Imitating to Export*

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Abstract

China's export processing zones (EPZs) attracted foreign companies to set up export operations. Chinese firms quickly imitated these firms in both export and import patterns. Exports of the products shipped from EPZs grew throughout the province, with the largest gains in the city containing the EPZ, and the next largest in the cities adjacent to the EPZ. Chinese companies also imitated the equipment imports of firms in EPZs, suggesting that they copied technology. Finally, firms which imitated EPZs enjoyed larger gains in productivity than non-imitating peers, demonstrating that imitation can lead to significant gains in technology. We conclude that a key ingredient of China's success in trade has been its ability to attract foreign firms, and its subsequent ability to copy them.

1 Introduction

After decades of spectacular growth, China became the world's largest trading nation in 2013. While there is little doubt that reform and liberalization have propelled much of

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this growth, it remains difficult to assess the effectiveness of individual policies (Rodrik, 2006; Brandt and Rawski, 2008; Alder et al., 2013). Yet disentangling the determinants of China's incredible success is of fundamental importance to understanding China's rise as well as assessing whether it can be replicated in other countries.

In this paper, we document an important and previously unaccounted-for contributing factor in China's rise. Using a broad set of incentives, ranging from lower taxes to decreased regulations, China attracted foreign firms to set up export operations in export processing zones (hereafter, "EPZs"). Exports from these zones, nearly entirely produced by wholly owned foreign enterprises (WOFEs), immediately exploded, going from zero at the beginning of 2001 to about 4 billion dollars per month by 2006. We find that Chinese firms in surrounding cities quickly imitated the exports from EPZs, with the largest growth occurring in the city of the EPZ, and the next largest growth in adjacent cities. Moreover, Chinese firms imitated the capital imports of these foreign firms, suggesting that they copied their technology. Finally, we find that Chinese companies experienced improved operating outcomes, with significant productivity gains observed among the set of imitating firms relative to their exporting peers. This suggests that copying foreign companies can allow firms to leapfrog others in terms of productivity. We conclude that a key ingredient of China's success in trade has been its ability to attract foreign firms, and its subsequent ability to imitate these firms.

EPZs began operation in 2001, and our study relies on detailed customs transactions in China over the period 2000-2006. Our study focuses on cities adjacent to EPZs because our assumption is that cities adjacent to the city of the EPZ cannot choose whether an EPZ is established or which products are shipped from it. While the relationship between exports of an EPZ and outcomes in the city of the EPZ may be affected by unobservable factors, we believe that the relationship between the exports of an EPZ and the export of similar products in adjacent cities represents a causal influence.

Details surrounding the location of EPZs and their export patterns facilitate our study.

Although the bulk of China's international trade emanates from coastal provinces, EPZs were geographically dispersed with many EPZs located in inland China. Three of the first 15 EPZs were in non-coastal provinces, and twelve EPZs eventually appeared in inland provinces over the sample period. In addition, each EPZ exported its own set of goods, with the shipments from one area differing from those in another. This allows us to examine the specific product mix from each EPZ, relative to the baseline of goods not exported by it. As a result, we are able to exploit the location of the EPZ and which products it began exporting. Our empirical approach employs the interaction of these sources of variation in a differences-in-differences estimation strategy.

Within each EPZ, we observe the date of first export for each product at the Harmonized System code 8-digit level (HS8). Following the date of first export, we show that exports from Chinese firms of the same products surge throughout the province, with the biggest gains located in the city of the EPZ, and the next biggest in cities adjacent to the EPZ. In our baseline specification, if a product was exported from an EPZ, exports of similar products at the HS8 level were 131% larger in the city surrounding the EPZ, and 57% larger in cities bordering the EPZ. These gains in value are accompanied by larger numbers of exporters.

We provide one important mechanism which signals that Chinese firms are imitating their foreign counterparts. We observe the HS codes and first import dates of equipment imported by EPZs. We find that imports of this equipment immediately surges in Chinese firms. Again, the biggest increases occur in the city of the EPZ, with the next biggest in cities adjacent to the EPZ. Since Chinese firms imitate the equipment of EPZs, this suggests that they are imitating the technology of EPZs.

We examine alternative explanations for these patterns. First, we show that agglomeration is probably not the major driver. Foreign firms in adjacent cities do not grow their exports and imports in the products shipped by EPZs; the value exported and the number of exporters actually shrinks in adjacent cities. Second, we rule out ex-ante differ-

ences between adjacent cities and non-adjacent cities by showing that the expansions in exports and imports by Chinese companies are coincident with the introduction of those products by EPZs. Third, we control for explanations such as area-specific comparative advantage and exogenous product-specific shocks by showing that our results are robust to including same-city growth by state-owned enterprises and foreign firms, which are unlikely to imitate in the same fashion. Each of these tests affirms the direction and significance of our findings.

Our third finding is that imitating Chinese firms experienced strong and positive gains in operating performance.[1] We observe which specific Chinese firms exported the same products as EPZs, and compare them to their peers who exported similar but not identical products. Matching these firms to data on operating performance, we find that Chinese firms which copied foreign ones experienced bigger gains in total factor productivity, increased wages more, and enjoyed larger gains in profitability. This suggests that copying technology can allow imitating firms to leapfrog their peers in productivity.

Our paper is related to a literature on product imitation in China. Brambilla et al (2009) use a combination of industry-level data on FDI flows and firm survey data to find that FDI inflows into China are associated with the probability of new product introductions. Zhou (2006) uses a cross-industry survey of Chinese firms to show that superior financial performance is correlated with innovating firms rather than imitating ones.

Another related paper is Manova and Zhang (2012), who show that exporters use higher quality imports to produce higher quality exports. We complement these results by showing how the selection of imports, through imitation of foreign firms, can lead to increased exports and improved productivity among imitating Chinese firms.

A related strand of literature studies the spillover effects of foreign direct investment

[1]Participation in export markets is often viewed as a precursor for economic growth. Park et al. (2010) discuss various pathways for the impact of exports on firm productivity and find supporting evidence from a sample of firms in China.

(FDI). Despite numerous theoretical models outlining various channels[2], empirical evidence has been inconclusive[3]. In the context of China, Swenson and Chen (2014) examine how the city-industry presence of multinational firms affects the quality, frequency and survival of new export transactions by private firms and find evidence of spillovers.

Our work can contribute to the FDI literature in two ways. First, the policy of EPZs provides a natural experiment to test spillovers because we can observe EPZs start from nothing and grow to large levels entirely from the production of WOFEs. Second, we provide additional insight of how FDI spillover effects take place because we utilize adjacency combined with related products as our key identifying characteristics.

Another strand of related literature evaluates the benefits of place-targeted programs[4]. In the context of China, several papers have assess the outcomes of Special Economic Zones (SEZs).[5] . These papers, which focus on the benefit of SEZs to their own cities, may be subject to endogeneity concerns since zones are not placed randomly. Our methodology is unique because it focuses on how EPZs affect surrounding cities, in the sectors where EPZs export. This approach is close to the approach in Rajan and Zingales (1998). Since cities are unlikely to be able to influence the establishment of their neighbors' EPZs, and cannot pick which products are exported, we believe that our empirical design represents a causal influence.

Our results also pertain to the debate about the effects of preferential regional policies on income disparity[6] EPZs were an "equal opportunity" form of trade policy in that they were extended to both inland areas and coastal cities. It is thus part of the large literature on liberalization and industrial policy in general and specifically on the Chinese reform experience.[7]

[2]See for example: Krautheim (2012), Fosfuri et al. (2002), and Glass and Saggi (1998, 2002).

[3]See for example: Aitken and Harrison (1999), Pavcnik (2002), Gorg and Greenway (2004), and Harding and Javorcik (2012), Javorcik and Spatareanu (2008, 2011), Mayneris and Poncet (2013)

[4]See for example: Greenstone et al. (2010), Kline and Moretti (2014).

[5]See for example: Wei (1993), Cheng and Kwan (2000), Démurger et al. (2002), Jones et al. (2003), Alder et al. (2013) and Wang (2013)

[6]See for example: Kanbur and Venables (2008), Kanbur and Zhang (2005).

[7]See for example Brandt and Rawski (2008) and Xu (2011).

The rest of the paper is structured as follows. Section 2 provides an overview of the institutional background of EPZs. Section 3 describes our data. Section 4 discusses the empirical strategy and presents the main results. Section 5 concludes.

2 Institutional Background

The International Labour Organization (ILO) defines an EPZ as "a relatively small, geographically separated area within a country, the purpose of which is to attract export-oriented industries, by offering them especially favorable investment and trade conditions as compared with the remainder of the host country." According to the ILO, the number of EPZs has increased exponentially from 79 in 25 countries in 1975 to over 3,500 zones in 130 countries in 2006 (ILO, 2007).

China authorized its first batch of 15 EPZs in April 2000, and the first export from these zones occurred in February 2001. The first three EPZs to export were in Chengdu, Hangzhou, and Suzhou. EPZs were scattered throughout China, with some provinces receiving several while others had none.[8]

We graph the locations of EPZs in figure 1. We are able to identify 32 EPZs in 29 cities that record positive values of exports in our sample.[9] There are no clear geographical patterns to the phase-in of EPZs, with early and late introductions present in all areas of the country.

