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Are special economic zones in emerging countries a catalyst for the growth of surrounding areas?

Susanne Frick and Andrés Rodríguez-Pose*

What is the impact of special economic zones (SEZs) in emerging countries on the economy of surrounding areas? Despite the popularity of SEZs as a policy tool in virtually all developing countries around the world, there is little evidence to date which systematically analyses this question. This paper sheds light on this topic by analysing the economic growth spillovers generated by 346 SEZs in 22 emerging countries. The analysis uses night light data as a proxy for SEZ performance as well as the economic performance of the surrounding area in order to overcome the lack of reliable economic indicators when measuring SEZ performance. It also relies on a novel data set on SEZ characteristics in order to understand how far they impinge on the economic fortunes of the surrounding areas. The results indicate that SEZs have a positive impact on the economic performance of the areas surrounding the zones. However, the growth spillovers are limited in area and display a strong distance decay effect: the magnitude of the impact decreases continuously up to 50 km. Furthermore, zones located in more remote areas seem to have less of an impact on neighbouring areas. Moreover, factors assumed to have a facilitating effect, such as the manufacturing base in the country and political stability, do not seem to matter on a structural basis.

Keywords: Special economic zones, economic growth, growth spillovers, distance decay effect, developing countries

JEL codes: L52, O14, O24, O25, R11

1. Introduction

Special economic zones (SEZs) are often regarded by policymakers as an instrument not only to stimulate investments and generate exports and employment, but also to dynamize the economy of surrounding territories. They, thus, often form part

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of broader development strategies. The fiscal and non-fiscal incentives offered by governments to firms aiming to locate in an SEZ are not given just with the aim of securing new investments and jobs within the zones, but also with the objective of achieving greater overall returns in regional development. Zones are, therefore, expected to create growth spillovers that can be reaped by economic agents in the local, regional and national economies. By attracting new businesses and providing them with a favourable investment climate, governments expect SEZ incentives to payoff through spillovers to local economies and economic growth in the long term (Farole, 2011; Picarelli, 2016; Zeng, 2016).

However, despite the popularity of SEZs as a policy tool in virtually all developing countries, little is known about the extent to which SEZs contribute to dynamizing the economy of the areas that surround them or whether their influence is simply bounded to within their borders. A systematic analysis of this question has mainly been hindered by data limitations and has generally been restricted to individual country case studies (see, for example, Alder et al., 2016; Picarelli, 2016; Wang, 2013). This paper aims to shed light on this under-researched topic by quantitatively analysing the impact of the growth of 346 SEZs in 22 emerging countries on the economic performance of their surrounding areas. In order to overcome the lack of reliable economic indicators when measuring SEZ performance, the analysis uses night light data as a proxy for SEZ performance as well as for the economic performance of the surrounding area. It furthermore relies on a novel data set of SEZ characteristics in order to understand how far those impinge on the economic fortunes of the surrounding areas.

We find that, on average, SEZ growth has a positive impact on the economic performance of surrounding areas. However, this impact is limited in area with a strong distance decay effect: the magnitude of the effect decreases continuously and is felt in distances of up to 50 km. Furthermore, zones located in more remote areas seem to generate fewer spillovers to be reaped by neighbouring firms and economic actors. Moreover, many factors assumed to have a facilitating effect on the generation of growth spillovers, such as the level of industrialization and the political stability of the country where the zone is located, do not seem to matter on a structural basis.

The paper is structured as follows. Section 2 provides an overview of the literature on spillover mechanisms and empirical evidence. Section 3 introduces the model and the data, while section 4 presents and discusses the results. Section 5 concludes and draws policy implications.

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2. The role of spillovers

2.1. Spillover mechanisms

Spillovers to local economies can be defined and measured by static and dynamic economic outcomes as well as socioeconomic outcomes (Farole, 2011). The first type of spillovers coming from SEZs to local economies are static and economic in nature and can be generated in a short period of time. Some instances include primary investments by SEZ-based firms, regional employment and export generation, additional government revenues or foreign exchange earnings (Farole, 2011; Farole and Winkler, 2014; Zeng, 2016). The second type of economic outcomes can be defined as *dynamic* effects which tend to be long-term structural and developmental legacies. Some examples are the upgrading of local skills and technologies, and improved local innovation capacity, economic and structural diversification, or increased openness (Farole, 2011). All those factors are crucial for better firm productivity and long-term sustainable economic growth in regions. The third type are the socioeconomic consequences of SEZ policies, including the quality of employment, gender-related impacts, and compensation or resettlement practices, as well as land acquisition problems. All those outcomes stem from interactions between SEZ firms, firms in surrounding areas and workers, including backward and forward linkages, labour pooling and labour mobility between firms, as well as knowledge spillovers. Hence, the stronger these interactions, the more spillovers are likely to be produced.

