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Economic and Technology Development Zones, SEZ and other special economic enclaves: Zooming in on the Chinese case

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1. Introduction

Designating selected local areas as "special" with the goal of stimulating industrial development is not a novel idea in the history of economic development policy making. The primary purpose of these place-based polices is to modify the incentives faced by companies when making location choices and to stimulate entrepreneurial activities that otherwise may not have occurred. However, economic and business research, being convinced of the increasing importance of space and location for individual companies, has trained its focus on the geography of industry and entrepreneurship over the last few decades, more than ever before.

Historically, specific locations have been more (or less) advantageous insofar as the development of entrepreneurial activities is concerned, such as by having better (or worse) access to natural resources, infrastructure, knowledge and/or human capital. Therefore, in many countries during different historical periods, governments have offered certain incentives to companies to attract them to "special economic enclaves" with the goal of boosting economic development and accelerating industrialization. In these cases, the ultimate policy target is to encourage economic growth not only in the designated zones but also in the wider region or the entire nation. In other words, the incentives are part of a national industrial policy and are not aimed solely at the development of these designated zones (Di Tommaso et al., 2013; Bellandi and Di Tommaso, 2006). The practice based on this economic policy rationale can be found throughout the history of industrialization (FIAS, 2008; Rubini et al., 2013), and has remained popular in today's business environment. Many types of "special" economic areas have been promoted in recent years in both developing and highly industrialized

countries (Farole, 2011). The common idea for these practices is that in some circumstances, it might be helpful to "isolate" certain local areas and offer "special conditions" to companies to stimulate industrial development, innovation and competition.

One of the most notable typologies of these special economic enclaves is the so-called Special Economic Zone (SEZ), which is typically designated as an area in which the rules that govern local economic activities are different from those in the rest of the country. SEZs are characterized by a development-friendly setting designed to attract capital, investment, production and companies (Aggarwal, 2007; Rubini et al., 2013). Other common and similar typologies of special economic enclaves include specific areas in which particular types of economic activities are emphasized as distinctively characteristic of a particular area, such as Free Trade Zones (FTZs), Export Processing Zones (EPZs), High-Tech Development Zones (HTDZs), Economic and Technological Development Zones (ETDZs), and Industrial Parks.

We identify all these economic enclaves using the generic term "development zones" to emphasize the clear intention to promote economic development by attracting specific activities (e.g., export-oriented, high-tech, sector-specific). All these zones may be considered special and different from other business locations because of a long list of possible policy-induced advantages offered only to entities operating within the boundaries of the designated area. Among the most frequent "special policies" for "economic development zones" include concessions related to factor prices (i.e., land, energy), production costs (i.e., subsidies and incentives for

research and development (R&D)), laws and regulations (i.e., fiscal and tax exemptions) and infrastructure (i.e., ports, laboratories, service providers).

Despite the rapid increase of various types of development zones worldwide, one important question remains unanswered: Have development zones significantly contributed to local economic development? Especially, what kinds of roles do development zones play in the host regions in China? It is particularly important to examine this issue based on China's experience with development zones for two reasons. First, in recent years, China has experienced extremely rapid and successful economic growth and industrialization. Second, no other country has developed a comparable number of special economic enclaves. In the following sections, we will continue our analysis by focusing on China's experience and zoom in on various Chinese territories. After the literature review that follows this introduction, we suggest two parallel study perspectives. In the first, a macro-level analysis will be performed covering the entire country, to correlate economic performance of host cities with the presence of development zones. In the second, a more detailed district-county level analysis will be undertaken in Guangdong Province.

2. International reviews on theories and practices of development zones

2.1 Place-based policies within various contexts

To reiterate, a wide range of various economic enclaves are created under various economic policies with different incentives and goals. A significant amount of the international literature has focused on EPZs – zones specifically aimed at

attracting export-oriented activities. Since the establishment of the first EPZ in Shannon, Ireland (in 1959), these zones have become popular as tools to promote industrialization and structural adjustment in primarily unindustrialized nations by promoting exports (Rubini et al., 2013). Most theoretical contributions on EPZs up to the 1990s built upon Heckscher–Ohlin (H-O) type trade models and analyzed the circumstances under which an EPZ could change production patterns and affect national income. Although earlier research was skeptical regarding the effects of EPZs (Hamada, 1974; Hamilton and Svensson, 1982; Young, 1987), later studies found more theoretical cases for the establishment of EPZs in less industrialized nations (Din, 1994; Devereux and Chen, 1995). Subsequent cost-benefit analyses and evolutionary theories (Madani, 1999; Warr, 1987; Johansson and Nilsson, 1997) have distanced themselves from earlier theoretical trade models, arguing that these earlier articles neglected a number of important matters, including the international mobility of capital goods and the footloose character of firms operating within EPZs. Recent contributions to the EPZ literature have focused much more on describing case studies and experiences across the globe and have addressed specific empirical questions (see among others Farole and Akinci, 2011; Aggarwal, 2007; FIAS, 2008). Relevant to the present study is the literature concentrating on the ability of economic zones to develop backward linkages with the host economy (Killick, 1993; Johansson and Nilsson, 1997; Farole and Akinci, 2011). A relevant part of such literature, in line with recent contributions on innovation and economic development, suggests that EPZs can succeed in fostering economic development, provided that the local industrial

base has acquired some basic level of production expertise and technological capabilities (see among others Madani, 1999; Fagerberg et al., 2010).