In general, cities which received EPZs were much larger than cities which did not. Table 1 shows the population, GDP, and exports levels in 2000 for cities that received

[8]A total of 15 export processing zones were first approved in April 2000 by the State Council. Subsequently, 2, 8, 14, and 18 EPZs were approved in 2001, 2002, 2003, and 2005, respectively. During our sample period, 23 provinces had set up at least one EPZ. We list the number of EPZs, alongside the name of the province: Shanghai (5), Beijing (1), Jilin (1), Sichuan (2), Yunnan (1), Inner Mongolia (1), Tianjin (1), Anhui (1), Shandong (5), Guangdong (4), Guangxi (1), Xinjiang (1), Jiangsu (14), Jiangxi (1), Hebei (1), Henan (1), Zhejiang (4), Hubei (1), Hunan (1), Fujian (4), Liaoning (3), Chongqing (1) and Shaanxi (1).

[9]Dates between footnote 8 and figure 1 differ because the footnote refers to the dates where EPZs were officially approved, while the figure 1 labels EPZs according to their date of first export.

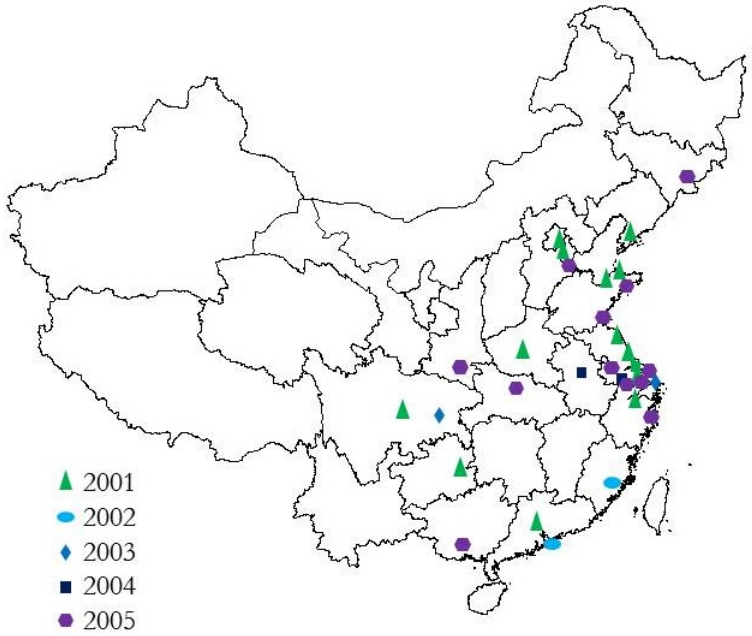

Figure 1: The locations of EPZs in China. The year of first export for each EPZ is labeled.

EPZs between 2000 and 2006 and cities which did not receive them. This table also contrasts cities which are adjacent to cities with EPZs with those cities which are in the same province but not adjacent (For narrative purposes, we term this group "non-adjacent cities").

While these latter two groups of cities were similarly sized in terms of population, cities adjacent to EPZs were larger in GDP and exported more. However, the difference between these cities for the specific products exported from EPZs was very small. Figure 2 shows that, among the specific HS8 codes exported by EPZs, adjacent cities seemed to export no more than non-adjacent cities.

EPZs in China were dedicated to processing activities, with more than 99% of exports from EPZs classified as processing.[10] The processing trade is the business activity of importing raw materials and components from abroad, and re-exporting the finished product after processing and assembling. Processing export is important to Chinese

[10]The mains forms of trade, apart from processing, are ordinary trade and assembling trade.

Table 1: How Cities Which Received EPZs Compare with Adjacent Cities and Cities in the Same Province

	Contains EPZ	Adjacent to EPZ	Not Adjacent, In Same Province	In Provinces Without EPZ
Number of Cities	29	92	191	131
Population (M)	2.5	1.5	1.5	2.2
GDP (B of RMB)	123.4	12.6	9.7	10.4
Average Exports per City (M of $US)				
Exports Matching at HS8	15.7	2.8	2.6	
Exports Matching at HS6	19.5	3.4	2.9	
Exports Matching at HS4	33.9	6.1	4.8	
Exports Matching at HS2	64.2	12.5	9.3	
All Exports	109.1	20.9	14.3	6.3

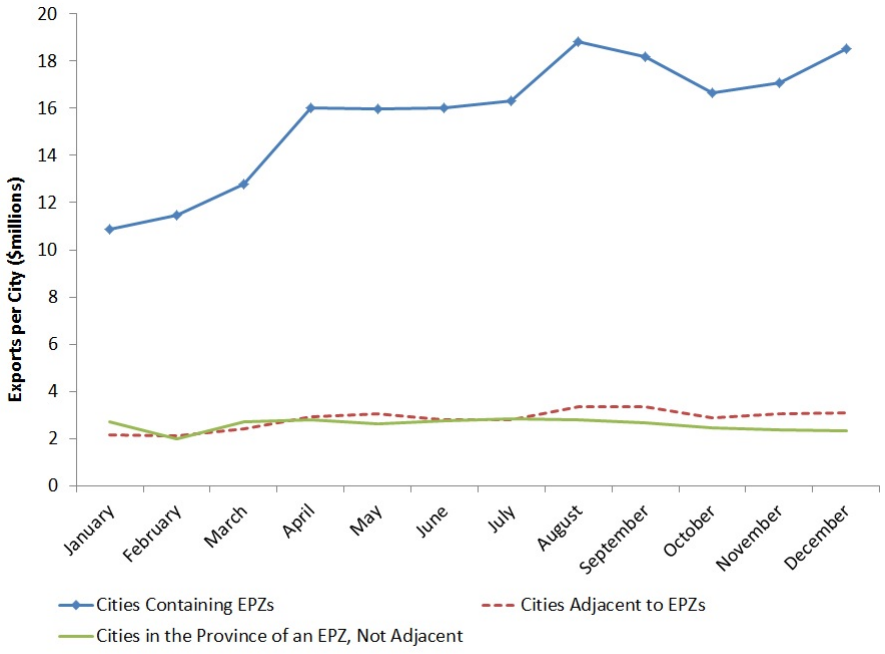

Figure 2: Exports of Products Matching the Products Exported from EPZs, in 2000.

trade (Feenstra and Hanson, 2005), and accounts for more than 40% of China's exports in our sample period.

At an early stage, EPZs were established to facilitate management of scattered processing businesses. Most EPZs take the form of fenced areas between 2 and 3 square kilometers large, placed within SEZs and Economic and Technological Development Zones (ETDZs).[11] Previous studies like Wei (1995) and Wang (2013), have lumped different types of economic zones together under the umbrella of development zones.

Although EPZs were not exclusively intended for international firms to set up operations, the vast majority of exports are attributed to WOFEs, rather than from firms with full or partial Chinese ownership. In our sample, 96% of exports from EPZs were attributed to WOFEs,[12] while exports from ETDZs were much more heterogenous. Once set up, exports from EPZs quickly exploded. Figure 3 shows how EPZs grew from inception to account for billions of dollars per month in exports by 2006. Exports from EPZs grew faster than exports from the cities in which they were located until 2005, when they accounted for about 8% of exports in those cities.

Compared with ETDZs, EPZs permit fewer business activities inside the zones. Enterprises inside the EPZs may not operate retailing, general trade, or any other business. This focus on processing activities allows the EPZ to offer additional incentives compared to ETDZs. A central feature of EPZs is the property "inside the border, outside customs," which means that goods flowing in and out of the EPZ are treated as exports and imports, respectively.[13]

EPZs had several advantages which were attractive to foreign firms. First, they allowed duty-free, permit-free, and quota-free imports of raw and intermediate inputs and

[11]The World Bank (2008) describe these policy arrangements as a unique zone-within-zone case as large opened economic zones (ETDZs) hosted smaller zones (EPZs, bonded areas, High-tech development zones) within their territory.

[12]Almost all of the remaining 4% of exports were from joint cooperative companies, i.e., firms with Chinese and foreign partners.

[13]Movements of goods between cities within China and EPZs are not recorded in our data, while movements between EPZs and other countries are recorded.