How are spillovers transmitted to local economies? Many mediating factors and transmission channels are crucial for facilitating spillovers. Those factors depend on both SEZ-based and non-SEZ-based firms, and the endowments of their workforces as well as institutional factors of host countries. First, localized knowledge spillovers are highly dependent on the regional absorptive capacity and learning competences of local workers and firms (Agrawal, 2002 and Feldman, 2004; Boschma, 2005). The effective transfer of knowledge and skills requires local absorptive capacity to identify, interpret and then transmit new knowledge into local production processes. Hence a workforce with at least basic skills is more likely to absorb new knowledge and incorporate new technologies.

Second, the impacts of spillovers and local productivity gains are stronger, the greater the interaction between SEZ-based and non-SEZ-based firms (Farole and Winkler, 2014). From a theoretical perspective, spillovers can happen within the same industry (called intra-industry or horizontal spillovers) or across different industries (inter-industry or vertical). Nonetheless, both the quality and quantity of backward and forward linkages matter for spillover effects. Through backward and forward interaction mechanisms SEZ-based firms transmit knowledge and

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technology or upgrade standards for local production or labour (Duarte et al., 2014; Farole and Winkler, 2014). Backward linkages encourage local firms to train their workers in order to be able to meet their buyers' expectations. Backward and forward linkages can therefore generate multiplier effects on local employment, innovation and growth (Farole, 2011; Zeng, 2016).

Third, the spillover potential depends on the characteristics of SEZ-based firms. Factors such as the motivations behind investments, global production and sourcing strategies, and technological intensity, as well as the length of their presence determine the quality and quantity of spillovers to local economies (Farole and Winkler, 2014). SEZ-based firms that stick to global supplier relationships reduce the scale of vertical spillovers to local non-SEZ-based firms.

The location of an SEZ and its proximity to large markets also matter for spillovers. The co-location of foreign and domestic firms in the same region can mediate the benefits from SEZs through technology and knowledge spillovers (Farole and Winkler, 2014). More specifically, SEZ-based firms co-locating in the same sector and region have the potential to significantly increase productivity and employment.

Overall, SEZ growth spillovers depend on the characteristics and strategies of SEZ-based firms and local endowments, as well as the institutional environment of the host country. All those spillover transmission channels are expected to attract foreign direct investment (FDI) to the region, upgrade local skills and technologies, and improve overall regional growth.

2.2. Empirical evidence of spillovers

What empirical evidence is there on the presence of growth spillovers from SEZs? The previous discussion has argued that both the quantity and quality of spillovers depend on complex transmission mechanisms from SEZs to local economies. While the literature on spillovers from SEZs is almost non-existent, there is a broader literature which has delved into spillover externalities, focusing mainly on FDI.

One of the main goals of SEZs is to attract FDI, the reason being that foreign companies are expected to produce significant spillover effects. This is corroborated by the empirical literature, which generally suggests that FDI generates positive externalities to local economies. Some cases, however, require government intervention to facilitate the creation of the necessary transmission mechanisms. This literature tends to be based on developed-country cases. The literature on developing countries (and developed countries below the technological frontier), by contrast, generally expresses considerable concerns about the capacity of the areas surrounding SEZs to reap any potential benefits from zones because of the limited absorptive capacity at the local level.

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Duarte et al. (2014), for example, assessed the impact of FDI and the prerequisites for spillovers in Mozambique. They found that low absorptive capacity and insufficient skills in the country greatly limited the effects of knowledge spillovers from FDI. They are sceptical about the capacity of a country with the characteristics of Mozambique to truly benefit from FDI and suggest that policies focusing on expatriation, emigration and tertiary education may be a more suitable option in order to generate development.

Osabutey et al. (2013) explored technology and knowledge transfer potential from multinational corporations within the construction industry in Ghana. Their findings uncovered that partnerships between foreign and local firms were rendered difficult by potentially complementary but dissimilar knowledge bases (e.g. technological vs. sociocultural and institutional knowledge). Hence, a pervasive absence of government policies and incentives to encourage foreign-local collaboration have prevented potential technological and knowledge transfers to local economies and represents an important further limitation on the diffusion of knowledge spillovers.

