelated with the independent variables, the coefficient estimates based on FE are consistent, but standard errors estimates are biased. Therefore, we use the DRISCOLL and KRAAY (1998) nonparametric covariance matrix estimator (DK) which corrects for the error structure spatial dependence[15]. This estimator also addresses the second problem, namely standard errors bias due to potential heteroskedasticity and autocorrelation of the error terms. The third problem is endogeneity due to potential correlation between the regressors and the error term. It is alleviated to some extent by using a wide range of control variables however it may not be fully eliminated. One of the possible solutions is to use the instrumental variables estimator. This estimator is asymptotically consistent yet it may be severely biased when applied to such short samples as ours. In Section 7 we assess the severity of the endogeneity problem through modifications to our base regressions i.e. restricting the sample to counties with SSE and enhancing the set of control variables.

Taking into account all of the above restrictions, we use fixed effects (FE) and Driscoll-Kraay (DK) to estimate Models 1-6. That said, we are fully aware that our results ought to be treated with caution – at the very least due to estimation problems typical for panel datasets with as short time dimension as in our sample.

6. Estimation results and implications

Having time dimension in the data set, one should start with examination of variables' stationarity. We use MADDALA and WU (1999) and PESARAN (2007) test[16]. Results presented in Table 5 indicate that all variables are stationary or trend-stationary.

***** Table 6 here*****

We begin with the analysis of employment models i.e. Model 1, 3, and 5.

It follows from the Model 1 (see columns (1) and (2) of Table 7) that **channel B** contributes to an increase in employment in SSE hosting counties. Estimates of β^{emp} amounts to 1.860 and are significantly higher than 1 for both FE and DK estimators (t-test p-values<0.01). Thus, every 100 jobs in firms located in SSE create on average 86 additional jobs in hosting counties outside the SSE.

***** Table 7 here*****

[15] It should be stressed that this type of spatial dependence may be also present in Models 3-6 even if the hypothesis that SEM is the true data-generation process has been rejected. Note that in the SEM specification the error term structure is of the form $u_{it} = \rho(\mathbf{Wu})_{\mathbf{it}} + \varepsilon_{it}$, while in DK estimator it is $u_{it} = \lambda_i f_t + \varepsilon_{it}$ where $f_t = \sigma f_{t-1} + v_{it}$.

[16] We are aware that the results of both tests may be biased. MADDALA and WU test assumes lack of cross-section dependence, which is actually the case for all analysed variables but is most suitable for short and fixed time dimension as in our sample. On the other hand, PESARAN test assumes cross-section dependence but T tending to infinity. Unfortunately, to our best knowledge no test addresses both of the shortcomings simultaneously.

In the next step we estimate Model 3 (see columns (3) and (4) of Table 7) which assumes that spatial effects of SSEs functioning are not restricted to the hosting counties. It allows us to directly test **channel C** and **channel D** of SSE functioning. Estimates of spatial autoregressive coefficient of total employment (ρ^{emp}) and spatial lag coefficient of SSE-based employment (δ^{emp}) are jointly different from zero for both FE and DK estimators indicating that non-spatial specification of Model 1 is not valid. At the same time the estimates of β^{emp} are statistically significant (for both FE and DK estimator *p*-value<0.01) and their value, 1.723, is similar to estimates received from Model 1. That said, to avoid erroneous conclusions we focus on the interpretation of *direct* and *indirect impact* (see column (1), (4) and (2), (5) of Table 8, respectively) instead of δ^{emp} and β^{emp} estimates. Estimates of *direct impact* of SSE-based companies' employment amounts between 1.738 (for FE) and 1.743 (for DK) and are statistically higher than 1 for both FE and DK estimators (Chi^2- test *p*-values<0.01). It confirms the results from Model 1 in terms of the existence and the size of **channel B** effects. The difference between *direct impact* and β^{emp} estimates which amounts to 1.738-1.723=0.015 may be interpreted as the feedback-loop effects of **channel D**. The low value of this difference as well as lack of statistical significance indicate that reverse inductions from increased employment in *i*-th county to neighbouring counties and back to *i*-th county are negligible. In turn the estimates of *indirect impact* of emp_sse_{it} variable are significant both statistically (z-test *p*-value<0.01) and economically. They amount between 1.368 (for FE) and 1.528 (for DK) indicating that an increase in SSE- based employment in a given county substantially increases the employment in neighbouring counties through spatially induced effects (**channel C)**. The scale of these effects may seem surprising but as argued by LESAGE and FISCHER (2008) it cumulates the impact of changes in particular explanatory variable in one region on the dependent variable in all neighbouring regions. In the analysed case it adds up the impact of employment in SSE on all neighbouring counties, which explains relatively high value of the estimate. To confirm that the spatially induced effects are driven by spatially lagged variables and not by spatially autocorrelated error term we test the hypothesis $H_0: \beta^{emp} + \rho^{emp}\,\delta^{emp} = 0$, which is rejected for both FE and DK estimator (Chi^2- test *p*-values<0.01).

***** Table 8 here*****

Next, we estimate Model 5 which opposed to Model 3 includes full set of spatially lagged explanatory variables. There are no major differences between the two models (see columns (5) and (6) of Table 7 and (7) - (12) of Table 8): estimates of *direct* and *indirect impacts* are statistically significant (z-test *p*-values<0.01), *direct impact* estimates are lower and *indirect impact* higher than in Model 3, but the differences are not significant. These similarities indicate that spatially-induced effects between employment in SSE-located companies and total employment in neighboring counties identified using Model 3, has not been driven by omitted spatial lags of remaining control variables.

Then, we analyze investments models i.e. Model 2, 4, and 6.

Estimates from the Model 2 (see columns (7) and (8) of Table 7) indicate that investments in SSE neither crowd in nor crowd out investments in hosting county outside the SSE. The estimates of β^{cap} equals 1.114 (for both FE and DK) and are not significantly different from 1 (t-test p-values>0.1).

In turn, estimates from the Model 4 indicate (see columns (9) and (10) of Table 7 and (1) – (6) of Table 9) that in the case of investments there are no spatially induced effects (**channel C** effects do not exist)**:** ρ^{cap}, δ^{cap} and *indirect impact* estimates are statistically insignificant (p-values>0.1for both FE and DK estimator). Estimates of *direct impact* of SSE-based firms' investment amounts between 1.092 (for FE) and 1.091 (for DK) and are not significantly different from 1 (Chi^2- test p-values>0.1), confirming the results from the Model 2.

***** Table 9 here*****

Lastly, we estimate the Model 6 enhanced with full set of spatially lagged explanatory variables (see columns (11) and (12) of Table 7 and (7) – (12) of Table 9). The results are in line with the ones from the Model 4 as far as FE estimator is concerned: *direct impact* amounts to 1.088 and is not significantly different from 1 (Chi^2- test p-values>0.1), whereas *indirect impact* is not statistically significant. In case of DK estimator *indirect impact* amounts to 0.326 and is statistically significant (z-test p-value<0.01). However, this result ought to be treated with caution as this is the only estimate in which variance-covariance matrix has not been positive definite and spatial effects standard errors have been computed using a modified matrix according to the method proposed by REBONATO and JACKEL (2000).

To sum-up, our results indicate that employment in SSE has substantial positive effect on employment outside the SSE. This effect is not restricted to the SSE hosting county, as assumed by **channel B**, but spills over to neighbouring counties in accordance with spatially induced effects of **channel C**. Non-spatial panel data approach which by assumption eliminates effects of this type, strongly underestimates the true impact of SSE on employment (that's probably why our evaluation of SSEs effect on employment is more optimistic than in most other studies on SEZs). By contrast, reverse inductions or feedback loop effects of **channel D** are negligible. As far as investments are concerned the results show that SSE attract new capital to hosting counties (lack of crowding out effects) but does not crowd in investments outside the SSE, neither in hosting county nor in neighbouring counties.

There are at least two possible complementary explanations of the results, both requiring careful examination, which goes beyond the scope of this paper.

Firstly, SSE-based companies may induce employee commutations from nearby areas (e.g. hosting and neighbouring counties) thus spurring employment outside direct vicinity of SSE territory with insignificant impact on investment. Furthermore, foreign owned companies, which dominate among SSE-based firms, offer their workers relatively high earnings. This constitutes additional purchasing power which is spent and thereby spur employment outside SSEs, in particular in services, which are labour intensive, but do not require large investments.