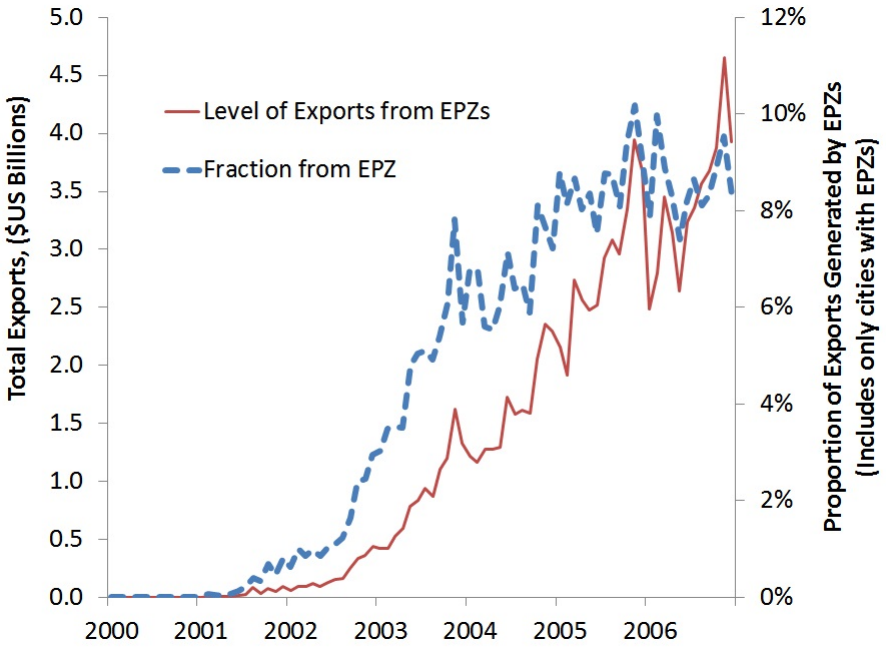

Figure 3: The proportion of exports generated by export processing zones, in cities with EPZs.

capital goods (like machinery, equipment, materials) for export production. This could represent a potentially significant savings in cost of goods sold for firms within EPZs. Second, government regulations within EPZs were streamlined. Particularly important was the presence of lowered regulations to clear customs. Third, firms in EPZs were given generous, long-term tax concessions. Outside of the EPZ, firms had to pay the value-added tax (VAT), but were rebated the VAT paid on goods that were exported. Within the EPZ, firms never paid the VAT. Fourth, the infrastructure within EPZs was more advanced than in other parts of the country. Communications services and transportation infrastructure in particular were substantially better within EPZs.

We examine the distribution of product HS codes exported by export processing zones. Since EPZs are primarily dedicated to the processing trade, it might be expected that the range of HS codes exported is narrow. However, as we show in table 2, a wide variety of products were exported. EPZs exported 55 separate HS8 codes on average, with each EPZ seeming to have its own product mix. The government did not create any barriers

Table 2: Composition of Exports and Equipment Imports for EPZs

HS Code	Code Name	# of Exports	% of Value	# of Imports	% of Value
01-05	Animal Products	3	0.05	2	0.00
06-15	Vegetable Products	14	0.01	6	0.00
16-24	Foodstuffs	16	0.05	6	0.00
25-27	Mineral Products	7	0.00	46	0.00
28-38	Chemical Products	107	0.08	213	0.00
39-40	Plastics/Rubbers	55	0.02	144	0.01
41-43	Raw Hides and Furs	13	0.03	19	0.00
44-49	Wood and Wood Products	36	0.01	125	0.00
50-63	Textiles	206	0.18	164	0.00
64-67	Footgear and Headgear	17	0.01	27	0.00
68-71	Stone and Glass	32	0.01	104	0.00
72-83	Metals	89	0.08	403	0.02
84-85	Machinery and Electrical	207	0.29	967	0.81
86-89	Transportation	51	0.09	37	0.00
90-97	Miscellaneous	106	0.08	278	0.15
98-99	Services	0	0	0	0

to entry and allowed enterprises across different industries to set up production sites. Anecdotal evidence suggests that, during their early stages, most EPZs did not have a clear plan as to what types of products should be produced. As a result, processing firms from a broad set of industries flocked to EPZs.

In the same table, we examine the range of products imported by EPZs as "EPZ Equipment," a designation we explain further in when we describe the data. We can see that, as expected, the largest set of HS codes in terms of both the number of products and the value imported that were designated equipment were in HS Codes 84 and 85, "Machinery and Electrical" equipment. However, there was a large variety of goods which were imported under the equipment label, ranging in almost every product category.

3 Data

We perform our analysis using the database of the Chinese Customs Trade Statistics (CCTS), compiled and maintained by the General Administration of Customs of China. It records all merchandise transactions passing through Chinese customs from January 1, 2000 to December 31, 2006.[14] In all, 520 cities record exports during our time period.[15] The database includes identifying information on the firm exporting the good (name, address, and ownership status), information on the product being exported (the name of the product, the product code, the quantity and value of the export), and the method of export (means of transportation, transit point, and destination country).[16]

Product codes are recorded using the Chinese version of the eight-digit Harmonized Commodity Description and Coding System (HS) codes. Chinese HS codes parallel international codes at the HS 2-digit level but differ at the 4-digit level and 8-digit level. Export and import values are reported in free-on-board terms in US dollars. The corresponding quantities are reported in various units depending on the nature of the good.

The customs data use a special category "EPZ Equipment" which firms in EPZs employ when they import equipment.[17] Because firms in EPZs receive duty-free, permit-free, and quota-free import of equipment, they are incentivized to report these imports accurately.

We also supplement the data with the Chinese Annual Survey of Industrial Firms (CASIF) from the National Bureau of Statistics (NBS). The CASIF survey data that we use covers the period 2000 to 2006. Two categories of firms are included in the survey: state-owned firms and firms of other ownership types with annual sales above 5 million Chinese yuan. On average, more than 200,000 firms are included each year and they

[14]It includes only transactions between EPZs and other countries, and does not include transactions between other parts of China and EPZs.

[15]We treat districts in four centrally-administered cities, Beijing, Tianjin, Shanghai, and Chongqing as "cities".

[16]Recent research utilizing the same database include Manova and Zhang (2012), Swenson (2007), and Swenson and Chen (2014), among others.

[17]The pinyin category code is "chukou jiagong qu jinkou shebei."

account for around 95% of total Chinese industrial output and 98% of industrial exports. The NBS requires firms to report details on their production activities and financial measures, and includes basic characteristics of the firm such as ownership structure, location, and industry.

4 Empirical analysis

4.1 Imitating the Exports of EPZs

4.1.1 Empirical Setup

Our primary interest is to examine how patterns of Chinese firm export and import behavior are affected by foreign firm exports inside EPZs. An obvious focal point is the cities where EPZs are situated. The problem with exclusively studying these cities is that the placement of EPZs is non-random: cities which received EPZs are much larger, export more, and grew faster than cities which did not receive them.

Our strategy is to simultaneously consider cities which are adjacent to EPZs. Adjacent cities are not able to pick whether their neighbors receive EPZs, nor what products are exported from those EPZs. Adjacent cities and non-adjacent cities appeared minimally different in their exports of the set of products exported from EPZs (figure 2), suggesting that non-adjacent cities form a natural control group for those exports.

We reason that geographical promixity and product relatedness should facilitate imitation. We hypothesize that cities that are closer to the EPZ should benefit more than cities which are farther away, and that sectors exported from EPZs should grow faster than sectors which are not exported. We hypothesize that Chinese enterprise exports should grow after the first export date of a given export by foreign firms in the EPZ.

We are able to observe the HS codes exported and the first dates of export for each HS8 code in each EPZ. We match between the exports from a given city and the exports

of EPZs near to it using these HS8 code matches. For geographical proximity, we utilize three spatial categories: the city incorporating the EPZ, the cities adjacent to the EPZ, and non-adjacent cities still within the province of the EPZ.

We employ the following equation in our analysis:

$$\begin{aligned} Y_{i,j,t} = & \left(Contains\ Shipping\ EPZ\right)_{i,t} * \left(HS\ of\ Shipping\ EPZ\right)_{j,t} \beta_1 \\ & + \left(Contains\ Shipping\ EPZ\right)_{i,t} \beta_2 \\ & + \left(Adjacent\ to\ Shipping\ EPZ\right)_{i,t} * \left(HS\ of\ Shipping\ EPZ\right)_{j,t} \beta_3 \\ & + \left(Adjacent\ to\ Shipping\ EPZ\right)_{i,t} \beta_4 \\ & + \left(HS\ of\ Shipping\ EPZ\right)_{j,t} \beta_5 \\ & + \alpha_i + \alpha_j + \alpha_t + \epsilon_{i,j,t} \end{aligned} \tag{1}$$

In this equation, the index i represents the city from which the export originates, j represents the HS code of the export, and t represents the year of export. In all tests using this specification, we employ fixed effects α_i, α_j, and α_t, corresponding to the city, HS code, and year of export, respectively. $\epsilon_{i,j,t}$ represents the error term, which is clustered at the city level.

We use the log of value exported as the main dependent variable and also examine the number of exporters. For the purposes of exposition in the rest of this section, we focus on the dependent variable of value exported. In this case, $Y_{i,j,t}$ represents the value exported from city i in HS code j in year t.

Our first set of three independent variables helps us examine patterns of exports in cities which contain EPZs. Our variable of interest is an interaction term which indicates whether a city containing an EPZ exported a specific product. Each component of the interaction term is also added as a control. The first control differentiates exports of the specific product exported by the EPZ from other exports in the city. The second control distinguishes exports of that product from cities with EPZs from cities that do not have an EPZ.

The variable $(Contains\ Shipping\ EPZ)_{i,t} * (HS\ of\ Shipping\ EPZ)_{j,t}$ is our first variable of interest. It is a dummy variable indicating whether an EPZ within city i exported HS code j in any year before year t. This variable assumes the value of 1 when three conditions are met. First, there must be an EPZ in city i. Second, the EPZ must have exported a product with an HS8 code matching j. Third, the EPZ must have exported this product in any year before year t.