Vahter (2011) investigated the FDI impact on knowledge-sourcing activities, innovation and productivity growth of domestic firms in Estonia's manufacturing sector. Using firm-level panel data and an instrumental variable approach, he found that FDI inflows into a particular sector were not associated with increases in knowledge flows into domestic firms and in innovation activities.

Research has also found that FDI does not necessarily foster technological upgrading. Garcia et al. (2013) evaluated the impact of inward FDI on host country firms as well as the degree to which inward FDI affects the innovativeness of Spanish firms. On the one hand, inflows into Spain were negatively associated with the ex-post innovation of local firms; on the other, inward FDI was positively related to ex-post labour productivity and total factor productivity. They concluded that although inward FDI facilitates efficient resource allocation in the local economy, it can be harmful for the local technological development and can disrupt long-term economic growth.

Finally, the importance of location and proximity to larger markets is often regarded as a vital factor for spillovers. Barrios et al. (2006) showed that foreign firms co-locating in the same sector and region significantly increase the productivity and levels of employment of local manufacturing firms in Ireland. Likewise, the co-location of firms in industry clusters has been shown to have an important impact on spillovers (Nadvi and Schmitz, 1994; Thompson, 2002). In certain cases, however, proximity to agglomerations and larger markets yields contrasting results depending on the geographical scale considered. In Indonesia, Sjöholm (1999) found that co-location generates positive spillovers at the country level, but negative ones at the region-sector level.

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Hence, although FDI may be at the source of spillover effects, local conditions in less developed and even more developed territories and countries may not always facilitate the diffusion of knowledge and, in particular, its absorption by local firms.

What does this imply for SEZ policies? SEZs have, in certain cases, been considered pivotal for economic takeoff and adjustment (Johansson and Nilsson, 1997; Farole and Akinci, 2011). The very first zones in "tiger economies" were regarded as facilitators of industrial development and technological upgrading. In China, Guangdong, Beijing and Shanghai are deemed to have benefitted from SEZs and industrial parks (Rodríguez-Pose and Hardy, 2014) and have become the biggest beneficiaries of SEZ economic reform (Zhang and Bao, 2015). In fact, the so-called Chinese model also provided a platform for bringing FDI as well as encouraged economic reforms across the country. Nevertheless, this approach has also been criticized for creating economic imbalances within a country.

SEZs have also been regarded as fundamental engines of economic growth in the surrounding areas. Wang (2013) reported an average increase in per capita FDI of 58 per cent in Chinese municipalities with close proximity to SEZs. She also observed that Chinese SEZs did not crowd out domestic investments and domestically owned capital stock. Alder et al. (2013), also using Chinese data, revealed that the establishment of major zones generated an increase in GDP levels of between 6 per cent and 10 per cent, depending on the type of zone. This impact of SEZs mainly stemmed from the accumulation of physical capital.

However, not all studies dealing with SEZs in China and, in particular, elsewhere reach the same positive conclusions. According to Amirahmadi and Wu (1995), export processing zones in Asia have generated very limited linkage effects to domestic economies, except in the most advanced developing areas of the continent. The pitfalls that limited spillovers stem from poor location choices, inadequate infrastructure and insufficient institutional quality. Thus, simplified rules and training of local workforces are both needed to enhance knowledge spillovers emanating from export processing zones and SEZs. Similarly, Leong (2013), using an instrumental variable approach for Chinese and Indian regions, reported that SEZs in both countries have had a very limited impact on the export growth of local industries.

3. Model and data

3.1. Model

The theoretical overview of the previous section suggests that SEZs can generate considerable spillovers and help dynamize surrounding economies. However, it also

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highlights the enormous difficulties faced by firms in SEZs in generating knowledge spillovers and by societies, in general, and firms outside the zone, in particular, in absorbing and realizing the knowledge spillovers emanating from the SEZ. Addressing whether and to what extent SEZs contribute to growth in surrounding areas requires assessing the presence of knowledge spillovers from the SEZ and examining the extent to which said spillovers expand over space.

The main barrier in this respect is that past empirical assessments of the nature and geographical extent of spillovers have relied on rather imperfect proxies to evaluate the territorial connections at the heart of the diffusion of knowledge over space. As discussed earlier, the existence of linkages between firms and agents inside and outside an SEZ may lead to knowledge exchange, but this knowledge may or may not result in economically viable activity. Capturing these processes cannot be done with simple proxies. Yet, lack of adequate data has meant that the most influential analyses of spillovers – although sometimes trying to bring on board other types of distances, such as technological distance – have remained firmly anchored in measures of geographical distance as the main way to measure the presence of spillovers (e.g. Audretsch and Feldman, 1996; Beise and Stahl, 1999; Kaiser, 2002; Maurseth and Verspagen, 2002).