A different and more recent stream of the literature analyzes a more generic form of "place-based policies." The theoretical debate continues, with new studies addressing the desirability of zone-type incentives. This literature focuses largely on the experience of place-based policies within industrialized nations, and the theoretical contributions are either based on spatial equilibrium models and investigate the effects on local welfare (wages, housing prices, cost of living, etc.), or they model the effects of place-based subsidies on investment, employment or wages at the facility level (see among others Busso et al., 2013; Glaeser and Glottieb, 2008; Criscuolo et al., 2012; Lynch and Zax, 2011). The basic theoretical argument (see Criscuolo et al. 2012) is that preferential policies involved with place-based incentives reduce the cost of capital for beneficiary firms. In doing so, governments allow firms to carry out marginal investment that would not have been possible otherwise. Through the effect on investment, regionally targeted incentives can then have effects on output, productivity and employment. However, the monitoring ability of governments is limited and policy incentives could be used by firms to finance infra-marginal investment that would have been realized anyway, with no additional impact on investment, output and so forth. In this sense the net effect of place-based policies is recognized as essentially an empirical question that depends upon the specific context in which the zones operate. Most empirical models utilize multiple regressions in this context, including a binary policy variable, and are typically

estimated by exploiting time and spatial differencing (Meyer et al., 2012; Overman and Einio, 2012; Busso et al., 2013).

Place-based policies and EPZs share a "geographically bounded" character, but they differ substantially in their objectives. On one hand, the main aim of place-based policies in the USA and/or Europe is to encourage economic growth to reach lagging regions, thus improving the territorial distribution of economic activities. EPZs in so-called developing countries, on the other hand, typically serve as the first lightning rod for initial economic activities that are then expected to trigger a wider process of industrialization and growth. In the EPZ context, displacement effects or growth imbalances are not major concerns – at least initially – because they concern place-based policies. In fact, in China's experience, some degree of displacement and/or territorial disequilibrium was accepted as part of the process of the gradual opening of the economy (Di Tommaso et al., 2013). The issue of rebalancing territorial disequilibria was then shifted to subsequent programs, such as Specialized Towns or Industrial Relocation Parks (Di Tommaso et al., 2013; Barbieri et al., 2009).

The role of China's development zones in actual economic growth also stimulates intellectual interest, given the wide range of policy-induced economic enclaves that have been promoted in China in recent decades. The literature has not arrived at a consensus regarding the desirability of development zones in China. From a countrywide perspective, although there is a general consensus that SEZs have played an important role in promoting Chinese industrial development, some studies

suggest that the rapid growth that often accompanies SEZs and other enclaves can occur at the expense of an enormous amount of land resources, intensive capital investment and loss of public benefits (Carter and Harding, 2011; Wong and Tang, 2005; Gopalakrishnan, 2007; Yang and Wang, 2008). From a city perspective, Alder et al. (2013) and Wang (2013) used prefecture-level data to assess the effects of development zones and to reach more positive conclusions. A large number of the available studies focus on the uncommon and expansive SEZs, overlooking other types of economic enclaves. In addition, the literature on the Chinese case in this regard appears incomplete because studies tend to adopt a "whole China" perspective, while Chinese provinces are treated as a single unit of analysis without including the details of these vast and heterogeneous territories.

2.2 Development zones boom in China

China first established four SEZs in the 1980s, and three of these were located in Shenzhen, Zhuhai and Shantou, all in Guangdong Province. Although much of the literature has identified these SEZs with "deregulation" tools, these early SEZs – so the argument goes – were used as "laboratories" for the socialist China to test accelerated economic development through the controlled import of foreign technology and capital. On the one hand, these four SEZs pilot in capitalism by testing market-friendly policies, acquiring advanced technology and management, and promoting employment and growth (Rubini et al., 2013). On the other hand, the learning process was severely controlled by a carefully planned foreign direct investment (FDI) attraction policy to "selectively absorb the good things and boycott

the bad things from abroad" (as cited in Carter and Harding, 2011: 61).

Inspired by the success in promoting growth and employment in the four SEZs, Chinese national and provincial governments invented more typologies of development zones aimed at promoting growth, employment, as well as technical innovation. Since 1992, China has experienced a fever of development zones, which include Economic and Technological Development Zones (ETDZ), High-tech Development Zones (HTDZ), Free Trade Zones (FTZ), Export Processing Zones (EPZ) and Industrial Parks (Di Tommaso et al., 2013, for a more thorough review; see also Zhang, 1999; Wong and Tang, 2005; OECD, 2010; Zeng, 2011; Guo and Feng, 2007).

Among these various modes of development zones, Economic and Technological Development Zones focus on attracting foreign investment as a response to the economic globalization. In most cases, ETDZs are smaller areas planned in the cities by local government and provided with a complete infrastructure system to absorb international investment in advanced manufacturing. Since the first ETDZs were established in 14 open coastal cities in the 1980s, there have been a total of 218 national-level ETDZs in China, as of the end of 2014 (as shown in Figure 1). In contrast to beneficial infrastructure in ETDZs, High-tech Development Zones (HTDZs) are characterized by preferential policies (such as tax concessions), which are designed to cluster innovative services and promote innovation and industrialization of high-tech industries. Both ETDZs and HTDZs need approval from the national or provincial governments and are empowered with a high autonomy. By

the end of 2014, there were in total 115 national level ETDZs and HTDZs in China. FTZs and EPZs, approved by the Duty Office, aim at exportation and trade abroad. Even being physically located inside China, companies in FTZs and EPZs can benefit from tax refunds on exports, import duty exemptions and a concessionary value-added tax. The EPZs are different than FTZs, with stricter control on products for domestic markets in China. Finally, Industrial Parks refers to development zones, approved by local governments, which are in a city and not autonomous in administration. Our research focuses on ETDZs and HTDZs approved by the central government on the macro-level and all ETDZs, HTDZs, FTZs, EPZs and industrial parks approved by both the central and local governments at the meso-level.