The variable $(Contains\ Shipping\ EPZ)_{i,t}$ is a dummy variable indicating whether an EPZ within city i has exported any product before year t. This variable can only assume the value of 1 after the establishment of an EPZ in city i, and is 1 only if an export from the EPZ occurred in in city i in a year before t.

The variable $(HS\ of\ Shipping\ EPZ)_{j,t}$ is a dummy variable which indicates when any EPZ in the province of city i has exported HS code j. Since some provinces have more than one EPZs, we use all EPZs in the province of city i to compare adjacent cities and non-adjacent cities. It takes on the value 1 under three conditions. First, there is an EPZ in the same province as city i. Second, this EPZ exported HS code j. Third, the export occurs in a year before t.

Our next variables help us examine patterns of exports in cities adjacent to EPZs. Similar to before, the variable of interest is an interaction term, and its components serve as useful controls.

The variable $(Adjacent\ to\ Shipping\ EPZ)_{i,t} * (HS\ of\ Shipping\ EPZ)_{j,t}$, is our second variable of interest. It is a dummy variable indicating whether an EPZ in a city adjacent to city i has exported HS code j in a year before t. It assumes the value of 1 under three conditions. First, there is an EPZ established in the city next to city i. Second, the EPZ exports product j. Third, the export of product j occurs in a year before t. The estimate of this variable captures how exports in the cities directly proximal to the city of the EPZ are affected by the export of goods from the EPZ.

Of its two controls, we have already explained $(HS\ of\ Shipping\ EPZ)_{j,t}$. Its other

component, the variable $(Adjacent)_{i,t}$, is a dummy variable that equals one if an EPZ in a city adjacent to city i has exported in a year before t. It takes on the value of 1 under two conditions. First, there is an EPZ established in a city adjacent to city i. Second, that EPZ exports any product in a year before t.

Along with the total value of exports, we also examine the total number of exporters. Each exporter in our data is a plant.These plants are assigned a unique ID number, and we count the number of unique exporters in city i of product j in year t with the variable $log\,(Num\ Exporters)_{i,j,t}$.

4.1.2 Results

We report our base specification in the first two columns of Table 3. In these regressions, each observation is the export value or number of exporters for each city, for each HS8, for each year. When a city exported a given product in one year and then did not export that product in other years, zeros are filled in for the value exported and the number of exporters in that year. All observations from cities containing EPZs exclude exports reported directly from the EPZ and measure only exports from the rest of the city. We limit the observations examined to "ordinary trade."[18]

The first row of Table 3 reports coefficient β_1, the correlation between exports of an EPZ and exports from the city containing that EPZ among the HS8 codes exported by the EPZ. We see a significant and positive relationship for both the value shipped and the number of exporters. The second row of this table reports coefficient β_2, the additional exports realized by the city containing an EPZ for all HS codes. We see that there is a significant positive correlation for the value exported and the number of exporters, indicating that the cities which contain EPZs also export more of other goods.

We demonstrated in Table 1 that cities with EPZs started with much higher export levels of the goods exported from EPZs in 2000, before EPZs were set up. It is therefore

[18]We exclude the the processing trade, since the processing trade requires a foreign contractor.

unsurprising that growth in these cities is higher. The placement of EPZs is non-random, and the selection of products is non-random; firms moving into EPZs are likely to select their products exported based on which ones are most profitable in a given area. In the first two rows of Table 3, we see strong evidence affirming that cities receiving EPZs grow faster between 2001 and 2006 during the same period for which EPZs are phased in. We emphasize that the coefficients in these rows are likely to represent a correlation rather than a causation.

The third row reports the coefficient β_3, our second variable of interest: the impact of exports from an EPZ on exports from adjacent cities. We see that the coefficient on value exported is positive and significantly greater than zero, indicating that firms in adjacent cities exported significantly more of the same good as the EPZ in the years after the EPZ began export. Coefficients on the number of exporters are positive but statistically indistinguishable from zero, suggesting that most of the gains in export value accrued in the form of increased export value for existing firms.

The fourth row reports coefficient β_4. Again, there is a positive and significant coefficient for the value of exports and the number of exporters, which indicates that cities which are adjacent export more on average among all product categories.

The fifth row reports coefficient β_7. Each of the coefficients are positive and statistically significant. The point estimate of β_5 suggests that the exports shipped from EPZs are 104% larger than those which were not shipped throughout the province of the EPZ. This coefficient serves as a baseline estimate for variables β_1 and β_3.

To interpret the economic meaning of our baseline specification, our estimate of coefficient β_3 implies that the export of an HS code from an EPZ boosts exports of that HS code from Chinese firms in neighboring cities by 57.3% relative to non-adjacent cities in the province. Since the variable controlling for HS codes shipped from the EPZ is present, this effect is additional to effects observed throughout the province.

Total exports experienced annualized growth rates of 25% between 2000 and 2006 in

China. Against this backdrop of rapid export growth, our results suggest that EPZs still had a large effect on exports from in adjacent cities. The magnitudes of the coefficients in row 1 are larger than those in row 3, consistent with the narrative that firms in cities which contained EPZs received the largest exposure to foreign firms and their technology.

Our coefficients estimated are noisy, with standard errors above 0.2 in row 3 for value, even though we employ millions of observations. We observe 959 distinct HS8 codes exported from EPZs in our data; thes exports have a median value exported of $US 13,000 and a mean value exported of $US 53,084. About 100 of these HS8 codes have a value exported of less than $US 1,000 over the 7-year panel, suggesting that they were not exported very much from EPZs and any imitation of these of exports would be small in scale. As a result, the standard errors that we observe are likely to reflect a wide variation in imitation, with some products likely receiving large amounts of attention and others receiving little or no attention.

In summary, this section has found that exports by Chinese firms grew more quickly in the products shipped by EPZs, with the largest effects occurring in the city of the EPZ and the next largest occurring in the cities adjacent to the EPZ. Exports of the specific products shipped by EPZs grew faster than products not shipped by EPZs, and exports in these cities grew faster than exports throughout the rest of the province.

4.2 Imitating the Technology of EPZs

This section lays out one mechanism by which Chinese firms imitated foreign ones. We show that Chinese firms purchase the same production equipment as firms in EPZs. If Chinese firms imitate the same equipment as foreign firms, they are likely to have imitated the technology introduced by foreign entrants.

We are able to observe the HS codes imported under the customs category "EPZ Equipment" and the date of first import for each HS code in each EPZ. There is no corresponding code among non-EPZ firms to document the import of equipment. As a

result, we again limit the set of imports in these regressions to "ordinary imports," which appear to contain most of the equipment imports. We test whether the date of first import of a given type of equipment by an EPZ is accompanied by increases in imports of that equipment in cities surrounding the EPZ.

To test this hypothesis, it is important to consider what export patterns we should expect to observe if Chinese companies surrounding EPZs imitated the operations of foreign firms setting up there. If they did learn, one would expect them to rapid purchases of capital equipment in the periods they began imitating. As a result, we test the increase in capital purchases in the year after the date of first import of each good by the EPZ.

We employ a specification that is parallel in structure to equation 1:

$$\begin{aligned} Y_{i,j,t} &= (Contains\ Importing\ EPZ)_{i,t} * (HS\ of\ EPZ\ Import)_{j,t}\gamma_1 \\ &+(Contains\ Importing\ EPZ)_{i,t}\gamma_2 \\ &+ (Adjacent\ to\ Importing\ EPZ)_{i,t} * (HS\ of\ EPZ\ Import)_{j,t}\,\gamma_3 \\ &+ (Adjacent\ to\ Importing\ EPZ)_{i,t}\,\gamma_4 \\ &+ (HS\ of\ EPZ\ Import)_{j,t}\,\gamma_5 \\ &+\alpha_i + \alpha_j + \alpha_t + \mu_{i,j,t} \end{aligned} \tag{2}$$

We briefly define each variable below. The key difference between this specification and that of equation 1 is that these dummies indicate whether the EPZ began importing a specific product in the year prior to the observation.

As before, i, j, and t are dummies corresponding to the city, HS8 codes, and year of the observation. This regression employs the same fixed effects and also clusters standard errors at the city level.

The first variable of interest, $(Contains\ Importing\ EPZ)_{i,t} * (HS\ of\ EPZ\ Import)_{j,t}$ is a dummy variable indicating whether 1) city i contains an EPZ, 2) that EPZ began import of HS code j, and 3) that the import of j began in year $t-1$. Similarly, the variable $(Contains\ Importing\ EPZ)_{i,t}$ is a dummy indicating whether 1) city i contains

an EPZ and 2) that the EPZ began importing in year $t-1$.

The second variable of interest, $(Adjacent\ to\ Importing\ EPZ)_{i,t} * (HS\ of\ EPZ\ Import)_{j,t}$, is a dummy variable indicating whether 1) city i is adjacent to an EPZ, 2) that EPZ began import of HS code j, and 3) that the import of j began in year $t-1$. The fourth variable $(Adjacent\ to\ Importing\ EPZ)_{i,t}$ is a dummy indicating whether 1) city i is adjacent to an EPZ and 2) that the city began importing any product in year $t-1$.

