Spatial impact of entrepreneurial zones: firm, city, and inter city evidence

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Spatial impact of entrepreneurial zones: firm, city, and inter-city evidence

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Abstract

We investigate the impact of a decade-long large public entrepreneurial infrastructure investment programme in an emerging European economy. Using a unique dataset, we examine the short-run firm, city and inter-city effects of entrepreneurial zones (EZs). EZs have a positive impact on business investment, sales and especially export revenues of firms located within them. Positive economic effects of EZs are limited on host and neighbouring towns and cities, decrease with distance and eventually become negative. This points to the localised nature of EZs effects and their potential for spatial redistribution and clustering of economic activity.

Keywords:

Entrepreneurial zones, spillover effects, firm performance, exports, economic incentives, emerging economies

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1. Introduction

Inequalities in economic development existed long before the Industrial Revolution (Milanovic et al. 2010), but have been increasing since the 1980s (Enflo et al., 2014; Rosés & Wolf, 2019) at both national and regional levels (Kokocinska & Puziak, 2018) threating social cohesion and political stability in Europe. A number of policies have been introduced to address the issue, but we are still unable to explain the discrepancies between development paths (Iammarino et al., 2019). Therefore, any successful policy instruments can be valuable for the analysis and identification of success factors that could be transferred and applied to other economies.

One of these instruments is the entrepreneurial zone (EZ), which dates back to ancient Greece (Delos Island) and was first established in its modern form in Ireland in 1956 as an Export Processing Zone (EPZ). These local business zones differ from other policy instruments in that they do not require public investment, only space that is attractive to investors thanks to the existence of physical infrastructure, tax breaks, less bureaucracy, and cheap labour (Moberg, 2017, pp. x, 2-3). By attracting investors, both foreign and domestic, EZs create new jobs, increase productivity (Liu, 2002), competitiveness and exports, and thus reduce the backwardness of less developed areas (Dawid et al., 2018; Moberg, 2015). These effects are not limited to firms within zones or to the local units in which zones are located (Aggarwal, 2019; Sosnovskikh, 2017; J. Wang, 2013). Inter-firm linkages cause spillover effects for neighbouring areas (Ciccone & Hall, 1996), facilitating their convergence.

However, many EZs fail due to poor policy coordination, weak incentives, or insufficient linkages with the rest of the economy (Bartlett et al., 2019). The phenomenon of failing EZs is particularly relevant for emerging economies that cannot afford to experiment with the implementation of new policy instruments (Boarnet, 2001). The evaluation of EZs is also inconsistent in the literature (Billings, 2009; Neumark & Kolko, 2010; Wilder & Rubin, 1996) and there is a lack of precise analysis of EZ performance. The literature is at a stage where mainly quasi-experimental studies are conducted across administrative units. This is mainly due to the poor availability of micro-level data (Ambroziak & Hartwell, 2018), although some attempts have been made here as well (see, for example: Ciżkowicz et al., 2017; Jenkins & Arce, 2016; Neumark & Kolko, 2010). This can be misleading in urbanised areas, where firm performance is influenced by numerous other factors (Frick et al., 2019), including government transfers and a natural propensity for high growth (Moberg, 2015). As a result, the literature still lacks more detailed analyses of how EZ and non-EZ units operate, with a precise indication of the direct effects of EZs on enterprises located in the zones, and the indirect effects affecting neighbouring areas.

Our research addresses these issues and answers questions about the spatial effectiveness of EZs (Givord et al., 2018). Drawing on an entrepreneurial ecosystems (EE) perspective that highlights that most entrepreneurial decisions and resource accumulation take place at the level of cities and towns (Spigel, 2017) and that the competitive advantage of businesses is embedded in local context (Audretsch and Belitski, 2017), we seek to gain a broader understanding of the impact of public investment in physical entrepreneurial infrastructure in the form of EZs on firm, city and inter-city economic performance. Moreover, building on previous studies that highlighted how EEs are spatially bounded (Audretsch and Belitski, 2021), we also investigate whether effects of EZs are limited to the cities of their founding and adjacent local administrative units, or whether they extend to a wider space. In doing so, we help to fill the research gap outlined in recent calls for entrepreneurial activity research to focus more on the local context (Audretsch and Belitski, 2017) and to explore individual, intrinsic EE features (Spigel, 2017).

One of reasons for limited research on the localised effects of EZs is lack of relevant data. Our study utilises rich dataset covering populations of firms and of EZs in Croatia, one of emerging European economies. The emergence of EZs in Croatia dates back to the 1980s, but reached its peak in 2004-2013, with approximately 500 million euros invested in EZs during that decade. Of this amount, more than 23% was invested in the form of non-repayable central government incentives for EZs. By 2013, 1,308 EZs had been formally established, but less than a third (451) were active. EZs were established by all towns and cities in Croatia and in most cases one or two zones were established in every location (Alibegovic et al., 2019). Such a large number of zones and investments made provide unique research material to answer our questions. In addition to the database of EZs, we use unique microdata from Croatian firms located in and outside these EZs. We answer whether EZs exhibit an impact on firms within their borders and on the local economy, including sales, exports, wages, and capital investment. Finally, we investigate whether EZs generate spatial spillovers to neighbouring cities and towns. In this way, we unveil the mechanisms of EZs-induced spatial externalities.

The study is unique in several aspects. It uses extensive firm-level microdata on all key firm performance characteristics inside and outside EZs, allowing to directly calculate the impact of EZs without any proxies. Second, we track the effects of EZs several years after their establishment, as zones gain stability. Third, the precise location of firms allows us to calculate effects in a thorough spatial distribution and assess effects at firm, city and inter-city level. Such comprehensive studies have not been conducted before (for initial attempts, see Alibegovic et al., 2019). Our results may be useful for potential investors, including foreign companies, policy makers, and researchers investigating policy instruments to support the entrepreneurship-driven local economic development.