Secondly, substantial positive effect of employment in SSEs on employment outside the SSEs and no effect of investments in SSEs on investments outside the SSEs could be explained by FDI dominance in the SSEs. Foreign-owned companies and domestic firms in Poland are not neck and neck competitors. The former ones (even those, which operate in low and medium-low technology industries) are generally more technologically advanced than the latter ones. Thus, they do not really compete (nor cooperate) with each other. In fact, foreign owned companies are often strongly integrated with international value chains. As a result, they might not require supplies from local companies and local markets are not necessarily their target markets. If this explanation was correct, then the positive effect of SSEs on employment and investments could falter with domestic firms climbing closer to technological frontier. The more similar the firms in and outside SSEs respectively, the larger the risk of SSEs causing serious distortions and thus, of crowding out effects. In this context, it is worth recalling that some studies for advanced economies identified faltering of benefits from SEZs in the long term (see, e.g. Gobillion, 2012). Hence, our more positive estimates of effect of SEZs on employment and investment than ones obtained in most other studies (cf. Section 2) may not stem only from the fact that we consider spatially induced effects that other studies ignore, but result also from the development gap between Poland that we do analyse, and advanced economies analysed in other studies.

Regardless of which of the above interpretations is appropriate, existence of positive spatially induced effects, even if present only on the labour market, call for the debate on if and how costs of SSEs' creation and functioning should be shared across local governments of SSEs hosting and non-hosting counties. However, designing a scheme for such a cost sharing would be extremely hard: possible faltering of benefits from SSEs would simultaneously change distribution of benefits between counties, which in turn imply a need for adjustment of a cost sharing scheme. Possible non-linearity in effects of SSEs of different characteristics (another issue for future research) may complicate that task further.

7. Robustness analysis

In this section we check the robustness of the results on various changes in modelling approach. For the sake of brevity we present FE estimates only, since the results do not differ substantially when DK estimator is used.

In part I of the analysis (see Table 10 columns (1) and (3)[17]) we check how estimates change when counties belonging to consecutive voivodeships are excluded from the sample. It allows to examine if the results are not driven by above-average impact of SSEs in particular area of the country. We analyse only non-spatial Models 1 and 2 as the spatial dependence structure is disturbed by exclusion of particular voivodeships. The estimates remain highly significant and their dispersion around the full-sample case is reasonably low. Having said that, estimates obtained with the exclusion of Lodzkie voivodeship are lower from the full-sample estimates, which suggest that the point estimate of coefficients for the entire sample should be treated with caution.

Next, in part II we restrict the sample to counties which hosted SSE in any of the analysed years. If counties characterised by lower initial level of economic development were generally more likely to be chosen as SSE locations, than the catching-up process of these regions could inflate the observed impact of SSE designation on regional economic performance. The same problem would arise if general investment attractiveness of counties (not controlled for by the set of explanatory variables) was positively correlated with likelihood of obtaining SSE designation. We also cross-check the analysis with the approach described in part I i.e. exclusion of entire voivodeships from the sample[18]. The results (Table 10, columns (2) and (4)) demonstrate that possible problem of endogeneity related to self-selection of counties for SSE designation is not an important issue in our analysis. It is worth stressing that this type of robustness check is not possible with dummy variable approach.

***** Table 10 here*****

Subsequently, in part III we check if changing explanatory variable in Model 5 from total SSE-based employment (emp_sse_{it}) to the number of newly created jobs in SSE-based companies ($emp\_sse\_new_{it}$)[19] affects the obtained results. This approach controls for the situation in which some of the already functioning companies have been included into SSE so their impact on hosting and neighbouring counties cannot be considered incremental. The significance of *direct* and *indirect impact* estimates[20] remains virtually unchanged as compared to the estimates obtained for the basline specification. The only notable difference is that the *direct impact* estimate of SSE newly created jobs appear somewhat stronger than the effects pertaining to total SSE-based employment.

***** Table 11 here*****

[17] We present only point estimates and t-statistics of $\beta^{emp}$and β^{cap} for Models 1 and 2. Remaining estimates are available upon request.
[18] As in part I we analyse only Models 1 and 2.
[19] Companies investing in the SSEs are required to declare the number of jobs they intend to retain and create after obtaining SSE designation. These numbers are reported and controlled to determine if a given company qualifies for SSE-based benefits.
[20] Estimates of remaining parameters are available upon request.

Next, in part IV we check if the results are not driven by local governments spending. If SSE designation in particular county coincides with more generous public expenditure on e.g. active labour market policies or infrastructure it may create spurious correlation between activity of SSE-based companies and employment or capital outlays outside SSE. We control for this effect by broadening the set of explanatory variables to include local government social and investment expenditure per capita ($social\_exp_{it}$, $invest\_exp_{it}$) in Models 5 and 6, respectively. The results (Table 12[21]) seem unaltered by these changes, though estimates of *direct* and *indirect impact* for added variables prove significant.

***** Table 12 here*****

Finally, in part V, to evaluate robustness of the estimated spatial effects to the assumed spatial dependence structure we run Model 5 and 6 with the use of different weight matrices (Table 13). We construct three alternative weight matrices:

- *Centroids distance 60 km*: inverse distance matrix based on geographic distance between centroids of every pair of counties with a cut-off distance of 60 km beyond which weights are assumed to be zero;
- *Capitals time 60m* and *Capitals time 90m:* inverse distance matrix based on time needed to get by car from one counties' capital to another, according to Google Maps[22]; cut-off distance beyond which weights are assumed to be zero is set at 60 and 90 minutes respectively.

The results for both employment and investments model seem unaffected to the changes of the weight matrix: *direct* and *indirect impact* estimates and their significance is comparable to the ones from the baseline specification.

***** Table 13 here*****

In conclusion, the results are robust not only to the choice of different estimators (as shown in the previous section), but also to exclusions of some of the counties from the sample (part I and II), changes in the set of explanatory variables (parts III and IV) as well as alternative specifications of weight matrix (part V). Relatively small deviations are present in the robustness analysis, but they do not change our main conclusions.

8. Conclusions.

We find that SSEs have substantial positive effect on employment. Employment in a given SSE create employment of almost similar scale outside the SSE in hosting county and almost twice as large in

[21] We analyse only Model 5 and 6 and restrict presentation of the results to direct, indirect ant total impact estimates. Estimates of other models as well as of remaining parameters from Model 5 and 6 are available upon request.
[22] We used Google Distance Matrix API and the data has been gathered on 30th of January 2015.

neighbouring counties. Effect of SSEs on investments is weaker, but still positive. Investments in a given SSE do not crowd in investments outside the SSE, but do not crowd them out either. Hence, investments in SSEs add one to one to capital stock in hosting counties.

Our findings are more optimistic than ones obtained in most other studies on SEZs. This difference may stem from the fact that we take into account spatially induced effects that other studies on the topic ignore. However, other explanations are also possible and require thorough examination. We leave it for future research along with the issues of faltering of benefits from SSEs in the long run, possible non linearity in effects of SSEs of different characteristics, design of fiscal cost sharing scheme, just to mention a few.

Our results are robust to changes in estimation methods, sample composition, set of explanatory variables and spatial weight matrix. That said, they should be considered with some caution – at the very least due to estimation issues typical for panels with a short time dimension.

References

AITKEN, B. and HARRISON, A. (1999) Do Domestic Firms Benefit From Direct Foreign Investment? Evidence From Venezuela, *American Economic Review* 89, 605-618.

BALCEROWICZ L., RZOŃCA A., KALINA L., ŁASZEK A. (2013) Economic Growth in the European Union, Lisbon Council, Brussels.

BILLINGS, S. (2009) Do Enterprise Zones Work? An Analysis at the Borders, *Public Finance Review* 37, 68-93.

BLOMSTROM, M., GLOBERMAN, S. and KOKKO, A. (2000) The Determinants of Host Country Spillovers From Foreign Direct Investment, CEPR Discussion Papers No. 2350, Centre for Economic Policy Research, London.

BLOMSTROM, M. and WANG, J. (1992) Foreign Investment and Technology Transfer: a Simple Model, *European Economic Review* 36 (1), 137-155.

BONDONIO, D. (2003) Do Local Tax Incentives Affect Economic Growth? What Mean Impacts Miss in the Analysis of Enterprise Zone Policies, Working Papers No. 03-17, Center for Economic Studies, U.S. Census Bureau.