Insert Figure 1 Here

2.3 Friend or foe for the host region

Despite Chinese development zones performing well in attracting foreign investment and promoting international trade, there still remains one persistent debate on the question of whether development zones have contributed significantly to local economic growth. Most Chinese scholars argue that the thriving development zones (e.g. ETDZs and HTDZs) have played multiple and positive roles in China's prosperity: as gateways for the opening-up of Chinese markets, as clusters of advanced manufacturing, and as engines for regional economic growth (Zheng and Wang, 2005; FIAS, 2008). However there still exists a sizeable amount of literature that is critical of the performance of Chinese development zones (Zheng and Zhang, 2014). These scholars argue that development zones mainly are rooted on massive

land use at a low compensation rate (the so-called Enclosure Movement), which is directed by local government instead of the market. In order to absorb investment within ever fierce competition, local governments subsidized enterprises in development zones with unreasonably low-price land, which garnered substantial amounts of hot money and real estate speculation, and inevitably led to a bubble economy and huge deficits (Zhang and Li, 2007; Yan, 2008). Moreover, because of their feeble spillover effects and poor performance, most development zones became bloodsuckers or isolated islands instead of beacons of growth. As a result, the preferential policies gave rise to regional disparity and the loss of public benefits as a whole (Li and Yang, 2010; Zheng and Zhang, 2014).

To summarize, we see some important and unexplored aspects in the debate over the effectiveness and desirability of development zones, particularly in Mainland China, where there is a lack of international debate based upon vast empirical evidence of the effects of economic zones within. Thus, we contribute to this debate in two ways: (1) We generate empirical evidence and original databases that allow the effectiveness of Chinese development zones to be examined, which has rarely been examined in previous literature. (2) We evaluate the role of development zones within different contexts by employing both macro- and meso-level analyses. Given the enormous differences between and within provinces, it sometimes proves difficult to disentangle the exact relationship between place-based policies and their performances. Thus, we believe that employing national and sub-provincial analyses must be the preferred tool to illuminate the role of development zones on the host

regions, embedded within the characteristic context of China.

3. Methodology and data

As highlighted above, the few previous empirical studies on development zones in China are either specific-zone case studies or macro analyses that compare different Chinese provinces (see, among others, Demurger et al., 2002). With few exceptions, most macro-level analyses focus on the SEZ as a specific tool and much less on the other forms of special economic areas. If it is true that Chinese provinces differ in terms of industrialization, growth and development, then it is also true that substantial differences remain between and within each province. To confirm this, both macro-level (between provinces) and meso-level (within provinces and counties) analyses are necessary to answer the international debates on Chinese development zones (Fan, 1995; Di Tommaso et al., 2013; Barbieri et al., 2012).

3.1 Data for macro-level analyses

For the macro-level analyses, first we choose to investigate the relationship between national-level development zones and the economic performance of the host cities. Second our research focuses on ETDZs and HTDZs, two major types of national-level development zones in China. Third we only trace the economic performance of development zones over the past decade, because the institutional contexts before and after 2004 are greatly different. In 2003, China's central government reorganized national-level development zones for its entry into the World Trade Organization (WTO).

We focused on national-level development zones approved before 2003 and their contribution to local economic growth, considering data accessibility. In China, the State Council approved 54 ETDZs and 53 HTDZs before 2003, and no national-level development zones were approved in 2004-2009. Later after 2009, an additional 164 ETDZs and 62 HTDZs were approved, but the data of the newly approved development zones are inaccessible to the public. After cleaning for missing data, we finally obtained 950 observations of 43 ETDZs and 52 HTDZs, from 2003-2012. The 95 development zones contribute to 66% of the value of industrial output of all development zones and 19% of the value of total China output in 2012. The variables of these 95 development zones are shown in Table 1.

We collected the data on development zones from the "Directory of Chinese development zones approval announcement" (2006 Edition) and the official approval documents for the expansion of development zones issued by the State Council. The data on their host cities, such as the urban developed area, investments in fixed assets, labor force in the second and the third industries, and the gross domestic product (GDP) of the second and tertiary industries, are obtained from the series of "Chinese City Statistical Yearbook" (2004-2013).

Insert Table 1 here

3.2 Model for macro-level analysis

The empirical model tests the assumption that local economic performances measured in terms of GDP, can be explained by the presence of the development zones, after controlling for other factors on economic output, which scholars have

already confirmed. The variables include the amount of capital invested and labors inputted that characterize an area, as well as the geographical and institutional characteristics that can make economic activity in some areas systematically more (or less) advantageous than others.

The model takes the following form:

$$LnGDP_{it}=C+d_t+\delta_i+\beta_1 parea_{it}+\beta_2 parea_{it} \cdot type_i+\beta_3 parea_{it} \cdot special_i+\beta_4 parea_{it} \cdot polit_i+\beta_5 lnempl_{it}+\beta_6 lninvest_{it-1}+\varepsilon_{it}+\beta_7 lnprop\_univi_t+\varepsilon_{it.}$$

LnGDPit denotes the logarithm of GDP of the second and the third industry in year t (t=2003~2012) of city *i*. *C* represents the intercepts of the regression model. *dt* refers to the time effect, and δi refers to the section effect. *Parea* represents the proportion of land covered by the development zone in the city's developed area, which is the core independent variable in this research, while the regression coefficient β1 measures the impact of the relative scale of ETDZs or HTDZs on the economic development of the host cities.

To understand how the type, location and administrative level might change the effects from the development zone, we introduce dummy variables and their interaction parameters with core independent variables. These dummy variables include the *type* of development zone (type=0 if ETDZ, else type=1), *special* (if the city is located in the developed Beijing-Tianjin-Hebei, Yangtze River Delta and Pearl River Delta regions =1, else=0), and *polit* (Polit=1 if the city is a provincial capital city, a vice provincial city or a municipality directly under the central government, else=0). Considering the importance of the investment and labor force that is

necessary for economic development, we employ three control variables of $lnempl_{it}$, the logarithm of investment in fixed assets, and $lninvest_{it-1}$, the logarithm of labor in the second and tertiary industries, as well as $lnprop\_univi_{t}$, which shows the quality of labor and is measured by the proportion of the highly educated to the total population of host cities. To address any possible endogeneity in our model，we use the lagged value of investment in fixed assets. All models' standard errors have clustered at the city level.

The Hausman test suggests using the fixed effect model as the reference for all panel regressions that are performed. We also introduced city fixed effects to control for possible characteristics of the city that may influence economic development. Similarly, we introduced time fixed effects to control for the possible factors in different years, which might affect economic development. By introducing fixed effects, we aim to address any possible omitted-variable biases.