The results of our study suggest that zones contribute to increased sales and export revenues, with the role of zones in increasing export competitiveness being particularly evident. Investments in EZs also have multiplier effects by facilitating private investment in fixed assets. These effects are not limited to firms operating within the EZs or the local units in which the zones are located. Inter-firm linkages generate spill-over effects and thus have a positive impact on sales and job creation in neighbouring cities and towns. However, these effects vanish or turn negative with greater distances, confirming the predictions of previous literature on spatially localised nature of EE features (Audretsch and Belitski, 2021).

The remainder of the paper is organised as follows. First, in Section 2, we provide a literature review on firm, city and inter-city effects of EZs. We then present the empirical strategy (Section 3). In Section 4, we report the empirical results, while Section 5 concludes.

2. Conceptual framework

2.1. Entrepreneurial zones within entrepreneurial ecosystems framework

Stimulating local economic development is a challenging task. It requires strategies that support land and labour at low cost; investment in infrastructure, provision of well-trained human capital, industry-university linkages and support for entrepreneurial culture, social networks, openness, and risk-taking (Chepurenko et al., 2019; Fritsch & Storey, 2014; Fritsch & Wyrwich, 2017; Spigel, 2017; Iammarino et al., 2019). These strategies must be place-sensitive as they should recognise the varying environments of companies in different locations. The relevance of the external environment for competitive ability, business performance, and thus economic development has been known in the literature at least since the Marshall's (1920) work on industrial districts and elaborated in the literature on competitiveness (Buckley et al., 1988), clusters and regional innovation systems (Asheim et al., 2011), and more recently EE perspective (Acs et al., 2017; Audretsch and Belitski, 2017; Chepurenko et al., 2019; Fritsch & Storey, 2014; Spigel, 2017; Stam, 2015; Stam & van de Ven, 2021; 2021; Wurth et al., 2021). While all these lines of thought share common traits, in this study we rely on EE perspective to explain the mechanism of EZs' impact on firm and local economic performance. The central premise of this EE framework is that the competitive advantage and business performance are embedded in the socioeconomic and institutional context of cities (Audretsch & Belitski, 2017; Stam & van de Ven, 2021) or regions (Wurth et al., 2021), where most of entrepreneurial decisions and resource accumulation takes place (Spigel, 2017).

EE framework identifies factors such as local culture, networks, infrastructure, and policies as key drivers of the entrepreneurship-driven local economic development (Audretsch and Belitski, 2021; Fritsch & Wyrwich, 2017). In recent years, research has attempted to unravel many of these factors, including their spatial boundaries, intrinsic attributes, configurations and enhancing policy instruments (Wurth et al., 2017). However, these studies have focused more on the intangible elements of EE, such as culture or networks, rather than physical infrastructure. This gap cannot be ignored, as physical infrastructure is a pillar for developing intangible proximities that improve organisational competitiveness and performance, and increase returns on local investments by enabling resource accumulation, savings and knowledge sharing spillovers, interactions and opportunity recognition (Boschma, 2005; Spigel, 2017; Audretsch and Belitski, 2021).

Among the different types of physical infrastructure, entrepreneurial infrastructure such as EZs are of particular interest (Audretsch & Belitski, 2019). EZs refer to spatially limited areas equipped with different types of infrastructure, such as energy, utilities, transport, and communication infrastructure. They can be general or targeted at specific sectors such as manufacturing, services, or logistics. The co-location of firms in such zones provides opportunities for knowledge sharing and savings on infrastructure investment, allowing companies to invest in other segments of their activities and thus develop. Additionally, these effects spill over beyond the boundaries of the zones as their tenants establish vertical upstream and downstream linkages or interact horizontally with rivals in their cities or neighbouring areas.

The above reasoning argues for policymakers interested in boosting regional and local economic performance to invest in the development of EZs as one of the main and most effective EE features (Fritsch, 2013; Audretsch and Belitski, 2021). Strengthening entrepreneurship, promoting export competitiveness, attracting foreign investors, and improving business productivity are among commonly known channels through which EZs reduce backwardness and raise living standards in the local units where these zones are located (Ambroziak & Hartwell, 2018). However, not all EZs successfully accomplish this task, and their effects are not fully understood or clear (Moberg, 2015). Accordingly, in the following sections we evoke the theoretical background of EZ effects at the firm, city, and inter-city level, which our study seeks to reveal in the empirical investigation.

2.2. Firm level effects of entrepreneurial zones

The performance and competitiveness of companies depend on three groups of factors: their own activities, industrial characteristics, and external environmental attributes, the last two implying the need to integrate with the local economy (Lauridsen, 2004). Penetrating national and international

markets requires financial resources, capacity and competence building, and vertical and horizontal linkages with competitors, suppliers, and customers (Bartlett et al., 2019). These processes can be an insurmountable barrier for SMEs, as they do not have their own resources and investing in such activities involves high costs. EZs help firms overcome such barriers by providing administrative and professional support, creating links with vertically related business units, and sharing resources between firms (Frick & Rodríguez-Pose, 2021). In general, the impact of EZs can involve changes in economic structure, employment growth (Bartlett et al., 2019; Ciżkowicz et al., 2017; Jensen, 2018), and productivity (Ciccone & Hall, 1996) and innovation (Delgado et al., 2014), reducing economic backwardness and development disparities at regional and national levels (Rodriguez-Pose & Wilkie, 2019).

