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Special economic zones and growth in China and India: an empirical investigation

Chee Kian Leong

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Abstract This paper investigates the role of special economic zones (SEZs) in liberalizing the Chinese and Indian economies and their impact on economic growth. The policy change to a more liberalized economy is identified using SEZ variables as instrumental variables. The results indicate that export and FDI growth have positive and statistically significant effects on economic growth in these countries. The presence of SEZs increases regional growth but increasing the number of SEZs has negligible effect on growth. The key to faster economic growth appears to be a greater pace of liberalization.

Keywords Special economic zones (SEZs) · Openness · Economic growth · Asia · China · India

1 Introduction

Both China and India have enjoyed remarkable rates of economic growth since 1980. Since over a third of the world's population are residing in these countries, the emergence of both countries as major economic forces in the global economy has been "one of the most significant economic development of the past quarter century" (Bosworth and Collins 2008). A large part of this phenomenal success has been attributed to the liberalization taken by both countries (Dollar and Kraay 2001, 2002). As a result, China and India are exemplars for the World Bank and other international organization in advocating that trade liberalization leads to economic growth.

C. K. Leong (✉)
Division of Economics, University of Nottingham, Ningbo,
199 Taikang East Road, Ningbo, 315100, China
e-mail: chee.leong@nottingham.edu.cn

When China opened her doors to world trade in 1980, an important aspect of her liberalization is the setting up of special economic zones (SEZs) or export processing zones (EPZs). China's SEZs are intended to serve as test beds for implementing capitalism. This has been so eloquently described by Deng Xiaoping as "crossing the river, feeling the stone one at a time". The phenomenal growth performance of China in the succeeding years has often been attributed to her success with these SEZs. Krugman and Obstfeld (1991, p247), for instance, asserted that Chinese economic growth in the 1980s amounted to "a classical demonstration of the potential of export-oriented industrialization".

China is not the first country to employ SEZs or EPZs as a growth strategy. In fact, India and the East Asian miracles (Hong Kong, Singapore, Taiwan and South Korea) have employed similar strategies before China. The spectacular economic growth performances for Hong Kong, Singapore, Taiwan, South Korea (World Bank 1993) have also been attributed to the use of EPZs as export promotion growth strategies. On the other hand, it is interesting and important to note that India was the first in Asia to set up an EPZ in Kandla in 1965. Yet being the first mover has conferred little advantage on India: her economic growth performance has been comparatively lacklustre. Despite the EPZs, India adopted heavily protectionist policies which have seen its share of world trade declined from 2 % in the 1950s to less than 0.5 % in the 1980s. Hence, liberalization of trade is not always associated with SEZs and EPZs. Does the setting up of SEZs and EPZs contribute significantly to the rapid economic growth of these countries?

In attempting to answer this research question, this paper contributes to understanding the role of special economic zones as a liberalization and growth strategy. Given the sterling performance of China, many other developing countries have attempted to emulate the Chinese blueprint of success by setting up EPZs and SEZs in the hope of replicating China's phenomenal success. Chief amongst these countries is India, which introduced its special economic zones policy, modelled closely after the Chinese. As of 2007, more than 500 SEZs have been proposed in India, out of which 220 have been approved. Other countries, such as Iran, Jordan, Poland, Kazakhstan, the Philippines, Russia, and Ukraine, have also pursued similar strategies. The staggering increase in the proliferation of such zones is a cause of concern for two reasons. Increasingly, one associates trade liberalization with the setting up of such zones. The establishment of EPZs and SEZs may not necessarily translate into the liberalization of trade. In the case of India, it had actually hindered trade liberalization. Thus, such a strategy may not lead to full liberalization as expected and may possibly deter governments from adopting more critical policies to liberalize their economies. Secondly, the increase in number of such zones leads to keener global competition for foreign direct investment (FDI). Unless FDIs can expand rapidly to accommodate the increase in number of such zones, the contribution of such export activities in these zones to the national output may be subjected to a shrinking pie. In short, an answer to the research question has potentially important policy implications.

Currently, there are several studies on SEZs in the literature which will be reviewed in Section 2. More recent studies such as Aggarwal (2004), Graham (2004), Arunachalam (2008, 2009), Das (2009), Palit and Bhattacharjee (2009) discussed the contexts in which SEZs were set up in India and China respectively and the rationale and implementation of the SEZ policies in these two countries. However, these studies are mostly qualitative and mainly focus on the role of SEZs in promoting exports or attracting foreign direct investment(FDI). In comparison, this paper differentiates itself from these studies in two ways. Firstly, a key contribution of this paper is an empirical investigation of SEZ as a liberalization tool and growth strategy for both the Chinese and Indian economies, using new available data at the national and regional level. Secondly, unlike these studies, the current paper attempts to analyze the relationship between liberalization and SEZ policies on economic growth through econometric models based on new datasets at both the national and regional level. Specifically, we employ an instrumental variable specification, taking a leaf from Frankel and Romer (1999) who also adopted an instrumental variable specification in studying growth and openness. In the present paper, the policy change to a more liberalized economy is identified using SEZ variables as instrumental variables. Because China and India adopted free trade policies in SEZs but did not necessarily liberalize their domestic markets, SEZs as a liberalization policy are unlikely to be correlated with factors omitted from the income equation. As such, they can be applied to identify the impact of trade. To ensure the robustness of our empirical results, we subject our models to specification tests to ensure that all instruments are valid and not weak.