In this type of research, the most dominant method of measuring spillovers is through the use of a normalized spatial weight matrix describing the interregional linkages between neighbouring regions, using either inverse distance or the k-neighbours method as the weighting criterion.

Even more difficult has been the assessment of absorptive capacity. As discussed in the previous section, the capacity to assimilate knowledge generated elsewhere is dependent, among other factors, on the skills available in the recipient territory, its economic structure and institutional conditions, and its accessibility. The mechanisms and interaction that determine the absorptive capacity of a territory are, however, complex and difficult to operationalize empirically. Researchers who have delved into this question have tried to gage absorptive capacity by the use of a number of so-called filters: the social filter (Rodríguez-Pose, 1999; Rodríguez-Pose and Crescenzi, 2008) or the knowledge filter (Acs et al., 2004; Acs and Plummer, 2005). These analyses typically include composite indices comprising factors such as skills and education, openness, wealth or institutional quality, which may facilitate the absorption of knowledge.

We follow these approaches by proposing the following model to evaluate the potential impact of economic activity in areas surrounding the SEZs considered in the analysis.

$$\Delta y_{j,t} = \alpha_1 + \beta_1\ y_{i,0} + \beta_2\ SEZ\ performance_{i,t} + \beta_3\ absorptive\ capacity + \beta_4\ SEZ\ related\ factors_{i,t0} + \epsilon_i$$

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Where:

- $\Delta y_{j,t}$ is the dependent variable, the economic growth – measured using night light in the area surrounding the SEZ;
- $y_{i,0}$ is the initial level of development of the area – measured using the luminosity in the zone surrounding the SEZ;
- *SEZ performance* is the economic growth in the SEZ in the same period – measured, once again, using night light;
- *Absorptive capacity* includes those factors that may influence the capacity of neighbouring areas to take advantage of SEZ firm activity;
- *SEZ-related factors* depicting some characteristics of the SEZ, as they may influence the spillovers from the SEZ to surrounding areas; and
- ϵ_i is the error term.

3.2. Surrounding area and SEZ growth

Ideally, the performance of an individual SEZ (*SEZ performance*) should be measured using indicators such as job creation (direct and indirect), growth in revenues, the export performance of the firms in the SEZ and spillovers to the national economy. However, a lack of such data for a large amount of SEZs and countries has limited quantitative research on the topic until recently and thus requires an alternative approach. We, therefore, rely on the data set assembled by Frick, Rodríguez-Pose and Wong (2019) and use night-time light as a proxy for the economic performance of an individual SEZ.[1] They show that the growth of night light within the area of the SEZ is highly correlated with other SEZ performance indicators such as employment and number of firms. Hence, night-time light growth can be used as a reliable proxy for SEZ performance.

We, furthermore, use night-time light growth to measure the growth in the areas surrounding the SEZ. For this purpose, circles of different radiuses are drawn around the centroid of the SEZ, while the area of the SEZ is subtracted from it. The growth in night light in these areas is then calculated. We experiment with different

[1] Night-time light data provide a suitable and increasingly popular alternative in those cases where direct economic data are not readily available. Stemming from the field of remote sensing, whose practitioners were the first to spot the economic implications of changes in night-time light data (Elvidge et al., 1997, 2007), economists and other social scientists have increasingly resorted to light data as a proxy for economic activity (e.g. Florida et al., 2008, Henderson et al., 2012), especially when economic data are unavailable or unreliable either for a specific region or period.

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radiuses to understand the spatial extent of the possible spillover. These include radiuses of 10, 20 and 50 kilometres from the centroid in the zone.

The initial luminosity in these areas is also used in order to control for convergence' i.e. areas that start from a lower base are likely to experience higher growth.

3.3. Absorptive capacity

In order to analyse the role of absorptive capacity in facilitating spillovers from SEZs, a number of factors measuring different aspects of the regional and national socioeconomic environment are included in the regression. *SEZ distance to closest city with at least 300,000 inhabitants* is included in the regression in order to understand whether the proximity of a zone to a city and thus a large workforce and potential non-SEZ trading partners affects spillovers into surrounding areas. *Regional population density* provides a further indication of the agglomeration economies a zone might be exposed to. *Years of schooling* and the natural logarithm of the *country GDP per capita* reflect the local socioeconomic environment and are basic elements of most social or knowledge filters employed to portray assimilation of knowledge and economic activity spillovers. *Industry (share of GDP)* captures a country's level of industrialization. A higher level of industrialization should be correlated with a larger manufacturing base and therefore a higher incidence of linkages between non-SEZ and SEZ firms. It would be desirable to add further nuance by including controls for the industry base and type of firms around the SEZ. However, these data are not available at this point. Finally, *political stability* controls for the political situation in a country. SEZ firms may be less prone to build up forward and backward linkages with local markets if the country's situation is unstable. This may attract more efficiency-seeking, "footloose" companies that can move production in a relatively short time span. Appendix 1 presents and includes a short description of the variables.