EZs facilitate vertical linkages and synergies in production and distribution chains (Bartlett et al., 2019). If EZs succeed in strengthening EEs, they can become a competitive advantage for firms (Delgado et al., 2016), facilitating the entry of new firms and attracting domestic and foreign firms from other locations (Devereux et al., 2007). Findings from numerous countries indicate a positive impact of EZ-related foreign investment on employment (Ciżkowicz et al., 2017; Neumark & Kolko, 2010), restructuring and export competitiveness (Bartlett et al., 2019; Yeung et al., 2009). Foreign ownership motivates domestic suppliers to improve their performance through technology transfer (Lin & Saggi, 2005), training, organisational and management support, and technical and financial assistance (Lee, 1999).

The benefits associated with locating in the zones are particularly important for manufacturing firms (Marshall, 1890). The proximity of firms within the same industry allows for the sharing of physical and technological infrastructure, the transfer of knowledge, the exchange of employees, the pooling of resources, and through these processes, the increase in technological and cost competitiveness of firms (Delgado, 2020; Delgado et al., 2016; Henderson, 2003). Moreover, once manufacturing firms locate in an EZ, backward and forward linkages are created within and between sectors, relating to suppliers and partners in the former and customers in the latter (Amendolagine et al., 2013; Jenkins & Arce, 2016; Lauridsen, 2004; Lin & Saggi, 2005; Ottaviano & Puga, 1998). However, in less developed regions, it can be difficult to create and strengthen such linkages due to lack of appropriate workforce skills (Bartlett et al., 2019), adequate accessibility, high local prices, and poor quality (Frick & Rodríguez-Pose, 2021).

Zones also generate demand for labour, wage increases (J. Wang, 2013), and improved working conditions through competition between firms for the most skilled and talented workers (Ciżkowicz et al., 2017) as a way to retain their human capital and encourage the transfer of knowledge and technology from their competitors (Glass & Saggi, 2002; Liu, 2008), albeit with some exceptions (C. C. Wang et al., 2010). Firms operating in zones are motivated to attract the best employees by offering higher wages and better working conditions, thus having an advantage in location-related costs and benefits, including

localised labour and technology, tax advantages, physical infrastructure, proximity to market, sources of materials (Lee, 1999). This allows us to formulate our first hypothesis and specific hypotheses as:

H1: Location within EZs improves firms' performance

H1a: Location within EZs improves firms' sales revenues

H1b: Location within EZs improves firms' export revenues

H1c: Location within EZs allows firms to pay higher wages

H1d: Location within EZs increases firms' investment in fixed assets

2.3. City and inter-city effects of investment in entrepreneurial zones

The linkages and synergies of EZs extend beyond zonal boundaries (Amendolagine et al., 2013) and can have positive (Ciżkowicz et al., 2017) and negative (Neumark & Kolko, 2010) effects on the economic activity of hosting and other areas (Lin & Saggi, 2005; Amendolagine et al., 2013; Jenkins & Arce, 2016). If EZs succeed in strengthening EEs, they can become a source of local competitive advantage (Delgado et al., 2016). The positive effects of EZs have been reported within and between localities in terms of employment (Ciżkowicz et al., 2017; Neumark & Kolko, 2010), restructuring and export competitiveness (Bartlett et al., 2019; Yeung et al., 2009). These effects bear the potential to ignite convergence and economic development across the space. From a policy perspective, they form the core of argument for investments of local and regional authorities (Montinola et al., 1995) as well as the central government (Ng & Tang, 2004) in the establishment and development of EZs.

By establishing linkages with domestic suppliers and distributors and by providing an opportunity for horizontal knowledge and technology spillovers EZs can facilitate the entry of new firms and attract firms from other locations (Devereux et al., 2007). EZs induces technology transfer (Lin & Saggi, 2005), training, organisational and management support, and technical and financial assistance (Lee, 1999), thereby motivating external partners to improve their performance. Reliance on EZs firms as suppliers provides the advantage of competitively priced and quality intermediates (Jenkins & Arce, 2016). The diversity and quality of inputs facilitate access to knowledge, skills and innovative business practices that would otherwise not be available (Delgado et al., 2014). The cost benefits of zones put pressure on other firms to increase their cost efficiency. This allows us to develop our second hypothesis and specific hypotheses:

H2: Investment in EZs positively impacts local economic performance in host cities

H2a: Investment in EZs positively affects sales revenues in host cities

H2b: Investment in EZs positively affects export revenues in host cities

H2c: Investment in EZs positively affects wage levels in host cities

H2d: Investment in EZs positively affects business investment in host cities

According to the concept of EEs, their effects may have spatial impact at the level of not only cities (Audretsch and Belitski, 2017) but also entire regions (Wurth et al., 2021). Hence, it can be assumed that EZs can also affect the economic activity and performance of neighbouring towns and cities (Alibegovic et al., 2019; Delgado et al., 2014; Delgado & Zeuli, 2016; Frick et al., 2019; Jenkins & Arce, 2016). The cost efficiency pressure exerted by EZs on external firms can lead to the relocation of businesses from other areas and increase market entry rates in the localities surrounding EZs, negatively impacting the economic activity of other towns and cities (Billings, 2009; Neumark & Kolko, 2010; Wilder & Rubin, 1996). The flow of labour between firms, even outside the zones, generates externalities and improves the efficiency of resource allocation and the performance of firms in neighbouring cities (Ciżkowicz et al., 2017; Henderson, 2003) by reducing extensive learning costs (Liu, 2008). However, attraction of most skilled and most talented workers towards zones may leave non-zone firms with an inferior workforce and these effects may be transmitted to other cities if they do not compensate for the growing gap between them and EZ firms (Frick & Rodríguez-Pose, 2019). Modern technological advances facilitate collaborations between firms and thus spillover effects over greater distances within the country (Frick & Rodríguez-Pose, 2021). Whether these effects extend spatially and how wide their spatial extent is has been hypothesised in the literature, but, to the best of our knowledge, no previous study has attempted to model the spatial effects of EZs as a specific component of EE. This allows us to formulate the final hypotheses:

H3: Investment in EZs positively influences economic performance outside their host cities

H3a: Investment in EZs positively influences sales revenues outside their host cities

H3b: Investment in EZs positively influences export revenues outside their host cities

H3c: Investment in EZs positively influences wage levels outside their host cities

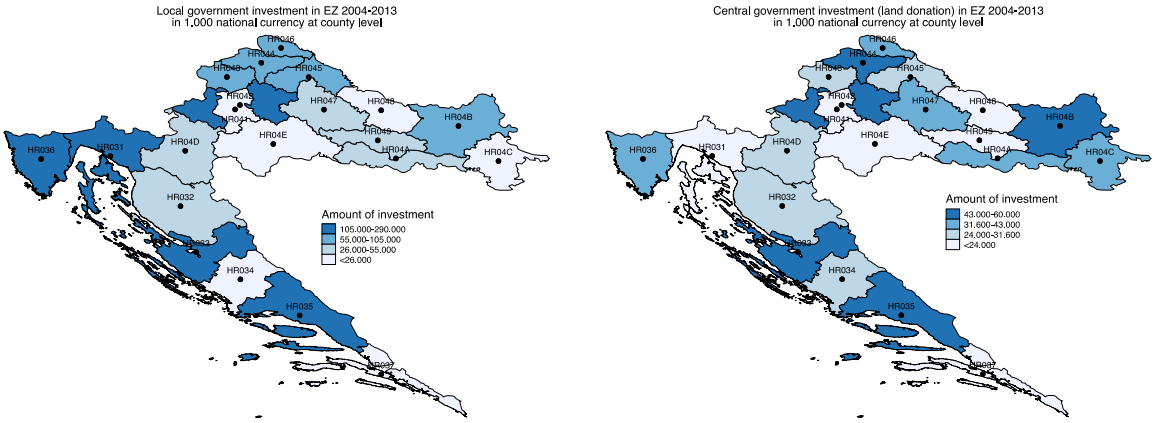
H3d: Investment in EZs positively influences business investment outside their host cities

2.2. Public investment in entrepreneurial zones in Croatia

The analysis is set in Croatia, a small and open emerging European economy with a growing entrepreneurial environment. EZs in Croatia are part of entrepreneurial infrastructure, which also includes institutions supporting entrepreneurship such as local and regional development agencies, science and technology parks, business incubators, entrepreneurial centres, business parks, competence centres, free zones, etc. They provide amenities to entrepreneurs such as energy, utilities, transport, and communication infrastructure. EZs are created for a specific type of activity and can be manufacturing, service and logistics zones. Their establishment serves the strategic aims of sustainable economic development, improved living standards and economic convergence by strengthening entrepreneurship and general economic activity, increasing the share of manufacturing in the structure of the economy, and creating new jobs.

Between 2004 and 2013, the Croatian government launched a large-scale project of land donations to cities and towns to establish EZs. Through these donations, the establishment of a total of 1,308 EZs was envisaged. However, in more than a third of 556 Croatian towns and cities, the process was stopped soon after it started due to local bureaucratic barriers. Elsewhere, the central government approved land grants worth about 700 million Croatian kuna (approximately 92.4 million euro) for the activation of EZs, combined with over 3 billion kuna (approximately 396 million euro) of investment from local governments (regional and municipal). Less developed districts received more investment from both sources than their developed counterparts, suggesting that EZs are located in places that really need development (Pamic & Belullo, 2018). Figure 1 shows the volume of local and central government investment in established EZs in Croatian NUTS3 regions.

Figure 1: Investment in EZs in 2004-2013 at NUTS3 level (thousands in national currency)



Source: Own calculations based on MINGO.

The process of public investment in EZs took place during one of the most severe economic crises in Croatian history, when many firms in Croatia and the rest of Central and Eastern Europe were struggling with stringent bank lending policies that made it difficult for them to maintain liquidity, investment, and competitiveness. These challenges were also present in the post-crisis period (Vujanovic et al., 2021), suggesting that access to EZ amenities (i.e., lower costs of infrastructure development and grant opportunities to strengthen competitiveness and entrepreneurial competence) may have played an important role for the economic performance of EZ firms and towns and cities with which they were linked. Our dataset allows us to trace the effects of these zones on firms located in them, their towns and cities, and neighbouring localities three years after the end of the programme and a time when country was well on the way to economic recovery.

3. Data and empirical strategy

3.1. Datasets

Our empirical strategy is undertaken at the firm and city level of aggregation. As such, it combines several data sources. In the first step, we obtained financial data on the population of firms from the Croatian Financial Agency (FINA), a public agency to which all companies must submit their annual financial reports. The second data source originated from the Croatian State Audit Office. In 2014, the audit of public investments in the EZs between 2004 and 2013 took place. From the audit reports we extracted data on the amount invested in EZs by central and regional (local) governments. Finally, we obtained access to the register of firms that operated in EZs in 2016, three years after the end of the programme from the Croatian Ministry of Economy, Entrepreneurship and Crafts.

These three sources gave us access to data on approximately 74,000 companies (i.e. the population of active firms in 2016 in Croatia) distributed across all 556 Croatian towns and cities, of which 1,523 operated in one of the EZs. We constructed a unique firm-level dataset that allowed us to assess the impact of location in EZs on the performance of firms located within their boundaries (measured by sales, exports, wages, and business investment) against the performance of firms operating in the same cities and towns but located outside EZs, i.e., to test our H1. Firm-level data were then aggregated at the level of individual towns and cities to construct measures of local economic performance. The aggregated dataset was used to test our other hypotheses, i.e., to analyse the city (H2) and inter-city (H3) impact of public investment in the EZs on the local economic performance, also defined as aggregate sales, exports, wages, and business investment.