The results in our paper indicate that export and FDI growth have positive and statistically significant effects on economic growth in these countries. The presence of SEZs increases regional growth but increasing the number of SEZs has negligible effect on growth. The key to faster economic growth appears to be due to a greater pace of liberalization, not in the increase of more SEZs.

This paper is organized as follows. Section 2 presents some background on the SEZs in China and India and a literature review. Section 3 describes the data and the empirical framework. Section 4 presents the results of the empirical tests and discusses the results. Section 5 discusses the policy implications of the results. We consider whether SEZs have a multiplier or immiserizing impact on economic growth and question whether increasing the number of SEZs will have a substantial impact on growth rate. Finally, Section 6 concludes and proposes some possible directions for future research.

2 Special economic zones in China and India: background and literature review

In this section, we survey the background and literature on special economic zones in China and India. The survey is not meant to be exhaustive and readers looking for more details can consult recent comprehensive surveys such as Arunachalam (2008, 2009), Das (2009) and Palit and Bhattacharjee (2009).

Special economic zones (SEZs) are localities with tax and business incentives, mainly set up to attract foreign investment and achieve technology transfer. There are different types of special economic zones: customs-bonded warehouse, customs-bonded factories, export processing zones, special economic zones and free trade zones, in ascending order of comprehensiveness and area. For a detailed classification and description of the various varieties of SEZs, see Wong and Chu (1984).

Despite the varieties of SEZs, they all share certain similar characteristics. Specifically, the main objectives of SEZs are to: (1) stimulate economic growth through promotion of exports, (2) attract foreign investment and increase foreign exchange earning, (3) increase employment and (4) achieve a transfer of technology and management skills. In the case of China, the SEZs also function as experiments for piloting the implementation of capitalist policies.

On August 1980, the Chinese government declared four cities in the southeastern coastal region as SEZs. Specifically, these were the small cities of Shenzhen, Zhuhai, and Shantou in Guangdong province and Xiamen in Fujian province. In these areas, tax incentives were offered by the local governments to foreign investors. Initially, these SEZs were conceptualized to be testbeds for capitalism, in which business enterprises make most of their own investment, production, and marketing decisions, and foreign ownership of such ventures was legalized. The new SEZs were mostly successful in attracting foreign investment and developed rapidly with expanding light and consumer-goods industries and growing populations. The literature generally treats these early SEZs as uniform, but there are some differences (Table 1): Shenzhen and Zhuhai are comprehensive SEZs while Shantou and Xiamen focused heavily on export processing. In terms of size, Shenzhen is the largest.

Following these early SEZs, 14 larger and older cities along the coastal regions were granted "open coastal city" status and opened to foreign trade and investment in 1984. These coastal opening cities include: Tianjin, Dalian, Qinhuangdao, Qingdao, Yantai, Weihai, Lianyungang, Nantong, Ningbo, Wenzhou, Fuzhou, Guangzhou, Zhanjiang and Beihai. These cities offered foreign investors similar incentives to the special economic zones but with higher corporate income taxes. In 1983, the entire island province of Hainan was turned into a special area for foreign investment and in 1988 Hainan Island became a separate province and officially became the largest SEZs. Since April 1990, the Pudong New Area in the city of Shanghai became an "open economic

Table 1 The first four SEZs in China

City	Shenzhen	Zhuhai	Shantou	Xiamen
Area (sq km)	1948.69	705	8937	1565
Size of SEZ (sq km)	300	7	0.2 (official) 20 (actual)	2.5 (1980) 131 (1984)
Type of SEZ	Comprehensive	Comprehensive	Export processing	Export processing

zone” with policies even more flexible than those already in force in existing SEZs.

In 1992, Chinese leader Deng Xiao-peng visited several SEZs in his famous “trip to the South” and apparently suggested that privileges extended to export-generating firms not to be restricted to these zones. Subsequently, such restrictions were lifted and other measures were taken to further liberalize foreign direct investment. Specifically, in 1992, similar policies were implemented in 23 major cities in inland China, including many provincial capitals.

The key experiences of China’s SEZs are also well documented in a recent World Bank study (Zeng 2010). In particular, the study focuses on three SEZs (Shenzhen, Tianjin, and Kunshan) and describes the SEZ experience in China as “gradualism with an experimental approach; a strong commitment; and the active, pragmatic facilitation of the state.”

India presents an interesting contrast to China. India established the first EPZ in Asia at Kandla (Kutch region) in 1965. The second EPZ appeared in Mumbai in 1974. Four more zones were established in Nodia (NEPZ), Chennai (Madras Export Processing Zone, MEPZ), Cochin (CEPZ) and Falta (FEPZ) in 1985. In 1994, the EPZ at Vishakhapatnam (VEPZ) was commissioned. Kundra (2000) notes that stimulating foreign investment was not a key objective for India EPZs, unlike those in the East Asian Miracles and China. Before liberalization in 1991, they were conceived more “as a means of providing relief to the domestic exporters from the regulatory regime.”