The fifth variable, $(HS\ of\ EPZ\ Import)_{j,t}$, is used in both interaction terms of the variables of interest. It indicates whether any EPZ in the same province of city i imported HS code j in year $t-1$.

We report results in Table 4. Rows 1 and 3 of column 1 report how the value imported of Chinese firms in cities surrounding EPZs and cities adjacent to EPZs responds after an EPZ begins importing equipment. We see that there is a significant and positive response for each of these types of cities. Moreover, we find that the same pattern of results is observed, with the largest increase in imports occurring in the city surrounding the EPZ, and the next largest occurring in the cities adjacent to the EPZ.

Similar to Table 3, we see that imports of equipment are larger throughout the province of the EPZ, although the magnitudes of the coefficients in row 5 are noticeably smaller in Table 4.

Similar to Table 3, column 2 suggests that the number of importers importing matching equipment in surrounding cities increases, with a positive but noisy number of importers in cities adjacent to the EPZ. In general, the similarity of tables 3 and 4 for our variables of interest is reassuring.

To summarize, we are able to observe the HS codes and first import dates of the equipment which foreign firms used when they set up in EPZs. We find that imports of matching equipment surge in the year following first import among Chinese firms in the cities surrounding EPZs and the cities adjacent to the EPZs. Chinese firms imitate the equipment of foreign firms in EPZs, suggesting that they are imitating the technology of

EPZs.

4.3 Alternative Explanations

In the following section, we examine some alternative explanations for our results. One possibility is that our results occur because of agglomeration. Under this explanation, the entrance of foreign firms creates economies of scale for suppliers or regional concentrations of managers with product-specific expertise. These would create surges in exports of particular products in areas surrounding the EPZ and in imports of particular forms of equipment. We address the possibility of agglomeration by showing that foreign firms in adjacent cities actually drop in output and the number of firms.

A second possibility is that adjacent cities were different from non-adjacent cities before the introduction of EPZs. We show that the changes explained above occur with a timing coincident with the introduction of the products from EPZs. Ex-ante differences cannot explain the timing of our results.

A third possibility is that region-specific comparative advantages accrue to both cities with EPZs and adjacent cities. We control for the export levels of closely-related products to show that related products do not enjoy the same gains. Any comparative advantage would likely adhere to both the specific products shipped from EPZs and closely-related products.

Finally, it may be argued that product-specific exogenous shocks cause both the introduction of products by EPZs and gains in exports from adjacent cities. We control for the export levels of state-owned enterprises and foreign enterprises in the same cities. These types of enterprises benefit from product-specific exogenous shocks but may be unable to imitate foreign enterprises in EPZs. Our results show that non-SOE Chinese firms export more of the same products and import more of the same equipment in cities adjacent to EPZs, even after controlling for the activities of foreign enterprises and state-owned enterprises.

To show that our results do not apply to foreign firms, we repeat the regressions from equation 1, restricting the set of observations to foreign firms rather than Chinese ones. We report these results in columns 3 and 4 of Table 3 for exports, and in columns 3 and 4 of Table 4 for imports.

In both tables, the coefficients are positive in row 1 for foreign firms, just as they are for Chinese ones. Firms in EPZs selected the products to produce because they are the most profitable in a given location, suggesting the presence of local comparative advantage. Since both Chinese and foreign firms are likely to benefit from these advantages, the growth of exports in both grew more in these products.

Importantly, we find that exports and imports for foreign firms in adjacent cities differ sharply from Chinese firms. Coefficients in row 3 are negative for foreign firms in table 3, suggesting that foreign firms situated next to an EPZ export markedly less of the products shipped by the EPZ. Imports of equipment are no different in adjacent cities. To explain this pattern of results, consider that EPZs attracted foreign firms to set up using the incentives explained in section 2. These benefits create two effects. First, foreign firms may move out of adjacent cities into EPZs in nearby cities. Second, firms in EPZs have lower costs and can outcompete similar firms in neighboring cities. We see evidence of both effects here.

In summary, when foreign firms in EPZs began exporting a product, foreign firms in adjacent cities were displaced; exports from foreign firms in adjacent cities decreased. If agglomeration were a dominant factor, we would expect to see the firms most similar to those in EPZs, other foreign firms, benefit most from the introduction of EPZs.

To show that our results cannot be explained by ex-ante differences between adjacent and non-adjacent cities, we provide evidence that the timing of the changes in export and patterns is coincident with the first shipment date of the EPZ.

We split the within-city, adjacent-city, and within-province dummies from equations 1 and 2 to examine how identical exports from cities surround an EPZ are timed with

exports from the EPZ. In these regressions, time t refers to the time when an EPZ began exporting a given HS8. Time t-2 and time t-1 refer to the years before the EPZ began export, and times t+1 and t+2 refer to the years after the EPZ began export.

We present the results of this regression for exports in Table 5. Examining Chinese firms in adjacent cities first, we can see that the coefficients in years t-1 and t-2, before the EPZ begins to export, are still positive. This suggests that our regressions are not entirely controlling for differences in export patterns between adjacent cities and other cities in years before the EPZ began operations. Even so, the point estimates increase in year t of the EPZ by about 0.14, and by a further 0.15 over the next two years. In the light of non-zero estimates on adjacent cities in years t-1 and t-2, our estimate of 0.573 from row 3 of Table 3 appears too large. However, we still see a gain of about 0.3 which is coincident with the introduction of the EPZ. The number of Chinese exporters in adjacent cities is similarly supportive. The number of exporters increases sharply in the year of introduction of the EPZ, and increases further in the years after the introduction.

The value of exports shipped by foreign firms in adjacent cities appears to follow the opposite pattern. The value of exports is near zero in the years before the export and the year of introduction of the EPZ, and sharply decreases in the two years after the introduction of the EPZ. Similarly, the number of firms decreases sharply in the years after an EPZ begins shipping a given product.

We present the results of timing regressions for imports in Table 6. The value imported and the number of importers increases among Chinese firms in year t and sees a very large bump in year t+1. Foreign firms see statistically insignificant changes. This strongly supports the prior narrative on imports of equipment. Chinese firms, after observing the equipment imports of foreign firms in EPZs, immediately boost their imports of the same equipment.

In some ways, this look at the timing of imports of equipment help enrich our understanding of how Chinese firms imitate foreign ones so quickly. The imports of foreign

firms are clearly visible to Chinese ones; they can directly observe the exact imports of specific firms. They can quickly import the same equipment, with some of this imitation occurring even in the same year. From that point, they begin exporting the same products.

In summary, our analysis of timing shows that the number of firms exporting and the value exported increases among Chinese firms in the year of introduction of the EPZ, with a similarly sized boost in the years after. Similarly, the value of equipment imported and number of equipment importers increases in these years. In both cases, the timing of changes coincides with the introduction of the EPZ, diminishing the possibility that our results can be attributed to ex-ante differences between adjacent and non-adjacent cities.

To address the possibility that comparative advantage explains our results, we control for the export levels of related products. Comparative advantage argues that adjacent cities benefit from many of the same comparative advantages as cities with EPZs. For example, an area may have concentrations of skilled workers, such as carpenters or metalworkers, that give a region a comparative advantage in metalworking. Alternatively, it may have natural resource advantages, such as access to low-cost coal or iron ore. While our empirical specification above includes fixed effects for a product for a province, these comparative advantages may be localized within a province and adhere only to cities that received EPZs and cities that are adjacent to EPZs, confounding our results.

To address the possibility of localized comparative advantage, we include a control variable $Y\left(HS6\right)_{i,j,t}$ in regressions testing the value exported. This variable is the value of all exports from city i in year t matching HS code j at the 6-digit level. For example, one frequent export from EPZs is HS code 85422129, "other monolithic digital ic, 018." The variable $Y6_{i,j,t}$ would take on the sum of exports for all products in HS code 854221, "monolithic integrated circuits, digital," excluding HS code 85422129. In regressions which test the number of exporters, we include the control variable of the number of exporters shipping products with the same HS6 code but not the same HS8 code.

Comparative advantage is likely to apply to a broad product category, such as strength in ironworking or chemicals, rather than to a specific HS8 product category. Hence, controlling for products which match by HS4 but not by HS8 allows us to control for comparative advantage.

Regressions including HS4 sales controls for Chinese firms are presented in columns 1 and 2 of Tables 7 and 8. Including these controls decreases somewhat the magnitudes of the coefficients from Table 3, but affirms the direction and statistical of these results.[19] We can reject the possibility that comparative advantage for adjacent cities explains our results.

Finally, we address the possibility that there are external shocks which are correlated with both the introduction of new products in an EPZ and the sales of those products by firms in surrounding cities. For example, if the price of a particular product becomes higher on the world market, firms in EPZs may wish to introduce that product. If firms in adjacent cities are better placed to take advantage of those shocks, they may also increase exports of that product.

To address the possibility of product-specific shocks, we control for types of firms which are likely to be subject to the same product-specific shocks, but are unlikely to imitate foreign firms. We conceive of two possibilities: state-owned enterprises, and foreign firms in other cities. State-owned enterprises are typically thought of as less flexible than other Chinese companies; moreover, they may have lower incentives to respond to market forces than private firms. Foreign firms in other cities are unlikely to imitate foreign firms in EPZs, since they may be subject to more stringent intellectual property laws than Chinese firms.