3.4. SEZ-related factors

Finally, we also aim to control for SEZ-related characteristics, as suggested by the literature review. Ideally, we would have information for the type of investors within the SEZ, their motivations and their sourcing strategies. However, as such data are currently not available, we resort again to the data set used in Frick et al. (2019). The question is which SEZ-related factors might affect spillovers in the surrounding areas. We consider a number of factors that may affect the production and diffusion of growth spillovers. The first one is *years operating,* which measures how long an SEZ has been in operation and whether the impact of SEZ growth on its surroundings can be sustained over time. Furthermore, while we cannot include specific information on the firms within the SEZs, we can include a control

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for a zone's sector focus. *High-tech* indicates whether an SEZ focuses its activities on high-tech industries. This could affect spillovers, both because of the labour intensity of the sector and because of potential links to local inputs and producers.

3.5. Estimation approach

The period of analysis is 2007 to 2012, for which information is available for 346 SEZs in 22 emerging economies from the aforementioned data sets. Appendix 2 presents an overview of the country coverage.

The analysis is conducted in two stages. The first stage considers only the potential influence of changes in luminosity during the period of analysis on the economic growth of surrounding areas, in order to understand the spatial dimension of the possible growth spillovers. In the second stage, the factors that may facilitate or deter the absorption of spillovers from activities conducted in the SEZ are inserted in the analysis.

4. Results

4.1. Baseline regression

Table 1 represents the first stage of the analysis. It intends to assess the capacity of SEZs to generate spillovers, proxied by their effect on the growth of neighbouring areas, up to a distance of 50 km from the zone. For each radius size, only the direct effect of SEZ performance is considered (table 1, columns 1, 4 and 7). Country (columns 2, 5 and 8) and regional (columns 3, 6 and 9) dummies are added in order to examine whether different local conditions significantly affect the capacity of SEZs to shape the performance of surrounding areas.

The results of the analysis show that areas surrounding an SEZ in emerging countries generally benefit in economic terms from its presence. The coefficients for changes in SEZ performance are positive and significant in eight of the nine estimations. However, while areas surrounding a zone tend to benefit from its economic dynamism, the results also display a strong distance decay effect. The coefficients are strongest within a 10-km radius from the zone and rapidly decline with distance: if we only take the regressions without country and regional dummies (columns 1, 4 and 7), the coefficient already becomes 13 per cent smaller at a distance of 20 km relative to the one estimated for a 10-km radius. At 50 km from the centre of zone, the effect of spillovers declines by a full 43 per cent (column 7).

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Table 1. Dependent variable: change in lights from 2007 to 2012 of surrounding areas

Sector	(1) 10-km radius	(2) 10-km radius	(3) 10-km radius	(4) 20-km radius	(5) 20-km radius	(6) 20-km radius	(7) 50-km radius	(8) 50-km radius	(9) 50-km radius
SEZ performance	0.383*** (0.0674)	0.344*** (0.0674)	0.268*** (0.0390)	0.336*** (0.0986)	0.277*** (0.0957)	0.108*** (0.0256)	0.218** (0.0934)	0.151* (0.0837)	0.0198 (0.0340)
Initial lights in surrounding area	-5.85e-06*** (1.43e-06)	-5.21e-06*** (1.47e-06)	-5.99e-06*** (2.04e-06)	-1.74e-06*** (5.60e-07)	-1.68e-06** (6.95e-07)	-7.45e-07 (7.21e-07)	-4.51e-07*** (1.23e-07)	-4.99e-07** (2.06e-07)	-1.88e-09 (1.39e-07)
Constant	0.172*** (0.0254)	0.171*** (0.0256)	0.191*** (0.0249)	0.172*** (0.0308)	0.179*** (0.0337)	0.171*** (0.0253)	0.191*** (0.0282)	0.208*** (0.0375)	0.156*** (0.0190)
Regional dummies	-	-	Yes	-	-	Yes	-	-	Yes
Country dummies	-	Yes	-	-	Yes	-	-	Yes	-
Observations	346	346	346	346	346	346	346	346	346
R-squared	0.442	0.515	0.829	0.270	0.349	0.808	0.198	0.304	0.943

Note: Robust standard errors in parentheses; clustered at within-country regional level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

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The distance decay effect is even greater in the preferred models; that is, when country and, especially, regional dummies are considered. When introducing country dummies in the analysis, the coefficient at 50 km is 56 per cent lower than at 10 km (column 8), whereas when regional effects are considered, it becomes fully irrelevant (column 9) – meaning that once the regional unobserved factors are taken into consideration, there is no evidence that SEZs have an influence on the economic growth of the areas that are located 50 km away.