Although India has liberalized its trade since 1991, it was only on April 2000 that the Government of India announced the introduction of the special economic zones policy in the country, modelled closely after the Chinese model. The SEZ Act 2005 was formally passed by the Indian parliament on May 2005 and came into effect on 10 February 2006, supported by SEZ rules. Existing EPZs were converted to SEZs and new SEZs were proposed. As of 2007, about 400 SEZs have been proposed, of which 234 have been approved. The number of SEZs is staggering and doubts about the efficacy of these SEZs in promoting economic growth and the economic feasibility of such a large number of SEZs have been raised.

Does pursuing liberalization through SEZs actually promote economic growth? On this issue, however, both the theoretical and empirical literatures are sparse.

On the theoretical side, Hamada (1974) is the pioneering study which presents a framework to analyze the welfare effects of such zones. Using the standard Ricardo-Viner 2-factors, 2-commodities trade model, he demonstrated that in the absence of foreign direct investment (FDI), the establishment of such a zone does not affect production if the protection is in the form of import tariff and increasing FDI in such zones does not necessarily improve the consumption possibilities available to the developing countries. Thus, foreign investment in such a zone has an immiserisation effect and establishing such a zone results in a welfare loss. A contrary conclusion was reached by Young and Miyagiwa (1987) who considered a country suffering unemployment of the Harris-Todaro type: rigid urban wage is the only distortion. In this case, the introduction of a "second best" distortion in the form of a reduction of tariffs on intermediate imports into a duty-free zone will increase the value of national output at world price. Schweinberger (2002) reviewed extensions of these two divergent theoretical perspectives and pointed out the many special assumptions and the lack of a unified framework and clear conclusions. A lacuna in the theoretical literature is that none of these theoretical models had been tested empirically.

On the empirical side, Wong and Chu (1984) presented a qualitative evaluation of the performances of several export processing zones and special economic zones in terms of attracting foreign direct investment, earning foreign exchange, export growth, employment generation, transfer of technology, backward and forward domestic linkages and regional development. Despite its ambitious agenda, the lack of data prevents a comprehensive empirical analysis of all these aspects. Since then, a World Bank working paper (Madani 1999) on Free Economic Zones (FEZs) presented a number of examples of FEZs and detailed description of organizational structure but went no further. A number of other studies on China's SEZs policy (Ge 1999; Park 1997) focus on detailed descriptions of the SEZs in China. Kundra (2000) compared the characteristics of EPZs in India with the characteristics of SEZs in China. Wei (1993) employed a city-level analysis, based on data from 1980–90 and finds "some clear evidence that during 1980–90 more exports are positively associated with higher growth rates across Chinese cities. In the late 1980s, the contribution of growth comes mainly from foreign direct investment." A more recent study by Graham (2004) discussed the success of export processing zones in attracting FDI based on the experience of China while that by Aggarwal (2004) discussed export performance for export processing zones in India. Arunachalam (2008, 2009), Das (2009) and Palit and Bhattacharjee (2009) are recent updates on the experience of India in implementing its SEZ policies.

This paper contributes to the empirical literature by adopting an econometric approach. This is a key difference between the present study and the above-mentioned empirical studies which are mostly empirical descriptions. In this sense, this approach is similar to Wei (1993), which was an econometric analysis at the city-level for a single country, China. In contrast, the current study is an analysis at the country-level for two countries, China and India.

Using SEZ as both liberalization and growth policies presents another challenge for empirical analysis. Currently, analysis of the relationship between openness and economic growth employ export to GDP ratio as a measure of openness. A serious shortcoming of this measure is that it measures the level of openness but does not capture the policy by a government to liberalize its economy. Moreover, it confounds both the effect of liberalization and that of SEZs. This is a shortcoming that we address in this paper by using both a policy dummy variable to denote the shift in policy towards openness and the number of SEZs or EPZs to obtain instrumental estimates of effect of export on income growth. Because China and India adopted free trade policies in SEZs but did not necessarily liberalize their domestic markets, SEZs as a liberalization policy are unlikely to be correlated with factors omitted from the income equation. Hence they can be used to identify the impact of trade.

3 Data and specifications

In this section, we describe the data and specifications employed in the empirical models used to analyze the role of SEZ on the economies of China and India as well as the regional cities of China and India.

The first part of the study focuses on the analysis of the panel data for China and India before and after they liberalize their markets. In both China and India, there were deliberate and discernable changes in the policy towards openness. For China, these occur in the years 1980 and 1991, while for India in the years 1991 and 2001. The distinct changes enable us to analyze the effects of a deliberate change in policy towards openness on economic growth.

In addition to the national analysis, this paper also contributes to understanding the role of SEZs in promoting regional growth. We were able to obtain data for Chinese regions and data for Indian regions with EPZs. The analyses of these new data contribute some interesting new insights into the role of SEZs and EPZs in regional growth.

In the next two sections, we describe the data tested and present the specifications used in the empirical tests.

3.1 Data description

The data set employed in this paper was consolidated from China Statistical Yearbook (various issues), China Data Online and CEIC database. This was cross-validated with data available from the World Development Indicator (World Bank 2009). Data for exports of the Indian EPZ regions are from Kundra (2000) while the national income data are obtained from the Reserve Bank of India.