We conduct this portion of our analysis by introducing as a control variable the value of exports and the number of exporters for SOEs and for foreign firms in each city:HS8:year cell. When we control for SOEs, we include the value of all Chinese firms except SOEs

[19] We apply the same test with controls matching at the HS6 level rather than the HS4 level and obtain the same results.

as the dependent variable. We present these results in columns 3 through 6 of Tables 7 and 8.

Comparing these results to columns 1 and 3 of Tables 3 and 4, we can see that the coefficients in rows 1 and 2 are now much smaller and generally not statistically significant. This suggests that exports of the products shipped from EPZs grow for Chinese firms, SOEs, and foreign firms at roughly the same rate in the cities containing EPZs. We found earlier that cities with EPZs are larger, richer, and export more than other cities. It is likely that foreign firms looking to export products select their location and the products to be exported based on which products are profitable at the time of setup.

Turning to adjacent cities, we can see that our main results for export and import behavior in are affirmed in row 3. Consistent with our hypothesis that learning occurs in adjacent cities, we find that exports from Chinese firms in adjacent cities grow when EPZs are introduced. In adjacent cities, exports from non-SOE Chinese firms grow much faster than SOEs and foreign firms, suggesting that the former firms can gain from imitation while the latter firms do not.

4.4 Gains in the Operating Performance of Exporters

We have demonstrated that Chinese firms imitate both the products exported and the capital equipment imported of foreign firms in nearby EPZs. We now turn to the question of how imitating firms benefit from copying. To answer this question, we must be careful to establish a comparison group for imitating firms. Participation in exporting has widely been viewed as a precursor for performance improvements[20] and more productive firms

[20]The studies focusing on developed countries, among others, include Bernard, Eaton, Jensen, and Kortum (2003) and Bernard and Jensen (2004) for the United States and Trefler (2004) for Canada. Furthermore, studies based on developing countries include Bustos (2009) for Argentina, Schor (2004) for Brazil, Tybout, de Melo, and Corbo (1991) and Pavcnik (2002) for Chile, Fernandes for Columbia (2007), Harrison (1994) for Ivory Coast, Krishna and Mitra (1998) and Topalova and Khandelwal (2010) for India, and Amiti and Konings (2007) for Indonesia. Park et al. (2010), Lu, Lu, and Tao (2010), Lu (2011), Brandt, Van Biesebroeck, and Zhang (2012), and Yu(2014) all find supporting evidence from China.

are more likely to become exporters (Bernard and Jensen, 1999).

Each observation in the customs data is one plant. We are able to observe the set of parent firms which control plants which export the same products as EPZs in the cities where EPZs are located and the cities adjacent to EPZs. We match these firms to their accounting information in the CASIF survey, using as our key identifiers the name, address, phone number, and zip code of the firm, following the method suggested in Yu (2014). We are able to match around 24% of the exporters to CASIF, a figure very similar matching outcomes compared with other studies that use the same data sets, such as Wang and Yu (2011), Ma, Tang, and Zhang (2011), Ge, Lai, and Zhu (2011), and Yu(2014). These firms comprise the "imitating" sample in this study: the set of firms which have subsidiaries that imitate firms in EPZs.

To construct a counterfactual, we use plants that are located in the same cities which export a similar yet different product from the EPZs. To be specific, we extract the set of plants in the city of the EPZ and the cities adjacent to the EPZ which export the same product at the HS6 level but do not match the EPZ export at the HS8 level.[21] Matching these plants to parental firm accounting information in the same way, we can then create a "control" sample of exporters. Once the sample of treatment and control firms has been identified, we use the performance firm identifiers (a firm's legal-person code) in CASIF to extract the performance information before the establishment of the corresponding EPZs.

We perform the analysis using a difference-in-difference approach with the below specification. The key variable of interest is the interaction term "Imitating*After", which dummies for the years after a firm (or its subsidiary) exports the same product in an adjacent EPZ. The coefficient indicates the performance differentials of imitating firms relative to other exporting firms in the same locations (either in cities containing an EPZ or cities adjacent to an EPZ) subsequent to the establishment of an EPZ. Similar to our

[21] Using the control sample based on exporting the same product at the HS4 level generates very similar results.

above analysis, we estimate the below equation separately for Chinese and foreign firms to examine whether the spillover effects differ by ownership type.

$$Y_{i,t} = After_{i,t}\beta_1 + After_{i,t} * Imitating_i\beta_2 + \alpha_i + \alpha_t + \epsilon_{i,t} \tag{3}$$

Three main outcome variables are examined. First, we examine total factor productivity (TFP), the residual of firm output after labor and capital inputs are accounted for.[22] Next, we examine a profitability measure, returns to assets (ROA), calculated as simply profit divided by total assets. We also examine labor productivity, Ln(Y/L), defined as the logarithm of sales divided by the total number of employees.

We first compare the average performance for imitating firms versus control firms before the establishment of EPZs and report the results in Table 9. Across all three metrics, the control sample actually outperforms the imitating sample, dispelling the possibility more productive exporters imitated firms in EPZs.

We report the results from Equation 3 in Table 10. The first three columns report estimation results when we pool Chinese and foreign firms together. Of the the 107,378 firm-year observations, 73,847 belong to the treatment sample and the rest 33,531 belong to the control sample. ROA and labor productivity both experience improvements for the treatment groups compared with control group after EPZs begin operation. We estimate the equation for Chinese and foreign firms separately and report the results in the remaining columns. The results show that Chinese firms exhibit significant improvements whereas their foreign counterparts do not. This is strongly supportive of our findings from prior sections that Chinese firms imitate foreign ones in EPZs while foreign ones do not.

The results are relatively small in magnitude. In our data, a single parent company may have many exporting plants; only a subset of these can potentially be affected by EPZs under the mechanisms we describe. Even so, the economic significance of these

[22]We follow the method suggested by Hsieh and Klenow (2009) with a slight modification. Hsieh and Klenow (2009) adjusted the share of labor inputs in total outputs. Here we use the share of labor inputs as is. However, our results are qualitatively unchanged if we follow closely Hsieh and Klenow (2009).

findings is non-negligible. For instance, after exporters' exporting products overlap with those exporters in a nearby EPZ, they experience a 0.2 percentage point increase in ROA, according to the estimates in column (2). When we separate the firms into Chinese and foreign firms, we find that ROA for Chinese exporters improve by about 0.3 percentage points while foreign exporters improve by about a smaller amount. The median ROA for our control sample is 3%. Our results, therefore, imply that Chinese exporters exhibit a 10% improvement in ROA relative to the sample median after they imitate the exporters in EPZs.

In Table 11, we report estimates when we separate the dummy variable "After" into two variables, "After * EPZ" which equals one for firms located in cities containing an EPZ and "After * Adjacency to EPZ" which equals one for firms located in cities adjacent to an EPZ, after the establishment of an EPZ. Results in the first three columns in Table 8 indicate that the bulk of the performance improvements stems from being located in the city containing an EPZ. The coefficient estimates on "Imitating*After * Adjacency to EPZ" suggest that for firms located in cities adjacent to an EPZ, Chinese exporters experience significant improvements whereas foreign firms suffer declines in TFP, a finding which corroborates our earlier results. Overall, our results suggest that exporting firms imitating from EPZs further improve their performance relative to exporters exporting similar yet different products as in the nearby EPZs. Most of the TFP improvements are realized by Chinese firms.

One important implication of our finding is that imitation can allow firms to leapfrog closely related firms in productivity. As we saw, firms which did not imitate actually started ahead of imitating firms in terms of productivity, but imitating firms experienced gains from copying relative to non-imitating ones. This is important when considering China's gains from its policies attracting foreign capital.

These results also shed light on an important question in the prior literature. While the correlation between the act of exporting and the improvement of productivity is

strongly established, the causality is not: Do better firms choose to export or does exporting *improve* firm performance? Our results show that the act of copying the exports of foreign firms has a strong and positive effect on firm performance, suggesting that the act of exporting can precede gains in productivity.

5 Conclusions

Our findings have policy implications for countries wanting to use zone-based policies to promote growth. Many developing countries adopt export-promotion policies hoping that these policies can eventually lead to real economic growth. Despite being one of the most important components of export-promoting strategy in developing countries since the 1960s, the real benefits of EPZs are still in doubt. Critics of EPZs claim that foreign firms, focused on exploiting cheap labor and reaping preferential tax treatment, end up competing with local firms and impeding the development of local industry. Even in China, this question is salient; China authorized its first-ever free trade pilot zone in Shanghai in October 2013 with other cities queued eagerly to follow.