3.3 Data for meso-level analyses

For meso-level analysis, the first methodological choice is to investigate the relationship between development zones and industrial performance at the district-county level, which is subordinated to prefecture-level cities. Second, the analysis is focused on the specific province of Guangdong, a developed region in China. Further, as the pilot field for "capitalism with Chinese characteristics", Guangdong was both the first province in China to use SEZs to attract industries and investment, and one which most combines different types of development zones (except for SEZs), including ETDZs, HTDZs, FTZs, EPZs and Industrial Parks. Third, the assumption of

meso-level analysis is similar with that of macro-level analysis, and we argue that the potential effects of development zones on industrial performance are best captured at the local level of the host counties and districts. Here industrial performance replaces the GDP used in macro-level analysis, considering the data accessibility that most development zones in Guangdong only reported their industrial output before 2008.

The database is an original panel dataset that registers information on a number of economic and policy indicators for 88 counties and districts of Guangdong Province for the period of 2000-2008[1] (for further details, see Di Tommaso et al., 2013; Barbieri et al., 2013; Barbieri et al., 2010). The database also covers all development zones that are officially recognized at the provincial or national level in Guangdong. For each district-county and year, development zones were computed in amount and land area covered. To obtain this information, different sources were merged and crosschecked.[2]

Below, a brief summary table is provided (Table 2) of the different zones by type, land area and main geographical location. Notably, the data collected suggest a much higher use of ETDZs and HTDZs by the national and provincial governments with respect to EPZs and Free Zones, which is consistent with the trend observed in the rest of the country. ETDZs and HTDZs together accounted for 98% of the total

[1] After 2008 the new policy initiative of Double Relocation Parks (Li and Fung, 2008) became active for most cities in Guangdong. Since we did not have specific information on the location and main figures for such parks (and given that they might influence the performance of several counties and districts) we stopped the meso-level analysis at 2008.

[2] Ministry of Commerce Guangdong Province (http://english.mofcom.gov.cn/aarticle/zt_business/lanmuf/200704/20070404627423.html), Hong Kong Trade Development Council (http://china-trade-research.hktdc.com/business-news/article/Fast-Facts/China-Industrial-Parks/ff/en/1/1X39VTUR/1X06BOS8.htm), Guangdong government prefectures' documents and websites, specific development zones' official websites; rightsite.asia.

land area designated for national and provincial special economic areas, with ETDZs being by and large the preferred tools of industrial promotion. The empirical analysis should therefore be read bearing in mind the extremely high contribution of these two specific types of economic development zones to industrial development policies.

Insert table 2 here

On the whole, there are 74 economic development zones in Guangdong Province. Approximately 60% of these were established before 2000 and only a few date back to the 1980s. In the high-growth prefecture-level cities of Guangzhou, Shenzhen, Dongguan, Foshan and Zhuhai, there has been extensive use of development zones other than SEZs.

3.4 Model for meso-level analysis

The empirical model for Guangdong Province estimates an aggregate production function type model (see, among others, Rosenthal and Strange, 2004; FIAS, 2008) at the district-county level. We augment the classical model by including a policy variable that considers the existence of development zones in the county. We also include a number of controlling factors that consider geographical and institutional aspects that might influence the designation of development zones in specific counties.

The model takes the following form:

$$lnY_{it} = \alpha_i + \beta_1 DZ\_DENSITY_{it} + \beta_2 lnLOCALINVEST_{it-3} + \beta_3 lnFDI_{it-3} + \beta_4 lnWORKERS_{it} + \beta_4 URBAN_i + \beta_5 PRD_i + \beta_6 COAST_i + \beta_7 YEAR + e_{it.}$$

Y_{it} is the industrial output per square kilometer in county/urban district $_i$ at time

t; $DZ\_DENSITY_{it}$ measures the percentage of the area of county/district *i* covered by an economic development zone (which, as previously acknowledged, is mainly ETDZs and HTDZs). If β_1 is positive and significant, we conclude that economic development zones have positively contributed to industrial output in Guangdong; $LOCALINVEST_{it-3}$ is the amount of national capital investment and capital renovation /maintenance in county/district *i* at year *t-3* per square kilometer; FDI_{it-3} is the amount of foreign direct investment at district-county *i* in year *t-3* per square kilometer; $WORKERS_{it}$ is the number of people employed at district-county i in year t per square kilometer.

$URBAN_i$ is a dummy variable equal to one for urban districts within prefecture-level cities and is used as a proxy to capture the different contexts in terms of institutions, market functioning, infrastructure development and services available that (supposedly) characterize highly urbanized districts as opposed to less urbanized areas (OECD, 2010; Barbieri et al. 2010; Tödtling and Wanzenböck, 2003).

PRD_i is a dummy variable that identifies counties and districts within the Pearl River Delta (PRD) area[3], which is historically a region that developed at a faster pace due to its location near the capital city, in addition to its proximity to Hong Kong, and because it had access to external trade through the Pearl River. It is also a region that has been targeted with specific incentives for industrial development (for further details see Di Tommaso et al., 2013; Barbieri et al., 2012; Enright et al., 2005).

[3] According to the official definition, the PRD area includes the prefectures of Guangzhou, Shenzhen, Zhuhai, Foshan, Jiangmen, Dongguan and Zhongshan, part of Huizhou (the urban district of Huizhou, Huiyang County, Huidong County and Boluo County) and part of Zhaoqing (the urban district of Zhaoqing, Gaoyao and Sihui).

$COAST_i$ is a dummy variable that identifies coastal counties and districts with geographical characteristics that are more easily accessible than the inland and mountainous areas of the province. We expect all these variables to exhibit a positive association with industrial output. In other words, all else being equal, higher output values should be registered within the PRD, coastal regions, the urban districts, and in areas in which investment in innovation and FDI have been higher.