BORENSZTEIN, E., DE GREGORIO, J. and LEE, J. (1998) How Does Foreign Direct Investment Affect Economic Growth?, *Journal of International Economics* 45, 115-135.

BYCZKOWSKA, M. and KACZMAREK, A. (2010) Activity of the Foreign Investors Functioning on the Area Enclosing Kostrzynsko-Slubicka Economic Zone After Polish Accession to the EU, *Acta Universitatis Lodziensis Folia Oeconomica* 242, 91-104.

CIEŚLEWICZ, W. (2009) Regionalna pomoc publiczna jako instrument aktywizacji gospodarczej-przypadek specjalnych stref ekonomicznych w Polsce, *Nierówności społeczne a wzrost gospodarczy. Uwarunkowania instytucjonalne* 15, 318-333.

CIŻKOWICZ P., KOWALCZUK M., RZOŃCA A. (2014) Heterogeneous Determinants of Local Unemployment in Poland, *NBP Working Paper* 188.

CIŻKOWICZ, P., CIŻKOWICZ-PĘKAŁA, M., PĘKAŁA, P. and RZOŃCA, A. (2015) Why Some Special Economic Zones Are More Successful than Others?, *mimeo.*

CRIUSCUOLO, CH., MARTIN, R., OVERMAN, H. and VAN REENEN, J. (2007) The Effect of Industrial Policy on Corporate Performance: Evidence From Panel Data, paper presented at International industrial organization conference, Washington DC, USA.

DEVEREUX, M., GRIFFITH, R. and SIMPSON, H. (2007) Firm Location Decisions, Regional Grants and Agglomeration Externalities, *Journal of Public Economics* 91, 413-435.

DRISCOLL, J.C. and KRAAY, A. (1998) Consistent Covariance Matrix Estimation With Spatially Dependent Panel Data, *The Review of Economics and Statistics* 80(4), 549-560.

DJANKOV, S. and HOEKMAN, B. (2000) Foreign Investment and Productivity Growth in Czech Enterprises, *World Bank Economic Review* 14, 49-64.

EDGE, R.M. and RUDD, J.B. (2010) General-Equilibrium Effects of Investment Tax Incenvites, CAMA Working Paper 3/2010, Centre for Applied Macroeconomic Analysis, Crawford School of Public Policy, The Australian National University.

ELHORST, J.P. (2010), Applied Spatial Econometrics: Raising the Bar, *Spatial Economic Analysis* 5(1), 9-28.

FINDLAY, R. (1978) Relative Backwardness, Direct Foreign Investment, and the Transfer of Technology, *Quarterly Journal of Economics* 92, 1-16.

GE, W. (2012) Special Economic Zone and Technological Learning: an Analytical Framework, *Economics and Finance Review* 2, 1 – 15.

GIVORD, P., QUANTIN, S. and TREVIEN, C. (2012) A Long-term Evaluation of the First Generation of French Urban Enterprise Zones, Working Paper No. G 2012/01, Institut National de la Statistique et des Études Économiques, France.

GIVORD, P., RATHELOT, R. and SILLARD, P. (2011), Place-based Tax Exemptions and Displacement Effects: an Evaluation of the zones Franches Urbaines Program, Working Papers No. 2011-19, Centre de Recherche en Economie et Statistique, France.

GLASS, A.J. and SAGGI, K. (1998) International Technology Transfer and the Technology Gap, *Journal of Development Economics* 55, 369-398.

GOBILLON, L., MAGNAC, T. and LAURENT, H. (2012) Do Unemployed Workers Benefit From Enterprise Zones? The French experience, *Journal of Public Economics* 96, 881–892.

GODLEWSKA-MAJKOWSKA, H. and TYPA, M. (2008), Atrakcyjność inwestycyjna województwa małopolskiego 2006-2008, Instytut Przedsiębiorstwa, Warszawa.

GORG, H. and STROBL, E. (2001) Multinational Companies and Productivity Spillovers: a Meta-analysis, *The Economic Journal* 111(475), 723-739.

GOSS, E. and PHILLIPS, J. (2001) The Impact of Tax Incentives: Do Initial Economic Conditions Matter? *Growth and Change* 32, 236-50.

GWOZDZ, K. and KWIECIŃSKA, K. (2005), Wpływ SSE Euro-Park Mielec na rynek pracy, in DOMAŃSKI, B. and GWOZDZ, K. (Eds) Dziesięć lat doświadczeń pierwszej polskiej specjalnej strefy ekonomicznej Mielec 1995-2005, Instytut Geografii i Gospodarki Przestrzennej Uniwersytetu Jagiellońskiego, Kraków.

HASKEL, J. E., PEREIRA, S. and SLAUGHTER, M. (2002), Does Inward Foreign Direct Investment Boost the Productivity of Domestic Firms? Working Paper No. 8724, National Bureau of Economic Research.

HAVRANEK, T. and IRSOVA, Z. (2011) Determinants of Horizontal Spillovers From FDI: Evidence From a Large Meta-Analysis, CNB Working Paper Series No. 7/2011, Czech National Bank.

HIRASUNA, D. and MICHAEL, J. (2005) Enterprise Zones: a Review of the Economic Theory and Empirical Evidence, Policy Brief, Minnesota House of Representatives Research Department.

HOUSE, C.L. and SHAPIRO, M.D. (2006) Phased-In Tax Cuts and Economic Activity, *American Economic Review* 96(5), 1835-1849.

JARCZEWSKI, W. (2006), Specjalne strefy ekonomiczne jako czynnik przyciągający inwestorów, in DOMAŃSKI, B. and JARCZEWSKI, W. (Eds) Klimat inwestycyjny w województwie małopolskim, Departament Gospodarki i Infrastruktury Urząd Marszałkowski Województwa Małopolskiego, Kraków.

JENSEN, C. and WINIARCZYK, M. (2014), Special Economic Zones – Twenty Years Later, CASE Network Studies and Analyses No 467/2014, Centrum Analiz Społeczno-Ekonomicznych, Warszawa.

JOHANSSON, H. and NILSSON, L. (1997), Export Processing Zones as Catalysts, *World Development* 25(12), 2115–2128.

KOKKO, A., TANSINI, R. and ZEJAN, M. (1996) Local Technological Capability and Productivity Spillovers From FDI in the Uruguayan Manufacturing Sector, *Journal of Development Studies* 32, 602-611.

KOZACZKA, M. (2008) Specjalne strefy ekonomiczne w Polsce 1995-2007, Fundacja CAMPUS, Stalowa Wola.

KRYŃSKA, E. (2000) Polskie specjalne strefy ekonomiczne – zamierzenia i efekty, Wydawnictwo Naukowe Scholar, Warszawa.

LESAGE, J. (2014) What Regional Scientists Need to Know About Spatial Econometrics, *The Review of Regional Studies* 44(1), 13-32.

LESAGE, J. and FISCHER, M. (2008) Spatial Growth Regressions: Model Specification, Estimation and Interpretation, *Spatial Economic Analysis* 3, 275-304.

LESAGE, J. and PACE, R. K. (2009) Introduction to Spatial Econometrics, CRC Press, New York.

LESAGE, J. P. and PACE, R. (2014) The Biggest Myth in Spatial Econometrics, *Econometrics 2*(4), 217-249.

LIN, P. and SAGGI, K. (2005) Multinational Firms, Exclusivity, and the Degree of Backward Linkages, Discussion Paper Series No. 1, Deutsche Bundesbank Research Centre.

LIU, Z. (2008) Foreign Direct Investment and Technology Spillovers: Theory and Evidence, *Journal of Development Economics* 85, 176–193.

MADDALA, G.S. and WU, S. (1999) A Comparative Study of Unit Root Tests With Panel Data and a New Simple Test, *Oxford Bulletin of Economics and Statistics* 61(S1), 631-652

MARKUSEN, J. and VENABLES, A. (1997) Foreign Direct Investment as a Catalyst For Industrial Development, NBER Working Papers No. 6241, National Bureau of Economic Research.

MAYER, T., MAYNERIS, F. and PY, L. (2013) The Impact of Urban Enterprise Zones on Establishments' Location Decisions: Evidence From French ZFUs', Banque de France Working Paper No. 458, Banque de France.

MAYNERIS, F. and PY, L. (2013) The Efficiency of Enterprise Zone Programs Some Conflicting Results? Discussion Papers No. 2013025, Institut de Recherches Economiques et Sociales.