The years covered for the Chinese national data includes 1952 through 2003. However, the data for the year 1952–1969 were patchy and contain many missing values. A similar problem occurs with the Indian national data. To balance the panel, only observations for the year 1970–2003 are included. This reduces the sample size to 68 sets of observations (Table 2).

The Chinese regional data covers the year 1978–2001 and 31 regions. These regions are Beijing, Tianjin, Hebei, Shanxi, Inner Mongolia,

Table 2 Descriptions of the national dataset

Variable	Description
log(GDP)	Log of GDP
log(exports)	Log of exports
log(FDI)	Log of FDI
T1	Initial trade liberalization dummy
T2	Second trade liberalization dummy
SEZ	Number of SEZs or EPZs

Table 3 Descriptions of the regional dataset (China)

Variable	Description
log(GDP)	Log of GDP
log(exports)	Log of exports
SEZ	SEZ dummy
Coastal	Coastal region dummy

Liaoning, Jilin, Heilongjiang, Shanghai, Jiangsu, Zhejiang, Anhui, Fujian, Jiangxi, Shandong, Henan, Hubei, Hunan,Guangdong, Guangxi, Sichuan, Guizhou, Yunnan, Shaanxi, Gansu, Qinghai, Ningxia, Hainan and Xinjiang. The sample has 704 sets of observations (Table 3).

Unfortunately, complete regional data for India were not available for export level, so our regional analysis for India is restricted to regions with EPZs where the data are available. These include Kerala, Maharashtra, Tamil Nadu, Uttar Pradesh, West Bengal and Gujarat. The period of the sample is from 1980–1997 and the sample has 108 sets of observations (Table 4).

Ideally, the regional share in exports contributed by SEZs should be examined. However, obtaining such detailed export data for all the regions for the time period under consideration is not possible. For one, not all the regions collect annual data on the export share by SEZs. Moreover, the regional data are seldom decomposed into SEZ and non-SEZ exports.

3.2 Specifications

3.2.1 National

The baseline specifications are those of pooled ordinary least square (OLS). Frankel and Romer (1999) have pointed out that if export is endogenous, an OLS regression will produce a biased and inconsistent estimator of the parameters. Since existing studies employ OLS, the OLS can a useful baseline for comparison with the instrumental variables models proposed in this paper. In the first specification (1), the log of GDP ($\log Y_{\text{it}}$) is regressed on the log of exports ($\log X_{\text{it}}$), an initial trade liberalization dummy ($T1$), a second trade liberalization dummy ($T2$) as well as the number of SEZs or EPZs for each country in each period (SEZ_{it}). The second specification is similar to the first specification, except that the log of foreign direct investment ($\log FDI_{\text{it}}$) is included as an additional explanatory variable.

Pooled least square

$$\log Y_{\text{it}} = \beta_0 + \beta_1 SEZ_{\text{it}} + \beta_2 \log X_{\text{it}} + \beta_3 T1_{\text{it}} + \beta_4 T2_{\text{it}} + \varepsilon_{\text{it}} \quad (1)$$

Table 4 Descriptions of the regional dataset (India)

Variable	Description
log(GDP)	Log of GDP
log(exports)	Log of exports Of EPZs in regions
EPZunits	Number of operational units in EPZ

$$\log Y_{it} = \beta_0 + \beta_1 SEZ_{it} + \beta_2 \log X_{it} + \beta_3 T1_{it} + \beta_4 T2_{it} + \beta_5 \log FDI_{it} + \varepsilon_{it} \quad (2)$$

where

$$T1_{it} = \begin{cases} 0 & \text{before 1st trade liberalization,} \\ 1 & \text{after 1st trade liberalization.} \end{cases}$$

$$T2_{it} = \begin{cases} 0 & \text{before 2nd trade liberalization,} \\ 1 & \text{after 2nd trade liberalization.} \end{cases}$$

Instrumental variable specification Our instrumental variable specification for the data set for China and India can be described using a simple two-stage least square panel data model. First, income in country i is a function of exports, FDI and other factors. Specifically, the three models are given by:

$$\log Y_{it} = \beta_0 + \beta_1 \log X_{it} + \varepsilon_{it} \quad (3)$$

$$\log Y_{it} = \beta_0 + \beta_5 \log FDI_{it} + \varepsilon_{it} \quad (4)$$

$$\log Y_{it} = \beta_0 + \beta_1 \log X_{it} + \beta_5 \log FDI_{it} + \varepsilon_{it} \quad (5)$$

Running an ordinary least-square (OLS) regression will produce a biased and inconsistent estimator of the parameters if X_{it} or FDI_{it} is endogenous, resulting in an identification problem. To resolve this, we need an instrumental variable, which is uncorrelated to ε_{it} but correlated to X_{it} or FDI_{it}. We propose using both the policy dummy variables to denote the shift in policy towards openness and the number of SEZs or EPZs to obtain instrumental estimates of effect of export or FDI on income growth. Because both China and India adopted free trade policies in SEZs but did not necessarily liberalize their domestic markets, SEZs as a liberalization policy are unlikely to be correlated with factors omitted from the income equation. Hence they can be used to identify the impact of trade. The equations are as follows:

$$\log X_{it} = \phi_0 + \phi_1 T1_{it} + \phi_2 T2_{it} + \phi_3 SEZ_{it} + \xi_{it} \quad (6)$$

$$\log Y_{it} = \varphi_0 + \varphi_1 T1_{it} + \varphi_2 T2_{it} + \varphi_3 SEZ_{it} + \xi_{it} \quad (7)$$

3.3 Chinese regions

For the Chinese regions, the baseline specification is the pooled OLS, which can be described as follows:

$$\log y_{it} = a_0 + a_1 \log x_{it} + a_2 SEZ_{it} + a_3 Coastal_{it} + u_{it} \quad (8)$$

where y_{it} is income for the region, x_{it} is export of the region, SEZ_{it} and $Coastal_{it}$ are dummy variables for the presence of SEZ or coastal cities in each region for each period while u_{it} reflects other influences on income of the region.