YEAR is a dummy variable employed to control for time effects, which can be read as changes in the macroeconomic scenario affecting the entire region.

The model was first estimated in its pooled specification (POOL) assuming a constant intercept and slope that is equal for all counties and districts – although we expect this model to place excessive restrictions on our data. Then it was estimated in terms of fixed effect (FE) and random effect (RE) specifications. In these cases, we assume that there is an individual *unobserved* heterogeneity that produces different effects for each county/district. In the fixed effect form, we assume that such unobserved individual effects are correlated with our explanatory variables, whereas they are not correlated in the random effect specification. Both estimations have advantages and drawbacks with respect to our data.[4] We performed a Hausman test (Wooldridge, 2009), which prefers the FE model to the RE model. However, given the advantages and drawbacks of the different specifications, we present all the estimates

[4] In particular, the FE form allows us to take into account omitted time-invariant explanatory variables, and it is particularly suitable if the sample represents the entire population of interest. However, the FE model produces estimates by essentially taking into account the within variability, that is, the variation over time of each individual unit of analysis from its own mean. Therefore, variables that have a low variability over time may be incorrectly estimated. Most of our variables (including the variable for development zones) tend to vary more across individual units than they do over time. Nonetheless, RE estimates make efficient use of both within and between variability (within each unit of observation and across units); however, if the FE is the valid model, RE estimates are inconsistent.

(Table 2), including a model specified in first-differences (FD). Furthermore, the exploratory data analysis suggests that the nature of the relationship between development zones and output may be non-linear. Therefore, as a robustness check, we also estimate a model that includes a quadratic term for the density of development zones (Table 3).

These models basically produce estimates of β_1 by comparing a) counties with a higher density of economic zones to counties with a lower density; b) counties with development zones to counties that do not have development zones; and c) counties over time.

Because of possible endogeneity in our model, due to reverse causality between investment and output, in particular, we employ lagged variables for both foreign and local investment. We use both investment at *t-1* (models _1 in regression tables) and *t-3* (models _3 in regression tables). We have also excluded, as a further check, the few zones created within the period of observation: the establishment of economic zones should not be in fact influenced by the level of investment in the future period (and at the same time city-specific factors, such as a general higher development, should be captured by fixed effects).

In addition, as a robustness check, the same model has been tested while controlling for the presence of SEZs (in the districts of Shenzhen, Zhuhai and Shantou) and the presence of outliers. Different measures of the policy variable have also been tested (in particular, the number of economic development zones rather than land area). We have also excluded the few zones created within the period of observation.

The results do not change significantly. All estimates are based on robust or clustered standard errors.

Finally, as a further check, we also estimated the effects of development zones on added value and exports instead of industrial output (Tables A2 and A3 in the appendix). Given the relevance of high-tech zones in our sample, it might be argued that the objective of many economic zones is to push production toward more innovative goods, which might be captured by an increase in the added value of production. Simultaneously, given the export orientation present in much of Chinese manufacturing, we check for the effects on exports, although economic zones specifically aimed at promoting exports are only a marginal component of our dataset. In addition, with respect to value added, we specify both a linear and non-linear relationship with output. We show the results for the non-linear value-added model, as it provides a better fit to the data. However, the non-linear term in the export model does not appear significant, and therefore we report only the results of the linear specification.

4. Finding and discussions

4.1 From macro-level analysis

Table 3 shows the result for macro-level analysis. Model 1 considers only the impacts of the labor force, labor quality, investment in fixed assets, and the size of a particular development zone on the level of production in the city. The results show the former three variables have a positive influence on the local economy, which is

consistent with both theoretical and empirical knowledge. However, the variable of size of development zones has a negative influence on the economic growth rate of the host cities, which means that the larger area a development zone covers, the poorer economic performer the host city can be. Moreover, to analyze the possible changes in impacts of the proportion of development zone areas over time, we adopt a structural variable coefficient model, making β1 a changeable variable in different periods. Model 6 in Table 3 shows that the regression coefficient of the development zone experienced modest increases over time, but the holding was always significantly negative. Thus, it can be concluded that the size of the development zones has imposed a continentally negative effect on the economic performance of host cities from 2003 to 2012.

Although market power in China has increased in significance on urban development since the economic reform of 1978, the administrative hierarchy, inherited from the commanding economy, remains influential in affecting local economic performance. But the result does not confirm the positive effects that the administrative hierarchy of host cities for development zones imposes on the local economic growth. As Model 4 in Table 3 shows, the interaction parameters of the development zones and administrative level are statistically insignificant to the local GDP.

Finally, Model 3 in Table 3 further considers whether the city being located in a developed or underdeveloped region might change the effects of the development zone on local economic development. The results show that *Para • special*, the

interaction parameters of the developed regions, are positive and statistically significant, with coefficients of 3.4. The regression coefficient of the size of development zones is still negative by -2.4, but below that of the developed regions. Thus we might say that the size of development zones negatively influences industrial performance across China, but it can show positive effects, particularly in the most developed regions. Models 4 to 6 also confirm this result.

Insert Table 3 here

4.2 From meso-level analysis

The regression at the county level can further clarify the effect of development zones in one of the most industrialized areas of the country, as shown in Tables 4 and 5. Interestingly, taking as a reference the FE model, the coefficient of the variable of interest (*lnDZ_density*) appears positive and significant after controlling for the other covariates, which means that, all else being equal, counties and districts that used economic development zones more intensely (as measured by total area covered) display higher industrial output values. The significance and magnitude of the effect increases in the quadratic model (Table 5), confirming that the relationship between output and development zones might be non-linear. In particular, the results would suggest that the effects of development zones at the district-county level tend to diminish the larger percentage of land area covered by development zones. Notably, this positive contribution of development zones to industrial output can be read in causal terms only if we accept that the selection of zone location is captured by the

other control variables included in the model and that other unobserved and omitted factors have a different effect on each county, although constant over time.