MINISTRY OF ECONOMY (2013), Informacja o realizacji ustawy o specjalnych strefach ekonomicznych. Stan na 31 grudnia 2012 r.

NEUMARK, D. and KOLKO, J. (2008) Do Enterprise Zones Create Jobs? Evidence From California's Enterprise Zone Program, NBER Working Papers No. 14530, National Bureau of Economic Research.

PESARAN, H.M. (2007) A Simple Panel Unit Root Test in the Presence of Cross-Section Dependence, *Journal of Applied Econometrics* 22(2), 265-312

PILARSKA, C. (2009) Specjalne strefy ekonomiczne w Polsce, Wydawnictwo Uniwersytetu Ekonomicznego w Krakowie, Kraków.

REBONATO, R. and JACKEL, P. (2000) The Most General Methodology to Create a Valid Correlation Matrix For Risk Management and Option Pricing Purposes, *Journal of Risk* 2, 17-27.

RODRIGUEZ-CLARE, A. (1996) Multinationals, Linkages, and Economic Development, *The American Economic Review* 86 (4), 852-873.

RYDZ, E. (2003), Functioning of Special Economic Zones in Poland and Their Role in Activating Regional Economy, *Acta Universitatis Carolinae- Geographica* 1, 355-366.

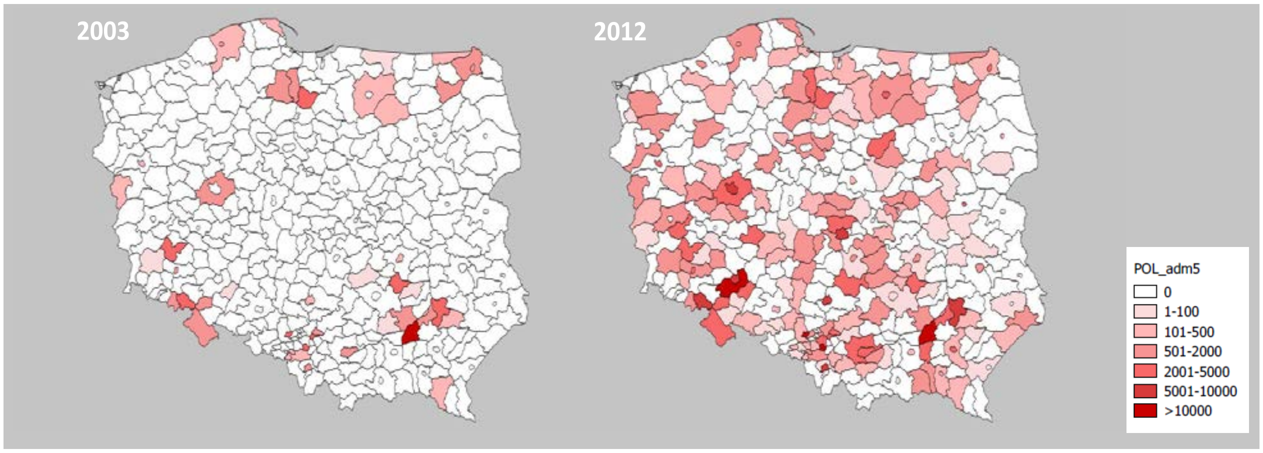
SMĘTKOWSKI, M. (2002), Polish Special Economic Zones as an Instrument of Regional and Industrial Policy, MPRA Paper No. 39184, Munich Personal RePec Archive.

SMOLEŃ, M. (2010), Dynamika działalności Tarnobrzeskiej Specjalnej Strefy Ekonomicznej, *Nierówności Społeczne a Wzrost Gospodarczy* 17, 496-510

TROJAK, A. and WIEDERMANN, K. (2009) Specjalne strefy ekonomiczne i strefy przemysłowe w kształtowaniu rozwoju gospodarczego regionów na przykładzie Polski i Czech, *Prace Komisji Geografii Przemysłu PTG* 12, 133-143.

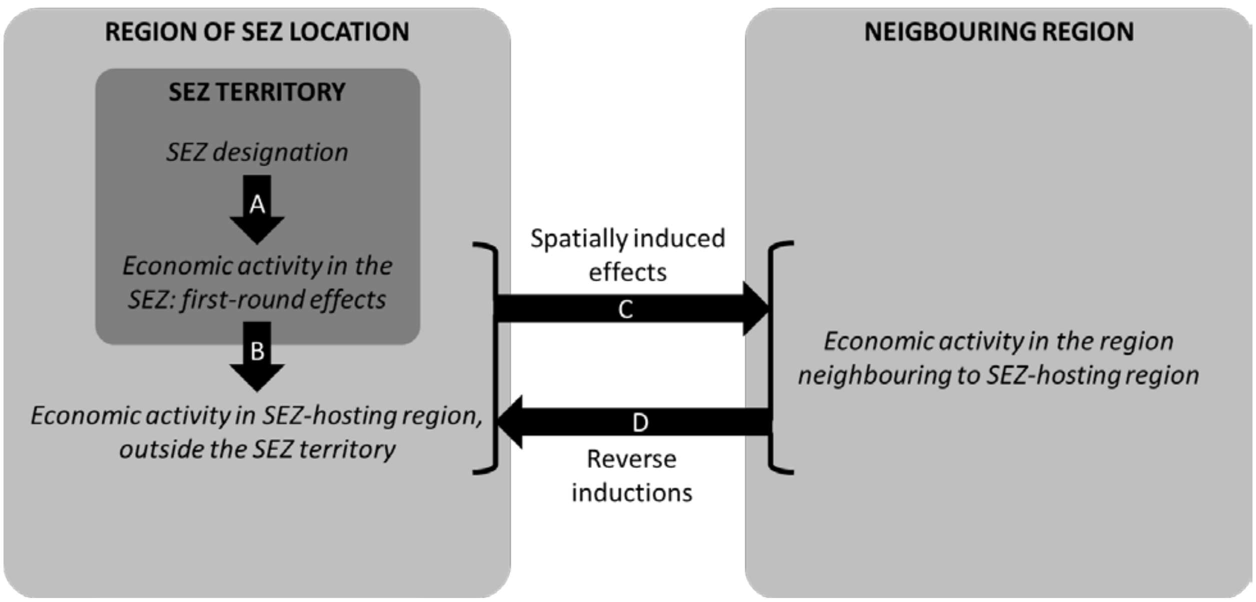
ZASĘPA, B. (2010), Efekty i skutki oddziaływania specjalnych stref ekonomicznych w obszarze rynku pracy ze szczególnym uwzględnieniem katowickiej SSE, in KOLCZYŃSKI, M. and WOJTASIK, W. (Eds), Innowacyjne i społeczne oddziaływanie specjalnych stref ekonomicznych i klastrów w Polsce, Towarzystwo Inicjatyw Naukowych, Katowice.

Figure 1. Number of persons employed in SSE-based companies by county.



Source: own elaboration

Figure 2. Channels of SEZ influence on regional economic activity.



Source: own elaboration

Table1. Maximum financial aid in SSEs.

Period	Maximum financial aid in SSEs
1995 – 2000	Total exemption from PIT and/or CIT of income earned during half the time of SSE existence (in principle during 10 years from the company start of operations in the zone), 50% exemption from PIT and/or CIT in the remainder of operations in the zone.
2001 - 2003	The tax exemption limited to the maximum aid intensity cap set out for each region separately. The maximum aid caps are expressed as percentages of costs related to investment or employment (qualified costs) generated by the company in the zone.
2004 - 2006	Increase of SSE available territory for large companies. From 1 May 2004 the maximum aid intensity caps were set at: ▪ 30% in the territory of Warsaw and Poznań ▪ 40% in the territory of Gdynia, Gdansk, Sopot, Krakow and Wroclaw ▪ 50% in the rest of Poland.
2007 - 2013	The maximum aid intensity caps changed to: ▪ 40% in zachodniopomorskie, pomorskie, wielkopolskie, dolnośląskie, śląskie and mazowieckie (until 2010) voivodeships; ▪ 30% in Warsaw and mazowieckie voivodeship (from 2011 on); ▪ 50% in the rest of Poland.
2014 – now	The maximum aid intensity caps changed to: ▪ 15% in Warsaw (1 July 2014 – 31 December 2017); ▪ 10% in Warsaw (1 January 2018 – 31 December 2020); ▪ 20% in Warsaw-West subregion; ▪ 25% in dolnośląskie, wielkopolskie, śląskie voivodships; ▪ 50% in lubelskie, podkarpackie, podlaskie, warmińsko-mazurskie voivodships; ▪ 35% in the rest of Poland.