Since x_{it} is endogenous, the ordinary least-square (OLS) regression will produce a biased and inconsistent estimator of the parameter. To resolve the identification problem, we need an instrumental variable, which is uncorrelated to u_{it} but correlated to x_{it}. We propose using the SEZ variable (SEZ_{it}) and the coastal city dummy variable ($Coastal_{it}$) as the instrumental variables. The equation is as follows:

$$\log x_{it} = c_0 + c_1 SEZ_{it} + c_2 Coastal_{it} + \delta_{it} \tag{9}$$

3.4 Indian regions

For the Indian regional dataset, all the regions with complete data have EPZs. In this case, the baseline pooled OLS specification is given by

$$\log y_{it} = \kappa_0 + \kappa_1 \log X_{it} + \kappa_2 EPZ_{it} + e_{it} \tag{10}$$

where y_{it} is income for the region, X_{it} is export of the region EPZ_{it} is the number of operational units in each EPZ for each period, while e_{it} reflects other influences on income of the region.

The instrumental variable model is given by using operational units in EPZs to obtain instrumental estimates of effect of export on regional income growth. The equation is as follows:

$$\log x_{it} = \psi_0 + \psi_1 EPZ_{it} + \mu_{it} \tag{11}$$

4 Results and discussion

In this section, we present and discuss the results of the regression models specified in the previous section.

4.1 National

Table 5 reports the regression for the national panel dataset.

Column (1) presents a pooled OLS regression of log income on log export, openness policy dummy variables and the number of SEZ. The point estimate for exports implies that an increase in export by 1 % is associated with 0.44 % in national income. It is interesting to note that the impact of the first liberalization is not significant. The impact of the number of SEZs is statistically significant with a point estimate of 0.0045.

Column (2) has a similar specification as column (1), but adds log(FDI) as explanatory variables. FDI is statistically significant though an increase in FDI by 1 % is associated with only a 0.059 % increase in national income. It is interesting to note that with log FDI added, the number of SEZ is no longer significant as an explanatory variable. In this case, it even has a negative sign.

Table 5 Openness and growth (national)

Variable	Pooled OLS		Instrumental variables		
	(1)	(2)	(3)	(4)	(5)
Constant	15.59***	15.46***	13.51***	26.91***	8.44***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
log(exports)	0.44***	0.46***	0.53***		0.74**
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
T1	0.019	−0.15	Instrument	Instrument	Instrument
	(0.88)	(0.23)			
T2	0.12***	0.09***	Instrument	Instrument	Instrument
	(0.00)	(0.01)			
SEZ	0.0045***	−0.0004	Instrument	Instrument	Instrument
	(0.00)	(0.84)			
log(FDI)		0.059***		0.35***	−0.14***
		(0.00)		(0.00)	(0.00)
N	68	57	68	57	57
Adjusted R^2	0.96	0.96	0.96	0.76	0.89
SE of regression	0.14	0.13	0.15	0.34	0.24
Hausman test			6.05	28.48	1.93
			[0.01]	[0.00]	[0.38]
Sargan test			5.72	3.15	2.82
			[0.06]	[0.21]	[0.09]
First stage F-statistics			F(2,64) = 124.61	F(3,53) = 179.90	F(2,54) = 227.87

Notes
1 Numbers in parentheses () are robust (White-heteroskedasticity corrected) standard errors
2 Numbers in parentheses [] are p-values
3 ***, ** and * indicate that the coefficient is significantly different from zero at the 1 %, 5 % and 10 % levels, respectively

Columns (3)–(6) are the IV estimations, with exports being treated as endogenous and the openness policy variable and the number of SEZs used as instruments. The variable log(exports) is statistically significant. From the point estimates, we also observe that the IV estimate of trade's impact on income is higher than the OLS estimates. One possible reason is that although these countries liberalized their trade policies through SEZs, they did not adopt other growth-enhancing policies, such as reforms to governance and property rights regime. This will lead to a negative correlation between exports and the errors terms in an OLS regression and thus creating a downward bias in the OLS estimate of export's effects.

To test the robustness of the specifications for models (3) to (5), a Hausman test (Hausman 1978) is performed on the null hypothesis that the OLS estimates are consistent. The asymptotic test statistics and the corresponding p-values are reported in the Table 5. The null hypothesis is rejected for both model (3) and (4) at 5 % significance level but could not be rejected for model (5).

Additionally, a Sargan over-identification test was applied to models (3) to (5) with the null hypothesis that all instruments are valid. The chi-square test statistics and the corresponding p-values are reported in the Table 5. There is no evidence to reject the null hypothesis that all the instruments are valid for all the three models at 5 % significance.