Furthermore, as highlighted in section 2 above, a great deal of the literature has questioned the desirability of economic zones due to displacement effects. We recall that in this study we concentrate on the ability of economic zones to trigger industrial production, arguing that a certain degree of displacement was accepted when choosing this specific tool of industrial promotion (Di Tommaso et al., 2013). Other programs have been promoted since this choice was made to rebalance the territorial disequilibria brought about by rapid industrialization. We refer in particular to the government program supporting specialized towns and industrial relocation parks (Di Tommaso et al., 2013), which continue to wait for a specific assessment.

The results on value added confirm the general positive contribution of development zones to local industrial output (Table A2, appendix). However, such contribution is statistically significant only in the RE model. The Hausman test also indicates the RE model as the preferred model in this case. However, in the case of value added, the different models provide estimates based on a much more inferior number of observations because of the high number of missing values. As for exports, the results do not show any significant correlation of economic zones with the value of exports (Table A3, appendix). The general fit of the model appears poorer in this case, suggesting that perhaps other factors must be considered when looking at the determinants of exports. We leave this issue for future research.

Regarding the other control variables, the results are as expected. The number of workers appears with a positive sign and is highly significant. The coefficients of investment in capital innovation and FDI generally appear to be significant and with the expected positive sign. In the FE and FD forms, time-invariant variables (such as the urban, coast, and PRD dummy variables) are not explicitly estimated, but they are included in the fixed effects, together with other unobserved time-invariant variables. The RE and pooled models allow us to estimate these time-invariant factors, which appear in some cases highly significant and with the expected positive sign (in particular, the variable capturing the PRD area).

Insert Table 4 and Table 5 here

5. Conclusion

This study investigates whether development zones have significantly contributed to local economic development based, in particular, on China's experience. We conducted our empirical analysis both at an aggregate macro-level and at a more local level. The aggregate analysis conducted at the provincial level, for China as a whole, revealed that, on average, development zones do not increase total output proportional to the share of land covered by development zones in the host city. However, the analysis also suggests some heterogeneity in the effects of economic zones across different territories. A clear distinction exists between the most industrialized areas (Beijing-Tianjin-Hebei, Yangtze River Delta and Pearl River Delta) and less industrialized ones. In economically less developed regions, the more land the development zones occupy, the worse the effect is that they will have on the

area. While in more developed regions, the impacts of development zones is slightly positive. Further meso-level analysis on the county and district-level of Guangdong, one of the most industrialized provinces of China, confirmed the positive and significant relationship between local industrial output and the use of economic development zones, after other relevant factors are taken into account.

These results provide some interesting insights into the Chinese experience of economic development zones. First, they suggest, as highlighted by the literature in other industrialized and industrializing countries, that the effects of economic zones are context-specific and may vary considerably according to the specific local characteristics of the host region. Second, they highlight that there may be inefficiencies associated with the use of economic development zones and in this case, development zones might not be the primary policy choice to effectively increase the volume of economic production in every territory. Following 2008, in addressing the financial crisis, China's central government approved 169 provincial ETDZs and 57 ETDZs to advance to the national level – most of these located in the central and western regions of China. The results from the provincial level analysis suggest that this might be an invalid move for the relatively less industrialized regions. At the same time the evidence from Guangdong shows that economic zones can be effective in promoting industrial development in industrialized regions. Further research is needed to understand the specific factors (for example, government ability or other institutional aspects) that have made Guangdong a successful case and the extent to which such factors can, or cannot, be replicated elsewhere. The results on Guangdong

are in line with the literature suggesting that economic zones can trigger a wider industrial development process, provided that the local technological capabilities and absorptive capacities are sufficiently developed. Therefore, other preceding policy initiatives might be necessary before the establishment of economic zones in remote areas, to equip hosting regions with the necessary know-how and skills.

Comprehensively assessing the net causal impact of economic zones is difficult. More difficult is to compare the economic benefits with the costs associated with the establishment of economic zones. Therefore further work can be undertaken by evaluating with multiple perspectives. However, given China's leading role in contemporary global manufacturing, one of the aims of this paper was simply to stimulate more empirical analyses of China's case and, in particular, more empirical analyses at the territorial levels of China, which at the moment remain almost completely overlooked.

Insert APPENDIX A here

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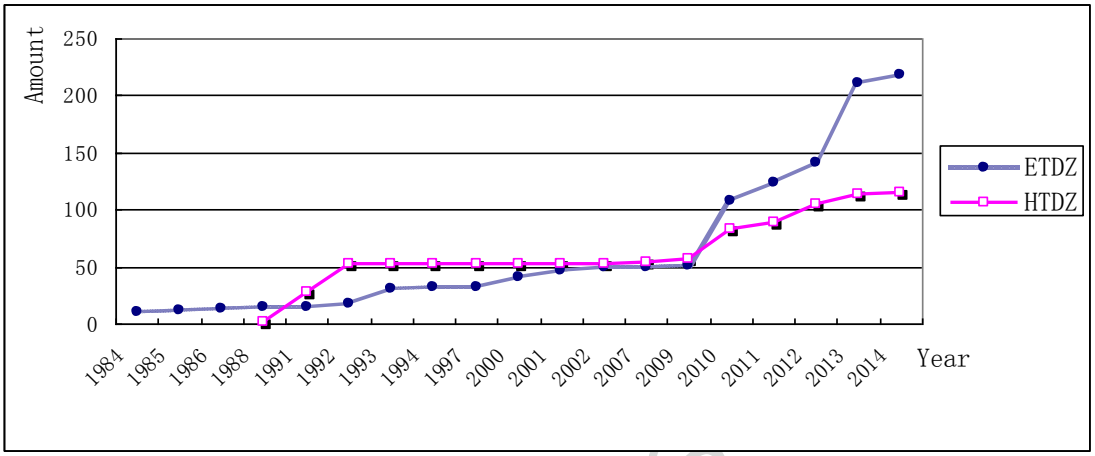

Figure 1 The changing number of ETDZs and HTDZs

Source: China Association of Development Zones http://www.cadz.org.cn/

Tab. 1 Basic information of development zones involved in the macro-level analysis

	Amount	Area (Sq2)	Industrial total output	Location				Administrative Level	
				Pearl river delta	Yangtze river delta	Jing-Jin-Ji Region	others	Provincial capital level	municipalities
ETDZs	43	547	66751	4	11	3	25	33	10
HTDZs	52	941	102299	6	6	4	36	31	21
Total	95	1488	169050	10	17	7	61	64	31

Source：ETDZ refers to the Economic and Technological Development Zones, HTDZ refers to High-Tech Development Zones; The data of ETDZ (Economic and technological development zones) and HTDZs (High-tech development zones) is collected from China Statistical Yearbook of Development Zones 2013 edited by Shi(2013) and China Statistical Yearbook of High-tech development zones edited by Zhang (2013).