Source: own elaboration

Table 2. Structure of fixed capital (PLN) invested in SSE regional groupings by OECD technology intensity definition in 2012.

	high-tech	medium-high-tech	medium-low-tech	low-tech
	(1)	(2)	(3)	(4)
Kamieniogórska	0%	19%	19%	18%
Katowicka	1%	55%	31%	12%
Kostrzyńsko-Słubicka	1%	26%	21%	51%
Krakowska	0%	30%	17%	12%
Legnicka	0%	57%	33%	9%
Łódzka	4%	11%	49%	39%
Mielecka	12%	26%	23%	38%
Pomorska	0%	4%	33%	63%
Słupska	0%	7%	40%	51%
Starachowicka	0%	15%	39%	46%
Suwalska	0%	1%	44%	55%
Tarnowska	0%	11%	66%	22%
Wałbrzyska	0%	37%	28%	35%
Warmńsko-Mazurska	0%	15%	22%	60%
Average	1%	30%	34%	32%

Source: own elaboration, values in rows do not sum up to 100% as some of the PKD activity groupings (Polish equivalent of NACE classification) could not be assigned to a particular OECD technology intensity classes.

Table 3. Selected characteristics of two neighbouring SSE-hosting counties – Jastrzębie-Zdrój and Żory.

		No of SSE-based companies	Employment in SSE	Capital outlays in SSE	Unemployment rate	Average wage	No of registered firms
			persons	*mn PLN*	*% labour force*	*PLN*	*No per 10th pop.*
		(1)	(2)	(3)	(4)	(5)	(6)
2003	Jastrzębie Zdrój	1	179	3.7	17.6	3197.7	607.0
	Żory	3	311	37.8	24.3	1790.0	801.0
2012	Jastrzębie Zdrój	1	154	15.4	8.7	5974.6	648.0
	Żory	14	1313	462.6	10.1	3224.7	856.0

Source: own calculations

Table 4. Comparison of selected economic variables between SSE-hosting non-hosting counties.

		2003				2012				delta 2012-2003			
		all counties	**counties without SSE**	**counties with SSE**	**ttest (p)***	**all counties**	**counties without SSE**	**counties with SSE**	**ttest (p)***	**all counties**	**counties without SSE**	**counties with SSE**	**ttest (p)***
labour market		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
unemployment rate	%	23.4	23.6	23.3	0.740	16.5	17.3	15.8	0.021**	-7.0	-6.3	-7.5	0.003***
long-term unemployment	%	12.4	12.6	12.2	0.430	5.9	6.4	5.5	0.004***	-6.5	-6.2	-6.7	0.105
economic participation rate	%	40.3	39.9	40.6	0.143	38.9	38.1	39.7	0.012**	-1.3	-1.8	-1.0	0.012**
demographic dependency ratio	%	1.5	1.5	1.5	0.386	1.6	1.7	1.6	0.055*	0.1	0.1	0.1	0.031**
average wage	PLN	1952	1905	1994	0.002***	3187	3108	3256	0.001***	1234	1202	1262	0.012**
corporate sector													
industrial production/population	PLN/th persons	10116	7630	12295	0.000***	21155	14584	26914	0.000***	11039	6954	14619	0.000***
capital intensity	PLN th	26.2	21.0	30.8	0.000***	33.5	26.5	39.7	0.000***	7.3	5.6	8.9	0.006***
REGON registered companies/population	-	826	786	861	0.003***	889	843	929	0.002***	63	57	68	0.180
microcompanies/registered companies	%	95.1	95.1	95.1	0.888	95.3	95.3	95.4	0.779	0.2	0.2	0.2	0.545
large companies/registered companies	%	0.11	0.10	0.12	0.000***	0.08	0.07	0.09	0.000***	-0.02	-0.02	-0.02	0.986
self employed/working age pop.	%	10.6	10.3	10.8	0.046*	10.5	10.1	10.9	0.006***	-0.1	-0.2	0.1	0.033**
manufacturing employment/total emp.	%	28.6	25.1	31.7	0.000***	28.3	24.8	31.3	0.000***	-0.3	-0.3	-0.4	0.886
market services employment/ total emp.	%	19.4	17.1	21.4	0.000***	19.9	18.4	21.2	0.003***	0.5	1.4	-0.2	0.000***
non-market services employment/ total emp.	%	21.1	20.8	21.3	0.424	21.4	20.6	22.0	0.058*	0.3	-0.2	0.7	0.014**
local government finances													
revenues/ working age pop.	PLN th	1.9	1.9	1.9	0.727	4.0	4.0	4.0	0.762	2.1	2.1	2.1	0.827
invest. exp./ working age pop.	PLN th	0.3	0.3	0.3	0.576	0.7	0.7	0.7	0.473	0.4	0.4	0.4	0.603
social. exp./ working age pop.	PLN th	0.3	0.4	0.4	0.891	0.8	0.8	0.7	0.050**	0.4	0.4	0.4	0.014**
budget balance	%	-2.1	-2.2	-2.0	0.613	-0.4	-0.5	-0.1	0.330	1.8	1.7	1.9	0.694

Notes: Counties hosting SSE - counties in which an SSE-based company operated for at least 1 year during 2003-2012. The ttest columns (4), (8) and (12) contain p-values of t-student test statistics for statistical significance of differences between average value of a given variable between SSE-hosting and non-hosting counties. Stars denote statistical significance at 1% (***), 5% (**), 10% (*) levels.

Table 5. Variables definitions and sources.

Variable	Name in models		Definition	Source
Variables concerning SSE functioning				
Employment in SSE	emp_sse	-	Total employment in SSE firms in a given county, including both retained jobs of firms functioning prior to SSE designation and newly created jobs after SSE designation	own calculation based on Ministry of Economy data
New employment in SSE	emp_sse_new	-	Newly created jobs in SSE-based companies after SSE designation	own calculation based on Ministry of Economy data
Employment excluding SSE	emp_non_sse	-	Employment in a county exluding employment in SSE firms, computed as a difference between employment in a given county (emp) and total employment of SSE firms (emp_sse)	own calculation based on Ministry of Economy and Central Statistical Office data
Capital in SSE	cap_sse	mln PLN	Capital outlays in SSE firms; computed as amortized capital stock in previous year plus real value of capital investment undertaken during the year	own calculation based on Ministry of Economy data
Capital outside SSE	cap_non_sse	mln PLN	Capital outlays of frims located outside SSE, computed as a difference between total capital outlays in a given county (cap) and capital oultays of SSE firms (cap_sse)	own calculation based on Ministry of Economy and Central Statistical Office data
Regional macroeconomic data				
Employment	emp	-	Average employment in a county, computed as number of unemployed persons divided by the unemployment rate minus the number of unemployed persons	own calculation based on Central Statistical Office data
Capital	cap	mln PLN	Value of gross fixed assets in the corporate sector (enterprises employing more than 9 persons)	Central Statistical Office
Industrial production	ind_prod	PLN	Industiral production per inhabitant, computed as value of industrial production sold by companies registered in a county divided by the number of the county inhabitants	Central Statistical Office
Rural population	rur_pop	per cent	Share of population living in rural area in total population of a county	Central Statistical Office
Working age population	work_age	per cent	Share of working age population 18-59/64 (women/men) in total population of a county	Central Statistical Office
Old working age population	old	per cent	Share of individuals aged 55-59/64s (women/men) in total working age population of a county	Central Statistical Office
Young working age population	young	per cent	Share of individuals aged 18-24 in total working age population of a county	Central Statistical Office
Number of firms	firms	-	Number of firms in National Office Business Register (REGON) per 10000 inhabitants	Central Statistical Office
Social expenditures	social_exp	th PLN	Social expenditures of local governments (counties and communities) per 1 person in working age	own calculation based on Central Statistical Office data
Investment expenditures	investment_exp	th PLN	Investment expenditures of local governments (counties and communities) per 1 person in working age	own calculation based on Central Statistical Office data

Table 6. Panel unit root tests.