This strong distance decay effect is not uncommon and highlights, as indicated by Wang (2013), that the strongest impact on economic growth linked to the presence of SEZs in emerging countries is felt in the immediate vicinity of the zone.

4.2. SEZ characteristics and absorptive capacity

Does this positive but rapidly declining association between economic growth in a zone in an emerging country and the surrounding areas stand when taking into account regional and national factors that may condition the capacity of neighbouring areas to absorb spillovers? Do specific factors associated with the SEZ also condition its impact on the growth of neighbouring areas?

Table 2 presents the results of the second stage of the analysis. Columns 1 to 3 show the results for each of the three distances, controlling for the different indicators measuring a region's and a country's absorptive capacity. Columns 4 to 6 add the further controls related to the SEZ characteristics.

Throughout, the results for the SEZ performance mirror those of the regressions of table 1: the coefficient of SEZ growth is always positive and highly significant, indicating a positive impact of SEZ growth on neighbouring areas. Furthermore, the magnitude of the coefficient of SEZ performance weakens considerably with distance – the coefficient goes from 0.370 at 10 km (column 4), to 0.308 at 20 km (column 5), and 0.184 at 50 km (column 6) when controlling for both absorptive capacity and SEZ characteristics. This confirms the strong distance decay effect of SEZ growth already identified in the first stage of the analysis (table 1).

What is the effect of the other controls? We find interesting results pointing to the importance of the absorptive capacity of surrounding areas. First, a larger distance of the SEZ to a city with at least 300,000 inhabitants is negatively associated with the growth of the surrounding area. The result is significant in all but one of the regressions. This suggests that spillovers are more likely to happen if the zone is located in proximity to a larger city, allowing for a sufficiently large pool of labour and firms to connect with. This is in line with previous findings in the literature which suggest that co-location of firms and access to a larger market facilitate spillovers to local firms (Barrios et al., 2006; Farole & Winkler, 2014; Nadvi and Schmitz, 1994; Thompson, 2002). Second, regional population density is negatively correlated with

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Table 2. Dependent variable: change in lights from 2007 to 2012 of surrounding areas

	Absorptive capacity			Absorptive capacity + SEZ-related factors		
Variables	(1) 10-km radius	(2) 20-km radius	(3) 50-km radius	(4) 10-km radius	(5) 20-km radius	(6) 50-km radius
SEZ performance	**0.371*** (0.0665)**	**0.312*** (0.0967)**	**0.184** (0.0854)**	**0.370*** (0.0682)**	**0.308*** (0.0981)**	**0.184** (0.0874)**
SEZ distance to the closest city with at least 300,000 population	-0.000128** (5.11e-05)	-0.000106* (5.69e-05)	-0.000130** (5.68e-05)	-0.000119** (5.43e-05)	-9.76e-05 (6.07e-05)	-0.000134** (6.13e-05)
Regional population density	-0.0163** (0.00645)	-0.0145* (0.00841)	-0.0190** (0.00946)	-0.0151** (0.00693)	-0.0131 (0.00898)	-0.0199* (0.0104)
LN GDP per capita 2007	0.0264* (0.0156)	0.0312* (0.0176)	0.0410** (0.0190)	0.0261* (0.0157)	0.0315* (0.0179)	0.0414** (0.0197)
Years of schooling	-0.0169*** (0.00608)	-0.0229*** (0.00626)	-0.0271*** (0.00670)	-0.0167*** (0.00599)	-0.0226*** (0.00621)	-0.0273*** (0.00665)
Share of industry in GDP (%)	-0.00152 (0.00159)	0.000606 (0.00201)	0.00317 (0.00222)	-0.00174 (0.00163)	0.000501 (0.00202)	0.00328 (0.00224)
Political stability	0.00598 (0.0139)	0.00826 (0.0173)	0.0132 (0.0214)	0.00586 (0.0145)	0.00722 (0.0182)	0.0125 (0.0231)
SEZ with high-tech focus				0.0117 (0.0193)	0.00732 (0.0167)	-0.0107 (0.0165)
Number of years SEZ operating				-0.000491 (0.000873)	-0.000669 (0.000990)	0.000153 (0.00124)
Initial lights in surrounding area	-4.93e-06*** (1.46e-06)	-1.44e-06** (6.38e-07)	-4.11e-07** (1.69e-07)	-4.95e-06*** (1.45e-06)	-1.45e-06** (6.42e-07)	-3.99e-07** (1.67e-07)
Constant	0.224 (0.143)	0.140 (0.166)	0.0496 (0.179)	0.228 (0.146)	0.136 (0.169)	0.0478 (0.189)
Observations	345	345	345	345	345	345
R-squared	0.474	0.298	0.252	0.475	0.298	0.253