Tab. 2 National and provincial development zones, Guangdong Province (2008)

Zone type	Number	Average land area (sq km)	Total land area (sq km)	% on special economic areas' total land
ETDZs	50	16	805	66.29
HTDZs	13	30	391	32.20
EPZs	3	2.4	7.4	0.61
FZs	7	1.3	10	0.82
Industrial Parks	1	1	1	0.08
TOTAL	74	10.4	1214.4	100

Source: Data of Economic and Technological Development Zones (ETDZs), High-Tech Development Zones (HTDZs), Export Processing Zones (EPZs), Free Trade Zones (FTZs), and Industrial Parks Economical ETDZ are collected from the Department of Commerce Guangdong Province (http://english.mofcom.gov.cn/aarticle/zt_business/lanmuf/ 200704/ 20070404627423.html)

Tab.3 The regression results of panel data for Gross Domestic Product

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
parea	-1.111*** (0.328)	-1.136*** (0.055)	-2.437*** (0.956)	-2.588*** (0.865)	-2.478*** (0.924)	
parea • type		0.055 (0.588)	0.471 (0.591)	0.265* (0.147)	0.267* (0.148)	0.278* (0.154)
parea • Special			3.395*** (0.885)	3.286*** (0.826)	3.317*** (0.876)	3.314*** (0.844)
parea • polit				0.984 (0.963)	0.765 (0.885)	0.680 (0.769)
lnempl	0.117*** (0.023)	0.117*** (0.023)	0.116*** (0.023)	0.160*** (0.025)	0.157*** (0.027)	0.144*** (0.026)

lninvest	0.691*** (0.014)	0.691*** (0.014)	0.663*** (0.017)	0.687*** (0.018)	0.675*** (0.017)	0.654*** (0.019)
lnprop_univ					0.148** (0.081)	0.123** (0.068)
parea_2007						-2.843*** (0.975)
parea_2008						-2.621*** (0.879)
parea_2009						-2.567*** (0.834)
parea_2010						-2.349*** (0.825)
parea_2011						-2.257*** (0.789)
parea_2012						-2.255*** (0.790)
Cons	3.817*** (0.311)	3.812*** (0.311)	4.371*** (0.340)	4.532*** (0.431)	4.413*** (0.408)	3.217*** (0.397)
city	control	control	control	control	control	control
year	control	control	control	control	control	control
F	1359.99	1018.23	837.12	605.99	603.14	587.89
Effect	FE	FE	FE	FE	FE	FE
Corr	0.443	0.443	0.444	0.541	0.542	0.543
Sigma_u	0.508	0.508	0.495	0.531	0.532	0.538
Sigma_e	0.124	0.124	0.122	0.122	0.122	0.121

*Remarks：***, **,* refers to the coefficient in 1%, 5% and 10%. Data of independent variables are collected from Chinese City Statistical Yearbook from 2004 to 2013*

Tab. 4 Regression results with determinants of local industrial output

Var	**POOL_1**	**POOL_3**	**FE_1**	**FE_3**	**RE_1**	**RE_3**	**FD_1**	**FD_3**
DZ_density	-.007	-.012	.050**	.343***	.014	.016		
Local_invest	.299***		.131***		.160***			
FDI	.135***		.059**		.073**			
Urban(dummy)	-.074	.367**			.026	.426		
Prd(dummy)	.758***	.744***			.961***	1.05***		
Workers	.848***	.737***	1.04***	.692***	.997***	.916***		
Coast(dummy)	-.030	-.074			-.028	-.026		
Year_effects (2000-2008)	YES	YES	YES	YES	YES	YES		
Loc_Inv*t-3*		.290***		.054		.080**		
FDI*t-3*		.135***		.046**		.057***		
DZ_dens_D							-.012	.363***
Loc_Inv_D							.196***	

FDI_D							-.044**	
Workers_D							.598***	.760***
Loc_Inv_*Dt-3*								.227***
FDI_*Dt-3*								.041**
cons	8.43***	8.45***	9.94***	11.25***	9.54***	10.27***		
N obs	630	465	630	465	630	465	517	360
R2	.85	.86	.55	.77			.112	.243

Source: Authors' elaboration. on data from Guangdong Bureau of Statistics (2000~2008) and Guangdong Prefectures' Statistical Yearbooks (2001~2009).