Finally, the first-stage F-statistics reported are all more than 10, suggesting that the instruments are not weak in all models.

4.2 Chinese regions

Table 6 reports the regressions for the panel data for the Chinese regions.

Column (1) presents the baseline pooled OLS regression of log income on log export and openness policy variables. The point estimate for exports implies that an increase in export by one percentage point is associated with 0.65 % in regional income. It is interesting to note that the signs for both the SEZ and the Coastal variable are negative and that the SEZ variable is statistically significant. Again, the wrong sign possibly indicates that the pooled OLS may not be an adequate specification.

Column (2) presents the IV estimation, with exports being treated as endogenous and the SEZ and coastal variables used as instruments. The coefficient on export falls to 0.52. The IV estimate implies that a 1 % increase in the export raises regional income by 0.52 %, lower than that for the pooled OLS model. One possible reason is that these liberalized regions are likely to adopt other growth-enhancing policies, such as infrastructure development, hence resulting in a positive correlation between exports and the errors terms in an OLS regression which biases the OLS estimate of export's effects upwards. It is interesting to note that this contrasts with the national level, where growth enhancing policies, albeit of a different nature (such as governance and intellectual property protection), were not adopted in addition to the liberalization policy through SEZs.

The asymptotic test statistic for the Hausman test is 14.65 with p-value = 0.00, which rejects the null hypothesis that the OLS estimates are consistent.

Table 6 Openness and growth (Chinese regions)

Variable	Pooled OLS (1)	Instrumental variables (2)
Constant	4.48***	5.32***
	(0.14)	(0.20)
log(exports)	0.65***	0.52***
	(0.02)	(0.03)
SEZ	−0.61***	Instrument
	(0.09)	
Coastal	−0.06	Instrument
	(0.10)	(0.01)
N	704	704
Adjusted R^2	0.70	
SE of regression	0.74	0.78
Hausman test		14.65
		[0.00]
First-stage F-statistics		F(2,701) = 215.87

Notes
1 Numbers in parentheses () are robust (White-heteroskedasticity corrected) standard errors
2 Numbers in parentheses [] are p-values
3 ***, ** and * indicate that the coefficient is significantly different from zero at the 1 %, 5 % and 10 % levels, respectively

Table 7 Openness and growth (Indian regions)

Variable	Pooled OLS (1)	Instrumental variables (2)
Constant	8.94*** (0.11)	8.84*** (0.12)
log(exports)	0.07** (0.03)	0.11*** (0.02)
EPZ	0.0021 (0.00)	Instrument
N	108	108
Adjusted R^2	0.28	
SE of regression	0.50	0.50
Hausman test		1.44 [0.23]
First-stage F-statistics		F(1,106) = 261.89

Notes
1 Numbers in parentheses () are robust (White-heteroskedasticity corrected) standard errors
2 Numbers in parentheses [] are p-values
3 ***, ** and * indicate that the coefficient is significantly different from zero at the 1 %, 5 % and 10 % levels, respectively

The first-stage F-statistic (2, 701) is given by 215.87, which indicates that the instruments are not weak.

4.3 Indian regions

Table 7 reports the regressions for the panel data for the Indian regions, for the period 1980–1997. Since data on exports are available only for regions with EPZs, the results are only indicative but still offer some interesting insights.

Column (1) presents the baseline pooled OLS regression of log income on log export and the number of operational units in each EPZ. The point estimate for exports implies that an increase in export by 1 % is associated with a mere 0.072 % in regional income. The number of EPZ units is not statistically significant.

Column (2) provides the IV estimation, with exports being treated as endogenous and the number of operational units in EPZ used as an instrument. The coefficient on export increases to 0.11. The IV estimate implies that a 1 % increase in the export raises regional income by 0.11 %, higher than that for the pooled OLS model. A Hausman test was performed, with the asymptotic test statistic given by 1.44. The high p-value = 0.23 suggests that it is not possible to reject the null hypothesis that the OLS estimates are consistent. The first-stage F-statistic (1, 106) is given by 261.89, which indicates that the instruments are not weak.

5 Policy implications

In this section, we discuss the policy implications of the results. Do EPZs and SEZs have a positive impact on growth, as claimed by Young and Miyagiwa (1987), or do they have an immiserizing effect, as concluded by Hamada (1974)? This is a question that we can attempt to resolve using our empirical results. Firstly, we consider whether SEZs have a multiplier or immiserizing impact on economic growth. Next, we question whether increasing the number of SEZs will have substantial effect on growth rate.

To shed some light on this issue, we consider two possible decompositions of the growth equation and link these to the empirical results to examine trade's impact on each component. Two decompositions of income are required because exports can be considered as a part of the output while FDI can be considered as a factor input in the aggregate production of the country.