3.2. An empirical strategy for firm-level analysis

The impact of EZs on firms located within their boundaries was analysed using a nearest neighbour matching (NNM) procedure from the family of treatment estimators (Imbens and Wooldridge, 2009; Guerzoni and Raiteri, 2015). Treatment analyses evaluate the performance of a category of treated observations (in our case firms located in EZs) relative to the performance of non-treated observations (in our case firms outside the EZs but in the same towns or cities) by matching treated and non-treated firms based on characteristics that are as similar as possible. These techniques are widely used in analyses of the impact of public policies or incentives (treatments) across a wide range of fields such as entrepreneurship, exports or innovation (Stojcic et al., 2020).

Treatment estimators are also known as potential outcome models since each observation (individual, firm, etc.) in the model has a defined outcome for each treatment level. Taking y_1 as the potential outcome of an individual treatment recipient (e.g. a firm located in EZ), y_0 would correspond to the

outcome that would have been obtained if no treatment had been received (e.g. a firm was not located in EZ). In practice, only one of the potential outcomes is observed, resulting in a missing variable bias. The treatments such as location within EZs are prone to non-random assignment bias into treated category. As a quasi-experimental approach and a non-parametric method, the NNM procedure allows to address this issue. It relies on the conditional independence assumption (CIA), which suggests that selection into the treatment is as good as random, subject to a set of observable covariates. For this reason, the control group must be formed from non-treatment units (e.g., firms not located in EZs) that share many characteristics with treated firms.

The NNM procedure proceeds in two stages. In the first stage, the propensity scores of the probability of receiving treatment (being located in EZ) are estimated using probit or logit estimation. In the second stage, the propensity score distance between the treated and untreated groups is minimised by selecting one control observation for each treated unit. In the pairing procedure, we perform exact matching on the origin of firm ownership (domestic or foreign) and on the type of local administrative unit (town or city), i.e. we match treated firms to those with the same ownership type and those in same towns or cities. The final result is calculated as the difference in average potential outcomes between the two groups (treated and non-treated). This is known as the Average Treatment Effect on the Treated (ATT) and takes following form:

$$ATT_{nnm} = \frac{1}{N}\sum_{i=1}^{N}(Y_i(1) - Y_i(0)) \quad (1)$$

where Y(1) and Y(0) are the average potential outcomes of treated and non-treated groups of units *i*, and N refers to the number of all units (firms) *i*.

In our analysis we include a categorical variable for foreign ownership among control variables as it is often associated with superior skills, knowledge, and technology in emerging European economies such as Croatia (Stojcic and Orlic, 2020). Firm size is measured by the natural logarithm of the number of employees and its squared term. The model also includes the natural logarithm of the amount of public production subsidies received by individual firm. The natural logarithms of the share of enterprises in the city divided by the number of enterprises in the country and the share of enterprises in the industry in the total number of enterprises in the city control for urbanisation and localisation externalities, respectively. The net entry of firms controls for market dynamics. Finally, we control for the distance of the local administrative unit from the regional (county) centre and for the type of the local administrative unit as a town or a city. Table 1 provides the definitions of the variables while their descriptive statistics can be found in Table A1 in the Online appendix.

Table 1: Description of variables used in the analysis at firm level

Variable	Definition
Dependent variables	
Sales – ln	Sales revenues of an enterprise in 2016
Exports – ln	Export revenues of an enterprise in 2016

Average wages – ln	Average wage paid by an enterprise in 2016
Investment – ln	Amount of enterprise investments in 2016
Treatment variable	
Zone	Categorical – 1 if an enterprise is located in EZ
Control (matching) variables	
Foreign	Categorical – 1 if an enterprise is majority foreign owned
Size – ln	Number of employees of an enterprise
Size^2 – ln	Number of employees of an enterprise squared
Subsidies – ln	Share of public production subsidies in the total revenues of an enterprise
Urbanization – ln	Share of enterprises in the city (town) in the number of enterprises in the country
Localization – ln	Share of enterprises in the industry *i* in the number of enterprises in the city (town)
Net entry	Entry minus exits of enterprises from a city (town) with a lag of one period
Distance - ln	Distance of a city (town) from the county (regional) administrative centre in km
Type of locality	Categorical – 1 if the local administrative unit is a city (town) (reference category)

Source: Authors.

3.2. An empirical strategy for city and inter-city analysis

Our analysis also aims to investigate whether public investment in EZs had any positive impact on the local economic performance of towns and cities in which these zones were located, and whether these investments created spatial spillover effects on the economic performance of other towns and cities. As explained previously, data on the level of public investment in EZs from both central and regional (local) governments was taken from the audit reports of the public investment programme in EZs between 2004 and 2013. These data refer to the total amounts of public investment made for this purpose to individual town or city. Data from the FINA dataset was aggregated at the level of all 556 Croatian towns and cities to construct measures of local economic performance three years after the programme ended (in 2016).

The nature of our objectives in this part of the analysis makes spatial econometric methods a logical candidate for an estimation technique. Since we are only able to measure performance in one year (2016), we have used a spatial autoregressive cross-sectional technique in which the local economic performance (sales, exports, wages, and private business investment) of towns and cities is modelled as a function of the same performance achieved in other towns and cities in the same year, the level of central and regional (local) government public investment in EZs achieved over the duration of public investment programme in EZs (2004-2013) and a set of control variables.