Test	Levels/First Difference	Trend	Lags	emp (1)	work_age (2)	old (3)	young (4)	firms (5)	cap_non_SSE (6)	ind_prod (7)	cap (8)	rur_pop (9)	emp_non_sse (10)	emp_sse (11)	cap_see (12)
Maddala and Wu	Levels	No	0	466.764	396.310	331.773	627.799	2167.391***	1005.392***	732.299	800.411	715.396	497.377	587.414***	379.907
	Levels	No	1	701.743	1013.704***	805.079	536.270	841.212**	1161.330***	1451.495***	1196.685***	759.702	713.771	701.416***	665.505***
	Levels	No	2	773.033	693.269	555.207	1469.657***	1297.951***	1197.947***	1917.866***	1177.242***	1203.210***	712.776	755.157***	798.737***
	Levels	Yes	0	516.070	1308.8***	3970.489***	40.486	933.990***	693.170	474.808	604.617	741.547	528.828	439.785*	403.706
	Levels	Yes	1	807.535	483.350	1966.228***	172.631	436.808	658.513	542.634	661.308	481.005	786.006	899.969***	789.759***
	Levels	Yes	2	1148.342***	695.112	1603.332***	812.673*	1034.225***	862.981***	833.338**	849.560**	869.601***	1039.411***	675.641***	1178.377***
	Dif.	No	0	2090.254***	1457.400***	962.613***	1162.389***	5061.809***	3338.958***	2577.257***	3029.7568**	2472.630***	2171.132***	1343.501***	1132.820***
	Dif.	No	1	1508.059***	1555.635***	1126.442***	612.428	1151.955***	1907.578***	2320.247***	1917.481***	1323.468***	1557.324***	847.547***	1053.291***
	Dif.	Yes	0	1438.042***	1267.859***	1822.554***	580.594	3976.751***	2689.631***	2094.348***	2537.249***	1917.734***	1490.419***	1101.003***	1020.143***
	Dif.	Yes	1	1805.264***	1865.735***	1889.946***	976.741***	1054.212***	1786.959***	2297.887***	1618.688***	1566.967***	1810.495***	1011.872***	986.557***
Pesaran	Levels	No	0	-12.858***	18.088	1.465	3.933	6.804	0.356	5.668	-1.445*	6.158	-12.055***	5.244	1.471
	Levels	No	1	0.450	23.893	-5.092***	-1.176	-2.288**	3.822	3.569	0.265	5.080	0.412	3.246	-2.485***
	Levels	No	2	48.364	48.364	48.364	48.364	48.364	48.364	48.364	48.364	48.364	48.364	35.308	35.308
	Levels	Yes	0	-2.303**	25.242	-2.407***	13.548	-5.653***	-6.874***	-1.863**	-6.938***	18.647	-1.013	4.929	-0.739
	Levels	Yes	1	-5.934***	23.962	0.755	10.505	-9.599***	-1.84**	3.480	-2.498***	20.185	-4.45***	6.401	-3.181***
	Levels	Yes	2	62.472	62.472	62.472	62.472	62.472	62.472	62.472	62.472	62.472	62.472	43.872	44.803
	Dif.	No	0	-29.978***	8.190	-9.141***	-7.379***	-3.444***	-16.652***	-14.467***	-17.066***	-2.238**	-29.466***	-0.167	25.634
	Dif.	No	1	-6.215***	22.574	-11.824***	-6.907***	-7.213***	-2.864***	-1.022	-6.660***	2.385	-6.429***	0.622	25.907
	Dif.	Yes	0	-18.487***	-0.133	-2.898***	0.104	6.240	-12.004***	-9.543***	-12.071***	0.198	-18.841***	2.971	22.451
	Dif.	Yes	1	48.364	48.364	48.101	48.262	48.364	48.364	48.364	48.364	48.364	48.364	33.802	47.662

Notes: Upper panel reports the results of MADALLA and WU (1999) panel unit root test. Results shown are chi-square statistics. Lower panel reports the results of PESERAN (2007) panel unit root test (CIPS). Results are Zt-bars. Stars denote rejection of null hypothesis of nonstationarity of panels at 1% (***), 5% (**), 10% (*) levels.

Table 7. Estimation results. Panel and spatial panel models of county-level employment and investment.

Dependent variable: **emp**

Specification	Model 1		Model 3		Model 5	
	Non-spatial panel		**SDM panel with emp_sse spatially-lagged**		**SDM panel with all variables spatially-lagged**	
	FE	DK	FE	DK	FE	DK
	(1)	(2)	(3)	(4)	(5)	(6)
emp_sse	1.860***	1.860***	1.723***	1.723***	1.559***	1.559***
	(24.180)	(12.100)	(23.480)	(13.863)	(22.558)	(18.343)
work_age	0.068***	0.068	0.040***	0.040	0.122***	0.122**
	(4.220)	(1.410)	(2.585)	(0.923)	(7.818)	(2.087)
old	9.763	9.763	-230***	-230**	-1000***	-1000***
	(0.170)	(0.070)	(-3.851)	(-2.000)	(-7.718)	(-7.083)
young	-154.885*	-154.885	-160**	-160	-1800***	-1800***
	(-1.940)	(-0.590)	(-2.084)	(-0.868)	(-17.682)	(-5.512)
firms	1.461***	1.461***	1.434***	1.434***	1.546***	1.546***
	(37.560)	(10.100)	(39.142)	(9.323)	(44.227)	(11.440)
capital_non_sse	1.035***	1.035***	0.983***	0.983***	0.913***	0.913***
	(13.750)	(3.570)	(13.912)	(3.642)	(13.803)	(3.522)
ind_prod	-0.01	-0.01	-0.012*	-0.012*	-0.013**	-0.013***
	(-1.580)	(-1.290)	(-1.953)	(-1.881)	(-2.214)	(-2.601)
W emp_sse	NA	NA	0.919***	0.919***	0.788***	0.7883**
			(4.691)	(2.841)	(3.639)	(2.066)
W work_age	NA	NA	NA	NA	-0.037	-0.037
					(-0.984)	(-0.945)
W old	NA	NA	NA	NA	1400***	1400***
					(8.748)	(7.370)
W young	NA	NA	NA	NA	2500***	2500***
					(17.707)	(6.235)
W firms	NA	NA	NA	NA	-0.845***	-0.845***
					(-8.153)	(-4.238)
W capital_non_sse	NA	NA	NA	NA	-0.073	-0.073
					(-0.363)	(-0.425)
W ind_prod	NA	NA	NA	NA	0.039**	0.039**
					(2.005)	(2.216)
W emp	NA	NA	0.158***	0.158*	0.295***	0.295***
			(6.331)	(1.760)	(9.296)	(8.471)
N	3790	3790	3790	3790	3790	3790
R2	0.71	0.71	0.98	0.98	0.986	0.986
SDM vs SEM	NA	NA	90.23	8.18	640.03	10929.44
			(0.000)	(0.017)	(0.000)	(0.000)
SDM vs Non-spatial FE	NA	NA	41.35	7.27	255.7	405.78
			(0.000)	(0.007)	(0.000)	0.0000

Dependent variable: **cap**

Specification	Model 2		Model 4		Model 6	
	Non-spatial panel		**SDM panel with emp_sse spatially-lagged**		**SDM panel with all variables spatially-lagged**	
	FE	DK	FE	DK	FE	DK
	(7)	(8)	(9)	(10)	(11)	(12)
cap_sse	1.114***	1.114***	1.0941***	1.094***	1.088***	1.088***
	(12.400)	(9.260)	(12.568)	(9.430)	(12.495)	(9.524)
rur_pop	-29.278**	-29.278**	-29.030**	-29.030***	-39.876***	-39.876***
	(-2.080)	(-2.590)	(-2.155)	(-3.838)	(-2.909)	(-3.951)
emp_non_sse	0.053***	0.053***	0.052***	0.052***	0.054***	0.054***
	(13.860)	(4.080)	(14.364)	(4.303)	(14.387)	(4.152)
firms	0.308***	0.308***	0.310***	0.310***	0.310***	0.310***
	(33.570)	(5.140)	(35.076)	(5.825)	(33.710)	(5.305)
ind_prod	0.013***	0.013***	0.013***	0.013***	0.013***	0.013***
	(9.350)	(5.050)	(9.425)	(4.508)	(9.189)	(4.207)
W cap_sse	NA	NA	0.276	0.276	0.26	0.260***
			(1.360)	(1.229)	(1.021)	(3.712)
W rur_pop	NA	NA	NA	NA	137.605***	137.605***
					(3.979)	(7.890)
W emp_non_sse	NA	NA	NA	NA	-0.020**	-0.02*
					(-2.256)	(-1.959)
W firms	NA	NA	NA	NA	-0.021	-0.021
					(-0.886)	(-0.412)
W ind_prod	NA	NA	NA	NA	-0.001	-0.001
					(-0.201)	(-0.165)
W cap	NA	NA	-0.029	-0.029	0.034	0.034
			(-1.090)	(-0.559)	(0.907)	(1.050)
N	3790	3790	3790	3790	3790	3790
R2	0.666	0.666	0.898	0.898	0.864	0.864
SDM vs SEM	NA	NA	2.13	1.53	25.88	1014.87
			(0.344)	(0.465)	(0.000)	(0.000)
SDM vs Non-spatial FE	NA	NA	1.62	1.55	24.25	528.35
			(0.203)	(0.213)	(0.000)	(0.000)