Firstly, we consider the output approach. In this approach, the output Y_i of the country i can be written as

$$Y_i = e^{\phi SEZ_i} D_i^{\alpha} X_i^{1-\alpha}$$

where N_i denotes the number of SEZs in country i and D_i is the part of the output which is consumed domestically and X_i is the part of the output which is exported. This equation could be used to decompose the effects on economic growth by both exports, domestic output and number of SEZs. Taking logarithms on both side yields the growth equation

$$\log Y_i = \phi SEZ_i + \alpha \log D_i + (1-\alpha) \log X_i \tag{12}$$

Further, putting $\beta_0 \equiv \alpha \log D_i$, $\beta_1 \equiv \phi$ and $\beta_2 \equiv (1-\alpha)$, we get

$$\log Y_i = \beta_0 + \beta_1 SEZ_i + \beta_2 \log X_i. \tag{13}$$

Secondly, we consider the factor approach. Unlike the output approach, the output Y_i of the country i is written as

$$Y_i = e^{\phi SEZ_i} K_i^{\theta} FDI_i^{1-\theta}$$

where SEZ_i denotes the number of SEZs in country i and K_i is the domestic capital input and FDI_i is foreign direct investment. This equation could be used to decompose the effects on economic growth by both domestic capital, foreign direct investment and number of SEZs. Taking logarithms on both side yields the growth equation

$$\log Y_i = \phi SEZ_i + \theta \log K_i + (1-\theta) \log FDI_i \tag{14}$$

As for the output approach, putting $\beta_0 \equiv \theta \log D_i$, $\beta_1 \equiv \phi$ and $\beta_3 \equiv (1-\alpha)$, we get

$$\log Y_i = \beta_0 + \beta_1 SEZ_i + \beta_3 \log FDI_i. \tag{15}$$

Similar derivations can be obtained in the case of regions.

5.1 Effects of exports and FDI on growth

To estimate the effects of exports on economic growth, we make use of Eq. 13. This can be estimated using he coefficients for model (3) in Table 5,

$$\log Y = 13.51 + 0.53 \log X \tag{16}$$

Next, to obtain the growth rate from the estimated level equation, differentiate the estimated Eq. 16 throughout with respect to t to obtain

$$\frac{\dot{Y}}{Y} = 0.53\frac{\dot{X}}{X} \tag{17}$$

Hence, at the national level, a 1 % increase in export growth rate only increases economic growth rate by 0.53 %. Alternatively, we can say that economic growth in these countries is positive but not export-elastic. Even so, the size of the relationship between growth of exports and growth is higher than the national average noted in Lewer and van den Berg (2003). Most empirical studies on the size of the relationship between trade and growth exhibit the consistent result that a one percentage point increase in the growth of exports is associated with a one-fifth percentage increase in economic growth. The power of compounding means that the effect of trade on growth could be very substantial over time and this appears to be the case for China and India.

Similarly, the elasticity of economic growth with respect to FDI can be determined by estimating Eq. 19. Using the coefficients from model (4) of Table 5, it can be shown that a 1 % increase in export growth rate only increases economic growth rate by 0.35 %, which is even less than that for exports.

Thus, at the national level, there does not seem to be any multiplier effect of exports on economic growth. On the other hand, there appears to be an indication of immiserizing effect in model (5) of Table 5, the sign of $\log(FDI)$ being negative. However, the point estimate is not statistically significant. The results thus appear to favour Young and Miyagiwa (1987)'s theoretical model over that of Hamada (1974).

Likewise, we can check for the multiplier effects for the Chinese region, which is as follows. From model (2) in Table 6, $\log y = 5.32 + 0.52 \log x$, so it follows that

$$\frac{\dot{y}}{y} = 0.52\frac{\dot{x}}{x} \tag{18}$$

At the Chinese regional level, a 1 % increase in export growth rate only increases regional growth rate by 0.52 %. So while the presence of SEZs may exert positive effect on the growth rate, the increase in regional growth is even more export inelastic than at the national level.

Finally, for the Indian regions with EPZs, we use the pooled OLS model from Table 7 to obtain

$$\frac{\dot{y}}{y} = 0.0021\frac{\dot{x}}{x} \tag{19}$$

This indicates that a 1 % increase in export growth rate in Indian regions with EPZs only increases regional growth rate by a mere 0.0021 %. As in the case of the Chinese regions, the increase in regional growth is even more export inelastic than at the national level.

5.2 Number of SEZs and economic growth rate

Since 2000, India has embarked on increasing the number of SEZs. As of 2007, about 400 SEZs have been proposed, of which 234 have been approved. Will the staggering increase in number of SEZs have a significant impact on economic growth? From our empirical results, such a strategy may not be wise. Using the pooled OLS model from Table 5, the effect of increasing the number of SEZ on national growth is not substantial: increasing the number of SEZ by 200 will only increase the national income by 0.009 %, not a very substantial increase.

For the Indian regions, the increase in number of EPZ units does not alter the regional income significantly. From Using the pooled OLS model from Table 7, increasing the number of EPZ units by 200 will only increase the national income by 0.004 %, again not very substantial.

6 Conclusion

In this paper, we investigate the impact of opening up the China and Indian economy on economic growth in these countries. We based our empirical analysis on new panel data sets for both the national economies and the regional economies of China and India.

Instead of using export to GDP ratio as a measure of openness, we use policy dummy variables to denote the shift in policy towards openness and also take into account the presence of SEZs in our specification. By doing so, we seek to understand SEZ as both liberalization and growth policies.