Among the control variables, we include the unit labour costs, the share of labour costs in sales revenue of a town or a city to control for its cost competitiveness, the net entry of firms in a town or a city to measure business dynamism, the distance of a town or a city from the county administrative centre, and population density of a town or a city as a proxy for demand and workforce availability. The model also incorporates the share of public production subsidies in the revenue of enterprises based in a town or a

city, the Ellison-Glaeser specialisation index and the share of imports in the total revenue of local businesses. Finally, dummy variables are included for each county. The specification used to examine the impact of public investment in EZs on local economic performance of city *i* is defined as:

$$lnPerformance_i = c_0 + \rho \sum_{j=1, j\neq i}^{n} w_{ij} lnPerformance_j + \beta_1 Govinv_i + \beta_2 Reginv_i + \gamma_3 Ulc_i + \gamma_4 Entry_i + \gamma_5 Distance_i + \gamma_6 Density_i + \gamma_7 Subsidies_i + \gamma_8 Specialization_i + \gamma_9 Imports_i + \sum_{k=1}^{21} County_k + u_i \quad (2)$$

In equation (2), the dependent variables are defined as natural logarithms of local economic performance: sales, exports, wages and private business investment. The term $\sum_{j=1, j\neq i}^{n} w_{ij} lnPerformance_j$ refers to the interaction effect between the dependent variable of a town or a city *i* and all other cities *j*, $j \in \langle 1, \dots, i-1, i+1, \dots, 556 \rangle$. The *ij*-th component of the non-negative spatial weights matrix $\mathbf{W}_{556\times556}$ in equation (2) is w_{ij}, while the spatial autoregressive coefficient (ρ) measures the impact of changes in the local economic performance of other cities *j* on the city *i* (and vice versa). Since our model takes a semi-logarithmic (log-linear) form, the coefficients β are city-level semi-elasticities of public investment in EZs while γ's refer to the semi-elasticities of the control variables.

By including the spatial lag of the dependent variable, we expect that the effects of EZs on other cities are realised through linkages between the home business sector and businesses in other areas. The spatial distance between towns and cities is modelled using three distinctive spatial weights matrices. In the baseline specification, spatial correlation is restricted to neighbouring towns and cities using the contiguity spatial weight matrix. We then allow an extended spatial correlation using contiguity spatial weights matrix, including first- and second-order adjacent spatial units (neighbours and neighbours of neighbours). Finally, we allow for full spatial correlation across the entire population of towns and cities using the inverse distance spatial weights matrix. This allows us to assess the extent to which EZs effects are spatially bounded. In line with common practice, the elements of all spatial weights matrices are standardised.

As noted by LeSage and Pace (2009) spatial models cannot be interpreted based on parameter estimates because changes in the performance of one spatial unit create so-called feedback loops, a partial feedback effect that passes through another spatial unit and returns to the original one. For this reason, it was necessary to take an additional step and calculate direct (within-city) and indirect (inter- or between-city) effects before interpreting the results. For this reason, our findings are also interpreted in terms of direct and indirect effects. Table 2 provides the variable description used to estimate city and inter-city effects, while Table A2 in the Online Appendix provides their descriptive statistics.

Table 2: Description of variables used in the analysis of city and inter-city effects

Variable	Definition
Dependent variables (Performance)	
Sales – ln	Sales revenue in 2016 of companies in a town or a city
Exports – ln	Export revenue in 2016 of companies in a town or a city
Average wages – ln	Average wage paid in 2016 by companies in a town or a city
Employment – ln	Number of employees in 2016 in companies in a town or a city
Investment in EZs	
Govinv	Value of investment in EZs by central government in 2004–2013 (land donation)
Reginv	Value of investment in EZs by local (cities or counties) governments in 2004–2013
Control variables	
ULC - ln	Share of labour costs in sales revenue in 2016
Entry	Entry minus exits of enterprises from a town or a city in *t–1*
Distance - ln	Distance of a town or a city from the county (regional) administrative centre in km
Density - ln	Population density of a town or a city
Subsidies - ln	Share of public production subsidies in total enterprise revenues
Specialization	Ellison-Glaeser index of specialization (geographical concentration)
Imports	Share of imports in total revenues of local enterprises
County dummies	Categorical – 1 for each county

Source: Authors

4. Analysis

The analysis was conducted in several steps as described earlier. We first examine whether location within an EZ induces additionality effects on sales, exports, wages and private investment of firms located within its boundaries. We then examine whether public investment in EZs induces positive intra- and inter-city effects on the same economic outcomes aggregated at the town or city level.

4.1. Effects of entrepreneurial zones at firm level

Using the nearest neighbour matching procedure, we evaluated the performance of firms located within EZs compared to their counterparts operating in same cities but outside the EZs' boundaries.[5] The results of analysis (Table 3) reveal that location in EZs established in 2004-2013 period affects three out of four analysed dimensions of firm performance. Firms located in EZs generate higher sales revenues and invest more than firms located outside the zones. The largest impact is observed for exports. Firms located in EZs generated more than twice as much export revenue as similar firms located

[5] Before interpreting the results, all model diagnostics were evaluated (available in the Tables A4-A5 and Figure A1 in the Online Appendix), which fully support the validity of our model. For expository convenience, we report here only the results of the treatment analysis. The results of the first stage (determinants of the probability of location in EZ) can be found in Table A3 in the Online Appendix.

outside EZs due to locational advantages. This is consistent with arguments of EE literature on the effects of physical infrastructure and provides support to our first hypothesis (except the impact on wages).

<Table 3 about here>

Table 3: The impact of EZs on companies operating within them.

Performance measure	The EZs effect
Sales revenues – ln	0.109 (0.021)***
Export revenues – ln	1.123 (0.246)***
Average wage – ln	0.009 (0.015)
Business investment – ln	0.038 (0.012) ***

Note: ***, ** and * indicate a significance of 1%, 5% and 10% respectively. Standard errors in parentheses. Nearest neighbour matching estimates.
Source: Authors' calculations.