Notes: The estimated models are Models 1 to 6 presented in section 5. Variables definitions are reported in Table 5. Presented regressions were carried out using fixed effects (FE) and Driscoll – Kraay (DK) estimators. Numbers in parentheses are t-statistics in case of non-spatial models (Model 1 and 2) and z-statistics for SDM models (Models 3, 4, 5 and 6). Numbers in parentheses for SDM vs. SEM and SDM vs. non-spatial model tests are p-values for respective test statistics (the tests are presented in Section 5). Stars denote coefficient estimates significance at 1% (***), 5% (**), 10% (*) levels.

Table 8. Estimation results. Spatial panel models of county-level employment. LeSage and Pace (2009) spatial impact decomposition.

Specification	Dependent variable:											
	emp											
	Model 3						Model 5					
	SDM panel with emp_sse spatially-lagged						**SDM panel with all variables spatially-lagged**					
	FE (3)			DK (4)			FE (5)			DK (6)		
	Direct	*Indirect*	*Total*	*Direct*	*Indirect*	*Total*	*Direct*	*Indirect*	*Total*	*Direct*	*Indirect*	*Total*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
emp_sse	1.738***	1.368***	3.106***	1.743***	1.528**	3.266***	1.594***	1.762***	3.356***	1.594***	1.779***	3.373***
	(28.132)	(6.603)	(14.458)	(16.258)	(2.084)	(4.406)	(27.265)	(6.229)	(11.434)	(22.913)	(2.659)	(5.082)
work_age	0.041**	0.007***	0.048*	0.043	0.014	0.057	0.123***	-0.003	0.120*	0.126**	0.013	0.139
	(2.442)	(2.584)	(2.490)	(0.941)	(0.798)	(0.927)	(7.053)	(-0.0579)	(1.975)	(2.025)	(0.155)	(0.984)
old	-230.00***	-41.930***	-270.0***	-230*	-57.955	-290	-980.00***	1500.0***	515.496***	-980.00***	1500.0***	494.995***
	(-3.554)	(-2.774)	(-3.473)	(-1.925)	(-1.051)	(-1.720)	(-7.039)	(8.179)	(4.503)	(-6.483)	(7.082)	(4.924)
young	-150.0**	-28.266*	-180.0*	-140	-10.296	-150	-1700.0***	2800.0***	1000.0***	-1700.0***	2800.0***	1000.0***
	(-2.070)	(-1.902)	(-2.063)	(-0.736)	(-0.234)	(-0.677)	(-18.223)	(15.936)	(7.084)	(-5.558)	(6.395)	(4.867)
firms	1.444***	0.264***	1.708***	1.442***	0.286*	1.728***	1.542***	-0.538***	1.004***	1.540***	-0.531***	1.009***
	(41.938)	(5.817)	(27.149)	(9.480)	(1.653)	(10.968)	(46.769)	(-3.722)	(6.664)	(11.763)	(-2.810)	(6.124)
capital_non_sse	0.975***	0.178***	1.152***	0.955***	0.172*	1.127***	0.908***	0.239	1.147***	0.873***	0.235	1.107**
	(13.993)	(5.721)	(13.718)	(3.282)	(1.758)	(3.903)	(13.598)	(0.939)	(4.164)	(3.248)	(1.083)	(3.079)
ind_prod	-0.011*	-0.002*	-0.013	-0.011*	-0.002	-0.012	-0.011*	0.05*	0.04	-0.011**	0.049*	0.038
	(-1.763)	(-1.659)	(-1.759)	(-1.683)	(-1.227)	(-1.786)	(-1.808)	(1.887)	(1.410)	(-2.167)	(1.924)	(1.385)

Table 9. Estimation results. Spatial panel models of county-level investment. LeSage and Pace spatial impact decomposition.

Specification	Dependent variable:											
	cap											
	Model 4						Model 6					
	SDM panel with emp_sse spatially-lagged						**SDM panel with all variables spatially-lagged**					
	FE (9)			DK (10)			FE (11)			DK (12)		
	Direct	*Indirect*	*Total*	*Direct*	*Indirect*	*Total*	*Direct*	*Indirect*	*Total*	*Direct*	*Indirect*	*Total*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
cap_sse	1.092***	0.267	1.359***	1.091***	0.245	1.336***	1.088***	0.362	1.450***	1.087***	0.324***	1.411***
	(14.745)	(1.445)	(7.562)	(11.150)	(1.400)	(5.490)	(14.751)	(1.353)	(5.476)	(11.262)	(3.348)	(11.591)
rur_pop	-29.015**	0.917	-28.097**	-29.476***	1.208	-28.269***	-39.467***	137.507***	98.039***	-40.260***	142.737***	102.477***
	(-2.242)	(0.893)	(-2.241)	(-3.748)	(0.704)	(-4.106)	(-3.011)	(4.316)	(3.105)	(-3.706)	(7.688)	(8.378)
emp_non_sse	0.053***	-0.002	0.051***	0.053***	-0.002	0.052***	0.054***	-0.019**	0.035***	0.055***	-0.019**	0.035***
	(14.382)	(-1.132)	(12.759)	(4.925)	(-0.597)	(4.567)	(14.419)	(-2.204)	(3.935)	(4.763)	(-1.977)	(3.827)
firms	0.311***	-0.01	0.301***	0.313***	-0.012	0.301***	0.310***	-0.01	0.300***	0.313***	-0.015	0.297***
	(31.934)	(-1.144)	(26.977)	(6.124)	(-0.687)	(7.808)	(30.710)	(-0.460)	(14.422)	(5.576)	(-0.284)	(23.172)
ind_prod	0.013***	-0.0004	0.012***	0.013***	-0.0005	0.012***	0.013***	-0.0009	0.012***	0.013***	-0.0003	0.013***
	(9.025)	(-1.142)	(9.564)	(4.925)	(-0.640)	(5.115)	(8.815)	(-0.248)	(3.311)	(4.664)	(-0.089)	(3.586)

Notes to Tables 8 and 9: The estimated models are Models 3 to 6 presented in section 5. Variables definitions are reported in Table 5. Presented regressions were carried out using fixed effects (FE) and Driscoll–Kraay (DK) estimators. *Direct*, *indirect* and *total impact* definitions are given in section 5. Z-statistics for coefficient estimates are given in parentheses. Stars denote estimates significance at 1% (***), 5% (**), 10% (*) levels.

Table 10. Robustness analysis part I and II. Models 1 and 2 estimated using limited sample.

	Dependent variable:			
	emp		**cap**	
	all counties	**counties with SSE operating for at least 1 year**	**all counties**	**counties with SSE operating for at least 1 year**
	(1)	(2)	(3)	(4)
All counties included	1.8597***	1.8034***	1.1136***	1.1555***
	(12.0956)	(11.1154)	(9.2551)	(8.2089)
Excluded conties belonging to the indicated voivodeship:				
Dolnośląskie	2.005***	1.941***	1.459***	1.490***
	(13.299)	(11.609)	(11.666)	(10.903)
Kujawsko-Pomorskie	1.909***	1.837***	1.169***	1.208***
	(11.297)	(10.454)	(9.175)	(8.177)
Lubelskie	1.872***	1.826***	1.134***	1.171***
	(12.177)	(11.310)	(8.989)	(7.902)
Lubuskie	1.873***	1.814***	1.125***	1.154***
	(12.064)	(11.232)	(9.357)	(8.185)
Łódzkie	1.488***	1.394***	0.854***	0.896***
	(9.102)	(8.231)	(8.167)	(7.973)
Małopolskie	1.7641***	1.7189***	1.0933***	1.1431***
	(11.5764)	(10.524)	(8.227)	(7.4441)
Mazowieckie	1.723***	1.677***	0.957***	0.952***
	(11.778)	(10.958)	(10.123)	(8.561)
Opolskie	1.867***	1.811***	1.141***	1.186***
	(11.934)	(10.864)	(9.400)	(8.261)
Podkarpackie	1.924***	1.867***	1.124***	1.174***
	(11.293)	(10.431)	(9.276)	(8.237)
Podlaskie	1.854***	1.811***	1.118***	1.161***
	(11.850)	(10.964)	(9.114)	(8.151)
Pomorskie	1.858***	1.788***	1.148***	1.210***
	(11.331)	(10.371)	(9.625)	(8.751)
Śląskie	1.906***	1.858***	1.107***	1.176***
	(11.04)	(10.583)	(8.256)	(7.139)
Świętokrzyskie	1.877***	1.821***	1.113***	1.153***
	(12.110)	(11.097)	(9.217)	(8.141)
Warmińsko-Mazurskie	1.882***	1.821***	1.107***	1.150***
	(12.070)	(11.052)	(9.004)	(7.861)
Wielkopolskie	2.004***	1.955***	1.107***	1.156***
	(12.577)	(11.559)	(8.775)	(8.038)
Zachodniopomorskie	1.863***	1.808***	1.100***	1.144***
	(12.130)	(11.073)	(8.463)	(7.528)