Note: Robust standard errors in parentheses; clustered at within-country regional level. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

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surrounding area growth. This implies that, although SEZs should not be located too far away from a relatively large city, the chance for spillovers is higher in less densely populated areas. And third, the initial luminosity of the area is negative and highly significant throughout table 2, suggesting the expected convergence effect.

Turning to the country characteristics, GDP per capita is positively correlated with the economic growth in areas surrounding the SEZ, while the coefficient for years of schooling is negative and strongly significant in all regressions. The former result indicates that a certain level of development is required for spillovers to occur, mirroring previous evidence that SEZ impact on neighbouring regions is more likely in more advanced areas (Amirahmadi and Wu, 1995). The negative effect of years of schooling in combination with the GDP per capita may suggest that once a certain level of development is reached, additional educational attainment is not structurally correlated with the impact of a zone on the growth of neighbouring areas. It also reinforces previous findings that highlight that the most successful SEZs in terms of economic growth in emerging countries have, so far, tended to be those with a relatively low-skill component (Frick et al., 2019).

Finally, the level of industrialization and institutional setting does not seem to have an effect on the ability of SEZs to drive growth in the surrounding areas. Neither *industry* nor *political stability* are significant in any of the regressions.

When including additional zone characteristics, the results remain largely unchanged. Furthermore, the two zone characteristics included do not seem to influence the impact of SEZs on the growth of neighbouring areas. *Years operating* is insignificant throughout the analysis and hence not a factor determining the capacity to generate and absorb knowledge spillovers. Similarly, whether a zone is focused on high-tech does not seem to matter, with the coefficient being insignificant in columns 4 to 6. Interactions between the zone performance and zone and contextual factors were tested, but resulted in insignificant coefficients.

The evidence emerging from these regressions is clear and supports the idea, highlighted in the literature, that although SEZs may be at the heart of new spillovers, their impact is constrained by local conditions and is generally felt only in close proximity to the zone. We have seen how even though SEZs contribute to the growth of surrounding areas, their effect on neighbouring areas declines steadily with distance. This result is robust to controlling for regional and national factors. There is, consequently, a strong distance decay effect in the capacity of SEZs to affect economic development in surrounding areas, which may be related to the size and characteristics of the zones, but more likely to the problems of absorption of many of the areas where the zones are located. A combination of successful low-tech zones based in low-cost regions with skills, infrastructure and institutional deficiencies outside the zone are likely to have played an important part

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in limiting the capacity of SEZs in these environments to maximize the impact in the surrounding areas (Vather, 2011; Osabutey et al., 2013; García et al., 2013; Duarte et al., 2014).

5. Conclusions

The aim of this paper has been to analyse the extent to which the performance of an SEZ drives economic growth in the areas surrounding it. The research relied on a new data set sourced from Frick et al. (2019), covering data on SEZ characteristics and performance across 346 zones in 22 emerging countries. These data make it possible to overcome challenges related to limited data availability related to SEZ characteristics and performance, a problem that has plagued research on the topic until recently. Night-time light data have also been used to proxy for economic dynamism in the areas surrounding the SEZs.

The evidence stemming from the analysis is clear. SEZs in emerging countries contribute to the growth of surrounding areas, but this effect suffers from strong distance decay. The immediate vicinity benefits and the influence of zones is still felt within a 50-km radius, but the effect at the latter distance is much weaker, when not outright insignificant. These results are robust to the inclusion of zone, regional and country characteristics. Furthermore, we find support for the expectation that SEZs located in more remote areas may have less of an impact on neighbouring areas owing to their limited ability to interact with non-SEZ firms and workers.