4.2. City and inter-city effects of entrepreneurial zones

One of theoretical justifications for the existence of EZs are hypothesised positive spillover effects to other firms in their area and to neighbouring towns and cities. EZ infrastructure in Croatia was financed from two public sources between 2004 and 2013, namely land donations from the central government and financial investments from county and city governments. From a policy perspective, it is important to assess whether one or both channels enable improved economic performance of businesses in cities and their adjacent areas.

<Table 4 about here>

Table 4: City and inter-city effects of public investment in EZs

	First neighbours		**First and second neighbours**		**Full spatial correlation**	
Outcome/Effect	Local (direct)	Spatial (indirect)	Local (direct)	Spatial (indirect)	Local (direct)	Spatial (indirect)
Sales – ln						
Central government investment	0.01*** (0.002)	0.001*** (0.0001)	0.02*** (0.002)	0.0003** (0.0001)	0.02*** (0.002)	-0.002*** (0.0005)
Local government investment	0.001** (0.0005)	0.00004** (0.00002)	0.001** (0.0005)	0.00002* (0.00001)	0.002*** (0.0005)	-0.0002*** (0.0001)
Export – ln						
Central government investment	0.07*** (0.014)	0.01 (0.008)	0.07*** (0.014)	0.007 (0.007)	0.07*** (0.014)	-0.02 (0.013)
Local government investment	0.003 (0.003)	0.001 (0.001)	0.004 (0.003)	0.0004 (0.0005)	0.005 (0.003)	-0.001 (0.001)
Wages – ln						

Central government investment	0.001** (0.0004)	-0.00001 (0.000002)	0.001** (0.0004)	-0.00001 (0.00000)	0.001* (0.0004)	-0.00003 (0.00002)
Local government investment	0.0002* (0.0001)	-0.000002 (0.00000)	0.0002* (0.0001)	-0.00000 (0.00000)	0.0002* (0.0001)	-0.00001 (0.00000)
Business investment – ln						
Central government investment	0.02*** (0.005)	0.001** (0.0005)	0.02*** (0.005)	0.001 (0.0004)	0.02*** (0.005)	-0.005*** (0.001)
Local government investment	0.0004 (0.001)	0.00002 (0.0001)	0.001 (0.001)	0.00002 (0.00003)	0.001 (0.001)	-0.0002 (0.0002)
Observations	556		556		556	

Note: ***, ** and * indicate significance of 1%, 5% and 10% respectively. Detailed printouts in Appendix (Tables A6-A8)
Source: Authors' calculations

Table 4 presents the results on the main variables of interest, those referring to the central and local government investment in EZs. In each model the local (direct) effects refer to the cities and towns where the EZs are located and the spatial (indirect) effects refer to the effects on neighbouring areas. The table shows that investment in EZs has a positive impact on sales and export revenues, wage levels and business investment. The size and significance of local (direct) effects are relatively stable and suggest that for every 100,000 Croatian kuna (about 12,000 euros) of central government investment in EZs, sales increases by 1%, private business investment by 2% and exports by 7%. The impact on wage growth is more modest, with an investment in the above value increasing the average local wage by 0.1%. Local (county and city level) public investment in EZs has even more modest impact. Here we find an impact on sales of 0.1% and on wage levels of 0.02%.

The inter-city (spatial) effects of EZ investment are found in terms of sales and business investment. These inter-city effects are positive on adjacent areas but turn negative once the full spatial correlation is allowed. This part of the study clearly signals that most of the effects belong to the cities where the investments are made, while the spatial effects are limited to neighbouring areas and decrease with distance from EZs. Two important implications arise from this finding. First, it appears that investments in EZs lead to redistributive effects and spatial concentration of economic activity in areas that have been successful in activating EZs. Second, our findings confirm the arguments of EE literature about the spatially bounded effects of these systems or their individual features. Overall, we find support for both our H2 and H3.

5. Discussion and concluding remarks

The aim of the study was to trace the firm, city, and inter-city effects of EZs. The results obtained are consistent with the existing literature, but reveal much more detailed spatial mechanisms of EZ establishment and operation. EZs, understood as investments in entrepreneurial infrastructure, aim to balance economic development across the country and across regions (Ambroziak & Hartwell, 2018).

Successful EZs are expected to accelerate local economic activity by supporting entrepreneurship, attracting domestic and foreign investors (Alibegovic et al., 2019; Delgado & Zeuli, 2016; J. Wang, 2013), bringing new technologies, and creating market opportunities within and outside the country (Amendolagine et al., 2013; Lin & Saggi, 2005; C. C. Wang et al., 2010). Evidence from other countries such as Taiwan, Korea or India (Aggarwal, 2012) provided support to public investment in EZs. In Poland it was found that proximity within zones facilitates success of companies within their boundaries (Ciżkowicz et al., 2017). Zones were also found to increase demand for services in adequately populated areas (Frick & Rodríguez-Pose, 2021)

Croatia has introduced investment in EZs into its economic policy on a large scale with the aim of promoting entrepreneurship and through entrepreneurial activity local and regional EEs as well as balanced economic development. The importance of this experiment should be seen in the context of the fact that in the 1990s and 2000s, the country was excluded from most offshoring processes that triggered the development of other Central European countries (Stojčić & Aralica, 2018). With all this in mind more than 700 million kuna (about 100 million euros) were invested by the central government in the development of business infrastructure between 2004 and 2013. As our findings reveal, EZs had beneficial effects on firm performance, and both central and local government incentives created positive city and inter-city effects. However, the success of the programme was partial as not all zones survived (Alibegovic et al., 2019).