We find strong evidence that Chinese firms were able to copy foreign ones in EPZs. The exact products which were exported from EPZs saw strong export growth by Chinese firms in nearby cities, with the biggest gains in the city of the EPZ, and the next biggest in the cities adjacent to the EPZ. We provide one mechanism showing this imitation: the imitation of equipment imports into the EPZ. This

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Table 3: The Relationship Between Exports of an EPZ and Exports of Cities Around the EPZ

	Chinese		Foreign	
	Value	Num Exporters	Value	Num Exporters
(Contains Shipping EPZ) * (HS of Shipping EPZ)	1.313***	0.686***	1.778***	0.531***
	(0.223)	(0.171)	(0.248)	(0.108)
Contains Shipping EPZ	0.389***	0.154***	0.274**	0.074***
	(0.142)	(0.044)	(0.112)	(0.016)
(Adjacent to Shipping EPZ)* (HS of Shipping EPZ)	0.573**	0.083	-0.379*	-0.075
	(0.254)	(0.070)	(0.230)	(0.055)
Adjacent to Shipping EPZ	0.272**	0.055***	0.086	0.007
	(0.115)	(0.020)	(0.126)	(0.016)
HS of Shipping EPZ	1.036***	0.234***	0.964***	0.165***
	(0.095)	(0.026)	(0.093)	(0.021)
Year FE	Yes	Yes	Yes	Yes
HS 8 FE	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes
N	4,070,360	4,070,360	1,538,285	1,538,285
R^2	0.230	0.346	0.177	0.250

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Each dependent variable is the log of that variable. Each observation in these regressions is the export of an HS8 code from a city in a year. Observations exclude exports shipped directly from EPZs. The variable "Contains Shipping EPZ" is a dummy variable indicating whether an EPZ inside that city exported any HS code in that year. The variable "HS of Shipping EPZ" is a dummy variable indicating whether any EPZ in the province of the city exported a given HS code in that year. The variable "Adjacent to Shipping EPZ" is a dummy variable indicating whether an EPZ in an adjacent city exported any HS code that year. Standard errors are clustered at the city level.

Table 4: The Relationship Between Imports of Equipment into an EPZ and Imports of Cities Around the EPZ

	Chinese		Foreign	
	Value	Num Exporters	Value	Num Exporters
(Contains Importing EPZ) * (HS of EPZ Import)	1.397***	0.434***	1.954***	0.672***
	(0.237)	(0.095)	(0.153)	(0.080)
Contains Importing EPZ	0.146	0.040	0.090	0.014
	(0.166)	(0.025)	(0.123)	(0.025)
(Adjacent to Importing EPZ)* (HS of EPZ Import)	0.523***	0.075	0.015	0.005
	(0.193)	(0.047)	(0.207)	(0.050)
Adjacent to Importing EPZ	0.122	0.030*	0.137	0.016
	(0.126)	(0.017)	(0.097)	(0.014)
HS of EPZ Import	0.190***	0.021	0.348***	0.047**
	(0.071)	(0.016)	(0.074)	(0.019)
Year FE	Yes	Yes	Yes	Yes
HS 8 FE	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes
N	3,201,933	3,201,933	2,277,639	2,277,639
R^2	0.212	0.312	0.240	0.352

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Each dependent variable is the log of that variable. Each observation in these regressions is the import of an HS8 code from a city in a year. Observations exclude imports shipped directly from EPZs. The variable "Contains Importing EPZ" is a dummy variable indicating whether an EPZ inside that city imported any HS code identified as "EPZ equipment import" that year or the year before that year. The variable "HS of EPZ Import" is a dummy variable indicating whether any EPZ in the province of the city imported "EPZ equipment import" in that year or the year before. The variable "Adjacent to Shipping EPZ" is a dummy variable indicating whether an EPZ in an adjacent city imported any HS code identified as "EPZ equipment import" that year. Standard errors are clustered at the city level.

Table 5: The Timing of Changes to Export Value

	Chinese		Foreign	
	Value	Num Exporters	Value	Num Exporters
EPZ in City Ships HS8 (t-2) *	1.308***	0.552***	1.653***	0.334***
	(0.271)	(0.153)	(0.201)	(0.045)
EPZ in City Ships HS8 (t-1) *	1.437***	0.663***	1.802***	0.402***
	(0.276)	(0.176)	(0.199)	(0.054)
EPZ in City Ships HS8 (t) *	1.592***	0.783***	1.941***	0.491***
	(0.251)	(0.199)	(0.252)	(0.077)
EPZ in City Ships HS8 (t+1) *	1.520***	0.805***	1.951***	0.567***
	(0.259)	(0.204)	(0.235)	(0.087)
EPZ in City Ships HS8 (t+2) *	1.359***	0.751***	1.862***	0.560***
	(0.260)	(0.198)	(0.280)	(0.115)
Adjacent EPZ Ships HS8 (t-2) *	0.469**	0.020	-0.033	-0.024
	(0.206)	(0.053)	(0.199)	(0.038)
Adjacent EPZ Ships HS8 (t-1) *	0.440*	0.029	0.088	-0.008
	(0.228)	(0.065)	(0.236)	(0.047)
Adjacent EPZ Ships HS8 (t) *	0.587***	0.059	-0.005	-0.021
	(0.220)	(0.071)	(0.249)	(0.055)
Adjacent EPZ Ships HS8 (t+1) *	0.703***	0.076	-0.313	-0.068
	(0.218)	(0.060)	(0.245)	(0.054)
Adjacent EPZ Ships HS8 (t+2) *	0.736***	0.108	-0.560**	-0.100
	(0.272)	(0.077)	(0.257)	(0.063)
EPZ in Province Ships HS8 (t-2) *	0.741***	0.137***	0.429***	0.053***
	(0.054)	(0.023)	(0.079)	(0.013)
EPZ in Province Ships HS8 (t-1) *	1.012***	0.194***	0.684***	0.094***
	(0.0821)	(0.026)	(0.092)	(0.019)
EPZ in Province Ships HS8 (t) *	1.382***	0.274***	1.107***	0.158***
	(0.090)	(0.030)	(0.092)	(0.019)
EPZ in Province Ships HS8 (t+1) *	1.361***	0.274***	1.202***	0.180***
	(0.100)	(0.028)	(0.096)	(0.021)
EPZ in Province Ships HS8 (t+2) *	1.170***	0.251***	1.119***	0.176***
	(0.106)	(0.030)	(0.108)	(0.025)
Year FE	Yes	Yes	Yes	Yes
HS 8 FE	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes
N	4,070,360	4,070,360	1,538,285	1,538,285
R^2	0.232	0.349	0.179	0.253

Table 6: The Timing of Changes to Import Value

	Chinese		Foreign	
	Value	Num Exporters	Value	Num Exporters
EPZ in City Ships HS8 (t-2) *	1.340***	0.369***	1.637***	0.422***
	(0.354)	(0.121)	(0.182)	(0.054)
EPZ in City Ships HS8 (t-1) *	1.363***	0.406***	1.962***	0.540***
	(0.304)	(0.124)	(0.229)	(0.067)
EPZ in City Ships HS8 (t) *	1.662***	0.517***	2.219***	0.685***
	(0.304)	(0.124)	(0.234)	(0.084)
EPZ in City Ships HS8 (t+1) *	1.692***	0.510***	2.269***	0.758***
	(0.294)	(0.108)	(0.187)	(0.091)
EPZ in City Ships HS8 (t+2) *	1.557***	0.444***	2.182***	0.771***
	(0.272)	(0.083)	(0.217)	(0.125)
Adjacent EPZ Ships HS8 (t-2) *	0.229	0.028	-0.046	-0.021
	(0.262)	(0.054)	(0.199)	(0.041)
Adjacent EPZ Ships HS8 (t-1) *	0.315	0.040	-0.037	-0.008
	(0.252)	(0.055)	(0.198)	(0.044)
Adjacent EPZ Ships HS8 (t) *	0.488*	0.073	0.091	0.016
	(0.269)	(0.059)	(0.234)	(0.052)
Adjacent EPZ Ships HS8 (t+1) *	0.718***	0.110*	0.139	0.026
	(0.267)	(0.059)	(0.248)	(0.058)
Adjacent EPZ Ships HS8 (t+2) *	0.387	0.043	-0.051	-0.007
	(0.249)	(0.061)	(0.287)	(0.076)
EPZ in Province Ships HS8 (t-2) *	-0.153**	-0.029**	-0.090	-0.046
	(0.072)	(0.013)	(0.069)	(0.015)
EPZ in Province Ships HS8 (t-1) *	-0.011	-0.015	0.135	-0.012
	(0.086)	(0.016)	(0.087)	(0.017)
EPZ in Province Ships HS8 (t) *	0.276***	0.024	0.441***	0.044**
	(0.096)	(0.019)	(0.096)	(0.020)
EPZ in Province Ships HS8 (t+1) *	0.248***	0.026	0.470***	0.076***
	(0.095)	(0.021)	(0.103)	(0.027)
EPZ in Province Ships HS8 (t+2) *	0.254**	0.040	0.435***	0.076***
	(0.100)	(0.025)	(0.103)	(0.027)
Year FE	Yes	Yes	Yes	Yes
HS 8 FE	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes
N	3,201,933	3,201933	2,277,639	2,277,639
R^2	0.236	0.337	0.251	0.364