Notes: Table 10 reports coefficient estimates for emp_sse and cap_sse. The estimated models are Models 1 and 2 presented in section 5. Variables definitions are reported in Table 5. Presented regressions were carried out using fixed effects (FE) estimator. Columns (1) and (3) present results for the sample including SSE-hosting and non-hosting counties, while columns (2) and (4) present results for a sample including only the SSE-hosting counties (in which a SSE-designated company operated in at least one year). Subsequent rows present estimation results obtained by including counties belonging to all voivodships in the sample or excluding from the sample counties belonging to a given voivodship. t-statistics for coefficient estimates are given in parentheses. Stars denote estimates significance at 1% (***), 5% (**), 10% (*) levels.

Table 11. Robustness analysis part III. Models 3 and 5 with emp_sse replaced with emp_sse_new.

Specification	Dependent variable: emp					
	SDM panel with emp_sse_new spatially-lagged			**SDM panel with all variables spatially-lagged**		
	Direct	*Indirect*	*Total*	*Direct*	*Indirect*	*Total*
	(1)	(2)	(3)	(4)	(5)	(6)
emp_sse_new	2.101***	1.558***	3.659***	1.960***	1.381***	3.341***
	(21.012)	(5.314)	(11.545)	(26.781)	(3.555)	(8.329)
work_age	0.027	0.007	0.034	0.118***	0.044	0.162***
	(1.577)	(1.639)	(1.595)	(6.721)	(0.857)	(2.659)
old	-240***	-62.092***	-300***	-920***	1400***	514.043***
	(-4.759)	(-3.500)	(-4.553)	(-6.561)	(7.745)	(4.361)
young	-230***	-59.476***	-290***	-1800***	2900***	1100***
	(-3.489)	(-3.011)	(-3.448)	(-19.319)	(16.489)	(7.211)
firms	1.432***	0.361***	1.793***	1.527***	-0.540***	0.987***
	(41.354)	(7.150)	(26.751)	(46.144)	(-3.608)	(6.34)
capital_non_sse	1.028***	0.259***	1.287***	0.962***	0.527**	1.489***
	(14.654)	(6.866)	(14.249)	(14.371)	(2.005)	(5.213)
ind_prod	-0.014**	-0.003**	-0.017**	-0.013**	0.089***	0.075**
	(-2.210)	(-2.080)	(-2.201)	(-2.267)	(3.135)	(2.515)
N		3790			3790	
R2		0.985			0.976	
SDM vs SEM		27.74			228.4	
		(0.000)			(0.000)	
SDM vs Non-spatial FE		106.61			680.89	
		(0.000)			(0.000)	

Notes: The estimated models are Models 3 and 5 presented in section 5. Variables definitions are reported in Table 5. Presented regressions were carried out using fixed effects (FE) estimator. *Direct*, *indirect* and *total impact* definitions are given in section 5. Z-statistics for coefficient estimates are given in parentheses. Numbers in parentheses for SDM vs. SEM and SDM vs. non-spatial model tests are p-values for respective test statistics. Stars denote coefficient estimates significance at 1% (***), 5% (**), 10% (*) levels.

Table 12. Robustness analysis part IV. Models 5 and 6 estimated with additional explanatory variables: social_exp and invest_exp respectively.

	Dependent variable:						
		emp				**cap**	
	Direct	*Indirect*	*Total*		*Direct*	*Indirect*	*Total*
	(1)	(2)	(3)		(4)	(5)	(6)
emp_sse	1.579***	1.600***	3.179***	cap_sse	1.085***	0.315	1.400***
	(26.996)	(5.715)	(11.066)		(14.744)	(-1.119)	(5.010)
work_age	0.117***	-0.022	0.094	rur_pop	-37.468***	137.323***	99.854***
	(6.670)	(-0.406)	(1.523)		(-2.8768)	(-3.652)	(2.676)
old	-1000***	1400***	362.056***	emp_non_sse	0.053***	-0.018*	0.035***
	(-7.202)	(6.844)	(2.773)		(-13.807)	(-1.8636)	(3.599)
young	-1700***	2500***	797.154***	firms	0.311***	-0.013	0.298***
	(-18.135)	(12.733)	(4.610)		(31.458)	(-0.581)	(13.546)
firms	1.545***	-0.495***	1.050***	ind_prod	0.013***	-0.0001	0.013***
	(46.657)	(-3.908)	(7.821)		(8.310)	(-0.037)	(3.371)
capital_non_sse	0.894***	0.19	1.083***	invest_exp	210***	-220***	-9.700
	(-12.585)	(0.685)	(3.777)		(4.860)	(-3.134)	(-0.143)
ind_prod	-0.010*	0.049*	0.039				
	(-1.776)	(1.858)	(1.391)				
social_exp	-1700***	2500***	7.400**				
	(-2.597)	(3.402)	(2.372)				
N		3790		N		3790	
R2		0.985		R2		0.866	
SDM vs SEM		497.77		SDM vs SEM		24.47	
		(0.000)				(0.0004)	
SDM vs Non-spatial FE		219.78		SDM vs Non-spatial FE		22.82	
		(0.000)				(0.0004)	

Notes: The estimated models are Models 5 and 6 presented in section 5. Variables definitions are reported in Table 5. Presented regressions were carried out using fixed effects (FE) estimator. *Direct*, *indirect* and *total impact* definitions are given in section 5. Z-statistics for coefficient estimates are given in parentheses. Numbers in parentheses for SDM vs. SEM and SDM vs. non-spatial model tests are p-values for respective test statistics. Stars denote coefficient estimates significance at 1% (***), 5% (**), 10% (*) levels.

Table 13. Robustness analysis part V. Models 5 and 6 estimated with alternative spatial weight matrices.

Weight matrix	Dependent variable: emp *Direct*	emp *Indirect*	emp *Total*	cap *Direct*	cap *Indirect*	cap *Total*
	(1)	(2)	(3)	(4)	(5)	(6)
Basic specification:						
Centroids distance 80 km	1.594***	1.762***	3.356***	1.088***	0.362	1.450***
	(27.265)	(6.229)	(11.434)	(14.751)	(1.353)	(5.476)
Alternatvie specification:						
Centroids distance 60 km	1.660***	1.708***	3.368***	1.086***	0.417*	1.503***
	(28.380)	(8.280)	(15.4007)	(14.780)	(1.900)	(6.810)
Capitals time 60m	1.623***	1.559***	3.182***	1.099***	0.531***	1.630***
	(21.468)	(9.565)	(16.764)	(14.948)	(2.958)	(8.692)
Capitals time 90m	1.582***	2.026***	3.608***	1.086***	0.563**	1.648***
	(21.251)	(10.532)	(17.887)	(14.733)	(2.546)	(7.318)

Notes: Table 10 reports coefficient estimates for emp_sse and cap_sse. The estimated models are Models 5 and 6 presented in section 5. Variables definitions are reported in Table 5. Presented regressions were carried out using fixed effects (FE) estimator. Z-statistics for coefficient estimates are given in parentheses. *Direct*, *indirect* and *total impact* definitions are given in section 5. Stars denote coefficient estimates significance at 1% (***), 5% (**), 10% (*) levels