These findings have important policy implications for those countries and areas in the developing world currently considering SEZs as a viable development tool. They show that although SEZs represent a development instrument worthy of consideration, policymakers should not place excessive hopes in their capacity to transform the economic dynamism of the country. As we have demonstrated, SEZs can and often do help dynamize the immediate surroundings of the areas where they are based. But, because of the presence of strong distance decay effects, it is unlikely that the impact and the economic effect of the zone will expand beyond 50 km. Hence, rather than an instrument for radically transforming the economic fortunes of a country – which is unlikely to happen, especially in view of the recent evidence that the economic trajectories of SEZs are often not more dynamic than those of the rest of the country where they are located (Frick et al., 2019) – zones should be seen as interventions to help transform the economic fortunes of specific localities and small regions. This implies that decision makers should adjust the ambition of the goals behind the development of SEZs. Such goals and ambitions need be far more realistic than what has often been the case until now.

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Policymakers may also want to exercise caution when making decisions about where to locate a new SEZ. In view of our research, promoting SEZs in relatively remote rural and isolated regions is unlikely to make much economic difference, as proximity to cities seems to be one of the driving factors behind the capacity of zones to link up with their immediate surroundings. Very often it is intermediate cities that stand to benefit the most from the development of SEZs, but even in such cases more attention should be paid to the possible link between firms in the zone and firms outside it.

The type of zone being promoted also matters. Very often high-tech fantasies have dominated the agenda. However, the gap between the high-tech companies that may be attracted to the zone by means of tax breaks and other incentives and subsidies, on the one hand, and the skills and capacities of local firms and other economic actors, on the other, is frequently too wide to fill. Tailoring the type of zone to the skills and innovation capacities of the local environment will in all likelihood lead to more successful outcomes than simply hoping that local firms will absorb knowledge spillovers from the new investment, with neither the capacities nor the support to do so. Attracting firms that would help increase the technological complexity of existing firms and that would encourage them to improve product quality and diversify is much more likely to produce local value chains that will translate to greater innovation, productivity and employment at the local level than is relying on high-tech fantasies.

Finally, decision makers should be acutely aware of the level of development of the country and of the place where the zone is going to be established. A certain level of development is required in order to maximize the spillovers emanating from a zone. Aiming too high when the local conditions are far from ideal risks wasting scarce resources that could yield greater returns in other types of interventions – from promoting and expanding basic education to improving the competitiveness of local firms. Hence, SEZ policies cannot really be considered as a substitute for broader structural reforms aimed at enhancing the potential for the development of economic activities, as well as the overall absorptive capacity in the country.

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Appendix 1

Variables	Description	Source
SEZ performance	$(Yi_{,1} - Yi_{,0})/ Yi_{,0}$: Growth rate of the sum of night lights of the pixels that compose the SEZ surface over period of analysis	Frick et al. (2019)
SEZ distance to the closest city with at least 300,000 Inhabitants	Road distance in kilometres to the closest city with at least 300,000 inhabitants	Frick et al. (2019)
Regional population density	Natural logarithm of regional population density in 2007	Regional data set sourced from Gennaioli, LaPorta, Lopez-de-Silanes and Shleifer (http://scholar.harvard.edu/shleifer/publications?page=1)
LN GDPpc	Natural logarithm of the GDP per capita in the beginning of the period of analysis (constant 2010 US$)	World Development Indicators
Years of schooling	Years of schooling in 2007	Barro & Lee data set (http://www.barrolee.com/data/full1.htm)
Industry (share of GDP per cent)	Industry, value added (share of GDP, per cent) in the beginning of the period of analysis	World Development Indicators
Political stability	Political stability indicator in the beginning of the period of analysis, from -2.5 to 2.5	Worldwide Governance Indicators
Number of years SEZ operating	Number of years zone had been operating in 2007	Frick et al. (2019)
High-tech focus	Dummy = 1 if the zone either “self-proclaims” on their advertising material that they specifically target high-tech sectors or if companies established are within high-tech sectors, as defined by OECD	Frick et al. (2019)

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Appendix 2

Countries	Number of zones
East Asia and Pacific	255 (73%)
China	33
Philippines	29
Malaysia	6
Republic of Korea	64
Thailand	20
Viet Nam	103
Europe and Central Asia	40 (10%)
Turkey	36
Russian Federation	4
Middle East and North Africa and Sub-Saharan Africa	6 (2%)
Ghana	1
Jordan	1
Kenya	1
Lesotho	1
Nigeria	1
South Africa	1
Latin America and the Caribbean	26 (7.5%)
Argentina	4
Chile	3
Colombia	6
Dominican Republic	10
Honduras	3
South Asia	19 (5%)
Bangladesh	8
India	8
Pakistan	3
Total	**346 (100%)**

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