Table 7: Robustness Checks for Exports

	HS6 Control		SOE Control		Foreign Control	
	Value	Exporters	Value	Exporters	Value	Exporters
(Contains Shipping EPZ) *	1.201***	0.652***	0.362	0.381**	-0.300*	0.033
(HS of Shipping EPZ)	(0.205)	(0.162)	(0.223)	(0.162)	(0.166)	(0.151)
Contains Shipping EPZ	0.338**	0.137***	0.211	0.104**	0.111	0.080**
	(0.133)	(0.039)	(0.154)	(0.047)	(0.122)	(0.038)
(Adjacent to Shipping EPZ)*	0.560**	0.084	0.529**	0.079	0.669***	0.128**
(HS of Shipping EPZ)	(0.237)	(0.067)	(0.195)	(0.043)	(0.197)	(0.050)
Adjacent to Shipping EPZ	0.245**	0.050***	0.221*	0.038*	0.191*	0.039**
	(0.109)	(0.018)	(0.123)	(0.022)	(0.100)	(0.016)
HS of Shipping EPZ	0.973***	0.223***	0.729***	0.149***	0.284***	0.038**
	(0.089)	(0.025)	(0.091)	(0.021)	(0.060)	(0.018)
Value Matching HS6	0.191***					
	(0.005)					
Exporters Matching HS6		0.186***				
		(0.006)				
Log(Val of SOE)			0.573***			
			(0.012)			
Log(Num SOE)				1.317***		
				(0.041)		
Log(Val of Foreign)					0.554***	
					(0.026)	
Log(Num Foreign)						1.027***
						(0.037)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
HS 8 FE	Yes	Yes	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes
N	4,068,990	4,070,360	3,931,578	3,931,578	4,070,360	4,070,360
R^2	0.241	0.360	0.290	0.499	0.321	0.526

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Each dependent variable is the log of that variable. Each observation in these regressions is the export of an HS8 code from a city in a year. Observations exclude exports shipped directly from EPZs. The variable "Contains Shipping EPZ" is a dummy variable indicating whether an EPZ inside that city exported any HS code in that year. The variable "HS of Shipping EPZ" is a dummy variable indicating whether any EPZ in the province of the city exported a given HS code in that year. The variable "Adjacent to Shipping EPZ" is a dummy variable indicating whether an EPZ in an adjacent city exported any HS code that year. Standard errors are clustered at the city level.

Table 8: Robustness Checks for Imports

	HS4 Control		SOE Control		Foreign Control	
	Value	Exporters	Value	Exporters	Value	Exporters
(Contains Shipping EPZ) *	1.310***	0.409***	0.172	0.134**	-0.231*	-0.040
(HS of Shipping EPZ)	(0.222)	(0.091)	(0.117)	(0.062)	(0.122)	(0.049)
Contains Shipping EPZ	0.137	0.037	0.100	0.023	0.089	0.027
	(0.159)	(0.024)	(0.144)	(0.024)	(0.120)	(0.017)
(Adjacent to Shipping EPZ)*	0.499***	0.070	0.218*	0.060**	0.237*	0.024
(HS of Shipping EPZ)	(0.182)	(0.044)	(0.130)	(0.026)	(0.124)	(0.029)
Adjacent to Shipping EPZ	0.111	0.027*	0.091	0.027	0.042	0.019*
	(0.120)	(0.015)	(0.101)	(0.018)	(0.097)	(0.011)
HS of Shipping EPZ	0.200***	0.023	0.075**	-0.001	0.005	-0.010
	(0.068)	(0.015)	(0.038)	(0.009)	(0.042)	(0.009)
Value Matching HS6	0.165***					
	(0.014)					
Importers Matching HS6		0.180***				
		(0.023)				
Log(Val of SOE)			0.688***			
			(0.004)			
Log(Num SOE)				0.663***		
				(0.026)		
Log(Val of Foreign)					0.628***	
					(0.011)	
Log(Num Foreign)						0.707***
						(0.036)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
HS 8 FE	Yes	Yes	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes
N	3,200,550	3,201,933	1,939,315	1,939,315	3,254,223	3,254,223
R^2	0.220	0.328	0.495	0.606	0.333	0.506

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Each dependent variable is the log of that variable. Each observation in these regressions is the import of an HS8 code from a city in a year. Observations exclude imports shipped directly from EPZs. The variable "Contains Importing EPZ" is a dummy variable indicating whether an EPZ inside that city imported any HS code identified as "EPZ equipment import" that year or the year before that year. The variable "HS of EPZ Import" is a dummy variable indicating whether any EPZ in the province of the city imported "EPZ equipment import" in that year or the year before. The variable "Adjacent to Shipping EPZ" is a dummy variable indicating whether an EPZ in an adjacent city imported any HS code identified as "EPZ equipment import" that year. Standard errors are clustered at the city level.

Table 9: Mean performance comparison of imitating and control firm before EPZ

	TFP	ROA	Ln(Y/L)
Imitating (N=38,743)	7.851	0.062	5.240
Control (N=12,521)	7.881	0.063	5.369
Difference	-0.030 **	-0.0016	-0.130***
	(0.013)	(0.001)	(0.010)

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The sample includes all exporters which are located in either an adjacent city to an EPZ or the city containing an EPZ before they export the same HS6 products as in an EPZ.

The imitating sample includes all firms that export the exact HS8 product as in an EPZ subsequently.

The control sample includes all firms that export the same HS6 but not the exact HS8 product.

TFP, (total factor productivity), the residual of firm output after labor and capital inputs are accounted for.

ROA, (return to assets), is calculated as profit divided by total assets.

Ln(Y/L) is the logarithm of sales divided by the total number of employees.

Table 10: EPZs and exporters' operating performance

					Chinese			Foreign	
	TFP	ROA	Ln(Y/L)	TFP	ROA	Ln(Y/L)	TFP	ROA	Ln(Y/L)
After	-0.007	0.001	0.006	-0.031**	0.001	0.012	0.008	0.001	0.004
	(0.008)	(0.001)	(0.006)	(0.014)	(0.002)	(0.010)	(0.010)	(0.002)	(0.007)
Imitating*After	0.010*	0.002***	0.012***	0.030***	0.003***	0.019***	0.002	0.002**	0.011***
	(0.005)	(0.001)	(0.004)	(0.010)	(0.001)	(0.007)	(0.006)	(0.001)	(0.004)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	107,378	107,378	107,378	37,683	37,683	37,683	69,695	69,695	69,695
R^2	0.851	0.586	0.843	0.856	0.613	0.813	0.849	0.579	0.856

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The sample includes all exporters which are located in either an adjacent city to an EPZ or the city containing an EPZ and export the same HS6 products as in an EPZ. We match these exporters to CASIF to obtain the accounting information for 2000-2006.

Variable "After" is a dummy variable that equals one for years since the EPZ exports an HS6 product.

Variable "Imitating" is a dummy variable that equals one for firms export the exact HS8 product.

TFP, (total factor productivity), the residual of firm output after labor and capital inputs are accounted for.

ROA,, (return to assets), is calculated as profit divided by total assets. Ln(Y/L) is the logarithm of sales divided by the total number of employees.

Standard errors are clustered at the firm level.

Table 11: Exporters' operating performance, EPZ and Adjacency effects

				Chinese			Foreign		
	TFP	ROA	Ln(Y/L)	TFP	ROA	Ln(Y/L)	TFP	ROA	Ln(Y/L)
After *EPZ	0.008	0.001	-0.006	-0.013	0.002	0.019	0.026*	0.001	-0.007
	(0.011)	(0.002)	(0.008)	(0.025)	(0.002)	(0.014)	(0.014)	(0.002)	(0.009)
After *Adjacency to EPZ	-0.030**	0.000	0.024***	-0.057**	-0.002	0.004	-0.038**	0.002	0.027**
	(0.013)	(0.002)	(0.009)	(0.025)	(0.002)	(0.013)	(0.019)	(0.002)	(0.012)
Imitating*After* EPZ	0.013**	0.003***	0.015***	0.017	0.004***	0.030***	0.014*	0.003**	0.013***
	(0.007)	(0.001)	(0.004)	(0.017)	(0.001)	(0.010)	(0.008)	(0.001)	(0.005)
Imitating*After *Adjacency to EPZ	0.004	0.001	0.008	0.037**	0.002	0.007	-0.022*	0.000	0.007
	(0.009)	(0.001)	(0.006)	(0.017)	(0.001)	(0.009)	(0.013)	(0.002)	(0.008)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	107,378	107,378	107,378	37,683	37,683	37,683	69,695	69,695	69,695
R^2	0.851	0.586	0.843	0.835	0.614	0.813	0.850	0.579	0.857

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The sample includes all exporters which are located in either an adjacent city to an EPZ or the city containing an EPZ and export the same HS6 products as in an EPZ. We match these exporters to CASIF to obtain the accounting information for 2000-2006.

Variable "After * EPZ" is a dummy variable that equals one for years since the EPZ exports an HS6 product. Variable "After * Adjacency to EPZ" is a dummy variable that equals one for years since the city adjacent to EPZ exports an HS6 product.

Variable "Imitating" is a dummy variable that equals one for firms export the exact HS8 product.

TFP, (total factor productivity), the residual of firm output after labor and capital inputs are accounted for.

ROA, (return to assets), is calculated as profit divided by total assets. Ln(Y/L) is the logarithm of sales divided by the total number of employees.

Standard errors are clustered at the firm level.