At the national level, export is statistically significant in all the specifications. However, the instrumental variable estimate of trade's impact on income is higher than the OLS estimates. Thus, it is possible that although these countries liberalized their trade policies through SEZs, they did not adopt other growth-enhancing policies, such as better governance and property rights protection. This will lead to a negative correlation between exports and the errors terms in an OLS regression and thus to downward bias in the OLS estimate of export's effects. In contrasts to the national results, the regional results suggest a positive correlation between exports and the errors terms in an OLS regression which biases the OLS estimate of export's effects upwards. It is likely that liberalized regions are likely to adopt other growth-enhancing policies, such as infrastructure development. It seems that such regional policies which enhance regional growth are not growth enhancing at the national level. Therefore, a possible policy implication would be that among other policies, China would have to ensure better governance and property rights regimes to enhance growth at both the regional and the national levels. Of the two phases of liberalization in both countries, the second stage is statistically significant for most specification. One possible reason is that the scale of liberalization is greater in the second phase. Additionally, we demonstrate that increasing the number of SEZs has negligible impact on economic growth. Taken together, these results suggest that what contributes to greater growth is a greater scale of liberalization, rather than increasing the number of SEZs. The policy implication is that India may need to reconsider its large scale creation of SEZs and strive for a greater liberalization of the economy instead.

Consistent with popular perception and existing studies, export growth does have a positive and statistically significant effect on economic growth in these countries. However, contrary to these perceptions, export growth does not have a “multiplier” effect on economic growth: the growth rates of these countries are export inelastic, in the sense that a one percentage point increase in export growth rate will have a less than one percentage point increase in economic growth rate of these countries. Based on our data, the percentage increase in national economic growth rate was 0.54. In the instrumental variables model, there also appears to be an indication of immiserizing effect of FDI, as suggested by Hamada (1974). However, the point estimate is not statistically significant. In other specifications, FDI appears to have statistically significant and positive impact on economic growth though the FDI elasticity of economic growth is lower than export elasticity. This appears to favour Young and Miyagiwa (1987)’s theoretical model over that of Hamada (1974).

Further, this paper also contributes to a better understanding of the relationship between SEZs, openness and growth at the regional level for both China and India. In the case of China, we conclude that while the presence of SEZs may exert positive effect on the regional growth rate, the increase in regional growth is even more export inelastic than at the national level. In this case, our estimate of the percentage increase in regional economic growth was 0.51 for every 1 percentage increase in regional exports. For India, data constraints restrict the data analysis to only those regions with EPZs. In these regions, economic growth is very export inelastic. The number of operational units in each EPZ is not statistically significant in all specifications. The increase in number of operational units in each EPZ has very limited impact on regional growth.

A number of caveats apply for our results. Firstly, as mentioned earlier, the designated economic function and physical size of the SEZs may vary from zone to zone. The number of the SEZs does not reflect these important differences. Even with identical functions and physical size, the implications for the regional and national economies can be different with some zones managing to take off while others failing to do so. Adjusting the number of SEZs against the size may imply a smaller impetus to export oriented growth through SEZs. Ideally, one should also examine the proportion of non-agricultural output accounted for by SEZs but such data are not readily available. Although these details are not explored in our model due to the dearth of reliable data, the results of our panel study clearly suggests that the number of the zones does not matter. In addition, the size, types and other characteristics of SEZs (if the data are available) may not matter. What matters ultimately may be the quality of the SEZs. China did not start with many SEZs and their sizes are varied. But the successes of these early SEZs contribute to the expansion of exports, FDI and ultimately GDP. Success breeds success, so it may be a case that increasing the number of successful SEZs contributes to greater economic growth. Consequently, policymakers should focus less on the number and size of SEZs and more on the quality of the SEZ's implementation. Future research may also focus on identifying factors which can contribute to the success of SEZ and developing a global benchmark based on these factors identified. Such a benchmark would be useful to extend best practices to other developing countries intending to implement SEZs as part of their growth strategy.

Furthermore, how the SEZ strategy fits into the overall growth strategy of a country may be important. In the case of China, the SEZs were envisioned as a gradual approach to liberalization and the resulting success of some of these zones were used as political justification of a more liberal policy towards trade and FDI (Zeng 2010). On the other hand, the SEZs in India were set up in an import substituting regime to promote foreign exchange inflows to fund imports. So, while it might be true that the economic growth is not export elastic, the SEZ experience may help in the export-oriented growth by enabling an erstwhile closed economy to participate in the global trade and exploit its comparative advantages. The resulting development in infrastructure and human capital may then pave the way for a broad-based growth. This may be the "secret" behind the East Asia miracle and China's phenomenal growth. Thus, the manner by which SEZs are related to economic policy could be important and merits further exploration in future research.

Another extension is worth considering for future research. Both countries are large countries and have more opportunity to trade between the regions. In this paper, we have not accounted for the impact of these regional trades on national income. It is possible that increased trade between regions within a country can also have effect on capital accumulation and hence income. In this respect, we are restricted by the current lack of available and reliable data for inter-regional trade. We leave this extension as a potential area for future research.

In summary, our study contributes to the understanding of the openness-growth nexus and provides some food for thought to countries contemplating the introduction of more SEZs to pave the way for more openness and growth. The results here suggest that the key to a greater rate of economic growth lies in a greater pace of liberalization, not in the increase of more SEZs.

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