*Note: ***(significant at the 1% confidence level); **(significant at the 5% confidence level); * (significant at the 10% confidence level); DZ_Density = percentage of county/district area covered by development zones; Subscript _D denotes differenentiated variables for the models in first differences.*

Tab.5 Regression results with determinants of local industrial output (non-liner models)

Var	**POOL_1**	**POOL_3**	**FE_1**	**FE_3**	**RE_1**	**RE_3**	**FD_1**	**FD_3**
DZ_density	-.037**	-.041*	.279***	.545***	.045	.053		
$(DZ\_density)^2$	.001*	.001*	-.012***	-.022*	-.001	-.001		
Local_invest	.302***		.130***		.158***			
FDI	.141***		.060**		.072**			
Urban(dummy)	-.077	.371**			.014	.410		
Prd(dummy)	.742***	.725***			.952***	1.06***		
Workers	.858***	.748***	1.05***	.643***	.998***	.899***		
Coast(dummy)	-.028	-.071			-.044	-.028		
Year_effects (2000-2008)	YES	YES	YES	YES	YES	YES		
Loc_Inv*t-3*		.289***		.057*		.080**		
FDI*t-3*		.143***		.045**		.056***		
DZ_dens_*D*							-.042	.574***
$(DZ\_dens\_D)^2$							.002	-.029
Loc_Inv_D							.196***	
FDI_D							-.044**	
Workers_D							.598***	.734***
Loc_Inv_*Dt-3*								.224***
FDI_*Dt-3*								.040**
cons	8.39***	8.44***	9.97***	11.42***	9.55***	10.31***		
N obs	630	465	630	465	630	465	517	360
R2	.85	.86	.56	.77			.113	.257

Source: Authors' elaboration. on data from Guangdong Bureau of Statistics (2000~2008) and Guangdong Prefectures' Statistical Yearbooks (2001~2009).

*Note: ***(significant at the 1% confidence level); **(significant at the 5% confidence level); * (significant at the 10% confidence level); DZ_Density = percentage of county/district area covered by development zones; Subscript _D denotes differenentiated variables for the models in first differences.*

APPENDIX A

Tab. A1 Meso-level analysis: correlation among explanatory variables

	Dev.zones density	Local Investment $_{t-3}$	FDI $_{t-3}$	Urban	PRD	Coast	Workers$_t$
Dev. zones density	1.0000						
Local Investment $_{t-3}$	0.4044	1.0000					
FDI $_{t-3}$	0.3412	0.6706	1.0000				
Urban	0.3688	0.8095	0.5927	1.0000			
PRD	0.0039	0.4184	0.6037	0.2824	1.0000		
Coast	0.0029	0.3203	0.2021	0.3018	0.2305	1.0000	
Workers $_t$	0.4178	0.8755	0.6980	0.8414	0.4178	0.4124	1.0000

Source: authors' elaboration on data from Guangdong Bureau of Statistics (2000~2008) and Guangdong Prefectures' Statistical Yearbooks (2001~2009).

Tab. A2 Regression results with determinants of local value added (non-liner model)

Var	**POOL_1**	**POOL_3**	**FE_1**	**FE_3**	**RE_1**	**RE_3**	**FD_1**	**FD_3**
DZ_density	.013***	.070***	.603	-.185	.076*	.155		
$(DZ\_density)^2$	-.000	-.012**	-.030	-.002	-.001	-.017**		
Local_invest	.192***		.018		.074			
FDI	.184***		.145***		.163***			
Urban(dummy)	-.942***	-.223			-.317	-.074		
Prd(dummy)	.171***	.189***			.453**	.512***		
Workers	1.06***	.897***	-.048	.375	.850***	.822***		
Coast(dummy)	-.111	-.139			.030	-.117		
Year effects (2000-2008)	YES	YES	YES	YES	YES	YES		
Loc_Inv*t-3*		.254***		.186***		.217***		
FDI*t-3*		.142**		.019		.057		
Loc_Inv_D							.043	
FDI_D							.031	
Workers_D							2.07*	.504*
DZ_dens_*D*							-.048	027
DZ_dens_D^2							.004	-.019
Loc_Inv_*Dt-3*								.315***
FDI_*Dt-3*								-.019
cons	-10.33***	-10.77***	-5.32***	-8.10***	-8.53***	-10.08***		
N obs	323	177	323	177	323	177	170	89
R2	.88	.84	.92	.60			.020	.22

Source: Authors' elaboration. on data from Guangdong Bureau of Statistics (2000~2008) and Guangdong Prefectures' Statistical Yearbooks (2001~2009).

*Note: ***(significant at the 1% confidence level); **(significant at the 5% confidence level); * (significant at the 10% confidence level); DZ_Density = percentage of county/district area covered by development zones; Subscript _D denotes differenentiated variables for the models in first differences.*

Tab. A3 Regression results with determinants of exports

Var	**POOL_1**	**POOL_3**	**FE_1**	**FE_3**	**RE_1**	**RE_3**	**FD_1**	**FD_3**
DZ_density	.022**	.016	-.028	-.112	.016	.028**		
Local_invest	.225***		.172**		.196***			
FDI	.308***		.078*		.112***			
Urban(dummy)	-.122	-.058			.073	.058		
Prd(dummy)	1.35***	1.30***			1.72***	1.73***		
Workers	.976***	1.03***	1.07***	1.07***	1.15***	1.18***		
Coast(dummy)	.082	.081			.030	.010		
Year effects (2000-2008)	YES	YES	YES	YES	YES	YES		
Loc_Inv*t-3*		.189*		.149***		.170***		
FDI*t-3*		.338**		.082*		.132***		
Loc_Inv_D							.242***	
FDI_D							-.092*	
Workers_D							.727***	1.02***
DZ_dens_*D*							.012	034
Loc_Inv_*Dt-3*								.229***
FDI_*Dt-3*								-.012
cons	-2.66***	-2.22*	-2.08**	-1.51	-3.04***	-2.67***		
N obs	596	443	596	443	596	443	477	335
R2	.76	.77	.36	.29			.063	.06

Source: Authors' elaboration. on data from Guangdong Bureau of Statistics (2000~2008) and Guangdong Prefectures' Statistical Yearbooks (2001~2009).

*Note: ***(significant at the 1% confidence level); **(significant at the 5% confidence level); * (significant at the 10% confidence level); DZ_Density = percentage of county/district area covered by development zones; Subscript _D denotes differenentiated variables for the models in first differences.*

Highlights:

- ✧ Investigates whether development zones have significantly contributed to local economic development based on empirical analysis of both provincial level and county-level.
- ✧ Indicates that development zones, even though positive in developed regions, do not contribute to economic growth in proportion to their share of land in host cities on the whole.
- ✧ Reveals a positive and significant relationship between local industrial output and the use of economic development zones in county-level and district-level of Guangdong Province.