What makes a EZ successful is the success of the firms operating in it. Our results confirm the findings of other studies that EZs support their firms in increasing sales revenues (Neumark & Kolko, 2010), and private business investment in capital assets (Ciżkowicz et al., 2017). Zones are particularly important for export competitiveness (Bartlett et al., 2019; Yeung et al., 2009). As our results show, firms in EZs have doubled their export revenues, suggesting that EZs help firms overcome the rather high sunk costs of exporting, such as acquiring knowledge, technology, skills, and fixed assets (Lin & Saggi, 2005; Liu, 2008; C. C. Wang et al., 2010), as well as integrating into global value chains (Schindler & Kanai, 2019). This would be an insurmountable barrier for many companies, especially small and medium enterprises, which can be overcome by networking with companies in the industry or related industries and with the EZ management department to gain knowledge and share tangible and intangible resources (Jenkins & Arce, 2016; Lauridsen, 2004).

Perhaps the most important part of the analysis is that related to the spatial effects of investment in EZs. Our results suggest that these effects are not limited to firms operating in the zones or their local communities, and furthermore, these externalities are positive up to a certain distance. Firm-to-firm interactions generate spillover effects to neighbouring cities, generating incremental impact on sales revenues which is in contrast to the results of Bartlett et al. (2019). Therefore, EZ firms are most likely

to create linkages with EEs, as Liu (2008) confirms for foreign firms and their backward linkages. However, these spillover effects decrease with distance from the zone. They are much smaller within the first order neighbours and even smaller within the second order neighbours, while they disappear completely or even become negative when the whole country is considered. This observation can explain the results of (Ciżkowicz et al., 2017), which point to a possible smaller impact of Polish EZs on neighbouring counties. These findings confirm that the success of EZs depends on them being embedded in the local economy and creating a specific EE that supports local businesses in various ways. The greatest benefits achieved closer to EZs testify to the existence of local mechanisms of knowledge and technology diffusion between firms in the immediate area.

Exports appear to be the main mechanism driving all zonal effects. The influences on export revenues are strictly localised and several times higher than those on other indicators. This suggests that zones bring benefits to exporters, such as the transfer of benefits to related firms (Lin & Saggi, 2005) and integration into value chains (Amendolagine et al., 2013; Schindler & Kanai, 2019). Future business-related infrastructure interventions should therefore be designed to emphasise the attractiveness of the export economy, rather than focusing on particular sectors. These localised export economies, together with the beneficial spillover effects of increased sales revenues, can therefore be seen as an intermediate product of the integration of local firms with both local suppliers and partners and global value chains in terms of customers (Jenkins & Arce, 2016).

Together with all previous evidence, this suggests that investments in EZs have the strongest impact on exporters, which rather points to a natural reprogramming of these zones into EPZs that are more successful globally than regular EZs (Engman et al., 2007). However, this should be done with caution, as our conclusion contradicts the findings of (Ciżkowicz et al., 2017), who did not identify any spatial effects of Polish EZs on investment outside the zones, either in the host county or in neighbouring counties. Although they do not offer an empirical explanation, they suggest that foreign firms located mainly in EZs may be too advanced to cooperate or compete with local firms and only induce a low-skilled service sector demand for labour. Another explanation is given by (Lin & Saggi, 2005) which states that when a multinational firm establishes an exclusive supplier in a local area, this contributes to a decrease in backward linkages and local welfare; or when resources, materials and intermediate goods are imported from the zone to the firm (Bartlett et al., 2019).

The results of the study show the positive impact of EZs on local economic performance and reveal the mechanism behind this process. Zones improve the performance of businesses within their boundaries and the overall local economy. We confirmed the theoretical model of Glass & Saggi (2002) that an increasing number of economic agents in EZs increases the demand for labour, which induces competition for the best workers by offering better employment conditions, both to gain access to local

knowledge and to prevent its outflow. Our analyses confirmed that EZs induce wage increases at local level (J. Wang, 2013) and provide the basis for improving the performance and competitiveness of economic agents thereafter (Liu, 2008), contrary to the findings of Lynch and Zax (2010).

Our analysis was conducted with a time horizon of three years from the completion of the EZ investment programme. In this respect, it is difficult to talk about long-term effects of these measures. However, some evidence suggests that locally-targeted incentives do not induce economic growth in the medium to long run (5 years) due to frequent firm closures and the lack of an exact match with the local labour market and available services, resulting in a lack of self-sustaining economic returns (Givord et al., 2018). Similarly, O'Keefe (2004) highlights employment effects, pointing out that they do not last longer than 6 years and even become negative after this time. Analysing the time horizon of our research, we can conclude that, on the one hand, the implementation of zones in Croatia has shown promising short-term effects as a first step towards sustainable development, but on the other hand, it needs to be studied in a longer perspective in the future.

Future incentives for EZs development should also include measures used in some local units to attract businesses and fill zones, such as removing financial barriers, supporting networks, and mediating the removal of administrative barriers for entrepreneurs. These mechanisms are particularly important in the case of zones planned to be established in remote and less developed areas with low economic activity, as reaching a critical mass of entrepreneurs for the sustainable development of the zone may prove particularly difficult in such areas.

Finally, any study has its limitations. Research on the effects of instruments such as special economic zones is scarce and valuable due to the lack of data that would allow such analyses. Our study adds to the existing body of knowledge, while being conducted in the context of an emerging European economy. Moreover, we cannot measure the long-term effects of EZs in the current framework. Future research should contribute to the robustness of our results by investigating whether they hold in other contexts and over different time periods. Finally, there are other effects of economic zones that may be equally important, such as those on business innovation, that our study was unable to examine. These remain a challenge for future researchers.

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