Inter-industry relatedness as a key determinant of industrial-policy efficiency

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We study the efficiency of the export-promoting policies implemented in China within the so-called Export Processing Zones (EPZ) and investigate whether the effect depends on the consistency of their focus with local comparative advantage. In the early 2000s the Chinese government established 57 Export Processing Zones, a type of free trade zone (FTZ) offering tax incentives and a barrier-free environment, to encourage investments from multinational companies into processing trade activities. We use sector-level data from Chinese manufacturing surveys over the 1998-2007 period and exploit information on the targeted sectors in each zone and on the adequation between targeted sectoral activities and the local availability of capabilities and resources. We find export benefits from the EPZ policy which are greater for sectors with denser links with the local productive structure. Our results suggest that industrial-policy effectiveness is magnified by pre-existing productive knowledge.

THE PROLIFERATION OF EXPORT PROCESSING ZONES IN THE FIRST HALF OF THE 2000s

China is probably one of the best-known examples of **the use of place-based policies**. Starting in 1979, the Chinese government established a multitude of Special Economic Zones as jumping-off points for its internationalization strategy. Export processing zones were developed in response to China's accession to the WTO in 2001, which required the tighter regulation of processing trade. The Chinese decided to focus the development of **processing trade within these zones**. Export processing activities within EPZs enjoy additional advantages compared to those outside the zones. Whatever the location, processing activity benefits from duty-free imports. In EPZs, firms pay no taxes on utilities and their activities are free of value-added and excise taxes. The objective is to grant zero export taxation on exports in order to eliminate double taxation before the exported products reach the consumers in the importing country. In addition, firms in EPZs benefit from advantageous land prices, possible direct subsidies and a more efficient business environment: for example, customs typically provide a 24-hour service within these zones.

Figure 1 : Geographical distribution of the EPZs

A total of 57 export-processing zones were established in China between 2000 and 2005. A first group of 15 export-processing zones were initially approved in April 2000 by the State Council. Subsequently, 3, 8, 13, and 18 EPZs were approved in 2001, 2002, 2003, and 2005, respectively. Many provinces (23 out of 31) include such zones, with the largest number being found in Jiangsu province (13 in 2005).
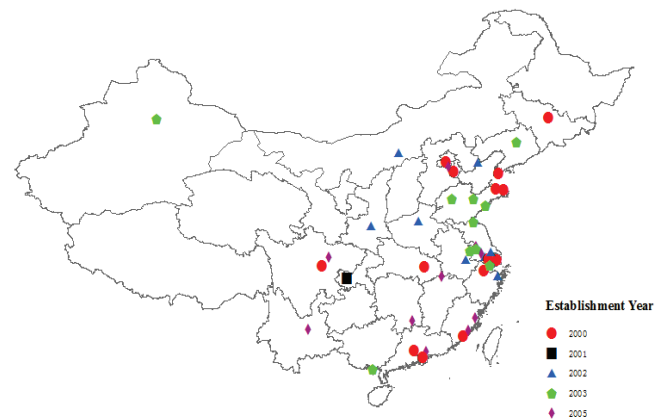
EXPORT PROCESSING ZONES ARE AIMED PRIMARILY AT FOREIGN MARKETS

The establishment of an EPZ in **a location is expected to boost exports through a number of channels**. The first is preferential policies aimed at attracting firms that are not present in the locality. These measures lower variable and/or fixed operations costs of firms and should raise their propensity to start exporting and expand their exports. However it is also likely that **pre-existing firms in the locality relocate to the EPZ to take advantage of the financial and logistic advantages offered**. Exports from the locality will rise if the exports from these relocating firms expand thanks to the export-promoting policies to which they have access in the EPZ.

EPZ creation in a locality is also expected to encourage local export performance via spillovers to firms outside the EPZ. The first channel relates to input-output linkages, as firms in EPZs may purchase local intermediate goods. It is important to note that these sales from non-EPZ firms to EPZ firms are supposed to be recorded as exports by non-EPZ firms, given the extraterritorial nature of EPZs. Second, since foreign-invested firms (FIEs) dominate exports from EPZs, a clear policy objective with respect to EPZs is the facilitation of technology transfer from high-productivity FIEs to domestic firms. EPZ firms are expected to generate technological spillovers to surrounding firms through imitation effects, vertical (supply and demand) linkages (Javorcik, 2004) and the re-employment of skilled labor from EPZ to non-EPZ firms (Blonigen and Ma, 2010; Hale and Long, 2011). Last, there could be benefits from the export experience of multinationals. The possible channels of those export spillovers are information externalities, cost-sharing opportunities, and joint actions in export markets (Li and Liu, 2014; Mayneris and Poncet, 2015).

THE LACK OF EMBEDDEDNESS AS A POTENTIAL THREAT TO THE INDUSTRIAL-POLICY EFFICIENCY

An interesting feature of the Chinese EPZs is that they have a sectoral focus. Some specific activities are officially listed as being priorities in the EPZs' attempts to develop export-processing activities. Firms operating in the targeted sectors of an EPZ are hence more likely to be accepted into the EPZ and to establish themselves there. We expect that, within a location, **the EPZ preferential policies benefit mostly to firms in the targeted sectors.** While electronics is a priority sector in most of the established EPZs, the exact list of priority sectors varies across zones. The fact that some sectors are listed as being priorities in all EPZs suggests that targeting does not systematically relate to comparative advantages, hence to intrinsic export performance potentials. This is in line with the general ideal that targeting is a policy tool based on many factors (Harding and Javorcik, 2012).

A growing literature has however warned against the inconsistency of industrial policy with the local productive structure (Lin, 2012, Cai et al., 2016). The production of goods requires capabilities and products that vary considerably in their knowledge requirements (Hausmann and Hidalgo, 2011). As the cities in which the EPZs are established may differ in terms of their existing productive knowledge, any failure to match the promoted products to the necessary capabilities and resources may limit the capacity of the EPZs to effectively promote exports.

Hence despite the high expectations regarding export creation by Chinese EPZs, their effectiveness may be reduced if the skills and inputs needed to develop the export activities are absent. The effectiveness of industrial policies appears to be more effective when targeted at sectors where the country has a latent potential (Cai et al., 2016). This potential comes from the ability to use the skills incorporated into the other local sectors. A sector's ability to mobilize the expertise of another sector is stronger when the two are related, i.e. they work with the same resources, technologies, infrastructure, etc. These proximities between products are reflected in the Product Space which is a network that formalizes the idea of relatedness between products traded in the global economy (Hildalgo et al., 2007). We use the bilateral proximities proposed in the product space framework to develop our key measure of the adequation between EPZ activities and the local productive structure: the density index.

In detail bilateral proximity (for each pair of products) is calculated using international country trade flows based on the probabilities that countries with comparative advantage in one of the goods also have comparative advantage in the other. The fact that producing and exporting computers is, for example, expected to require competencies, technology, inputs and production factors which are similar to those used to produce televisions, hence that many countries export both computers and televisions yields considerable proximity between the two products. Alternatively, since the necessary requirements for the production and export of products like T-shirts or toys are very different from those for computers, the proximity value between these two products and computers is likely much lower.

Our key variable of density measures, for each locality-sector pair, the density of links to the local productive structure. Following Hidalgo et al. (2007) and Kali et al. (2013), the density for a good in a locality is calculated as the average of the good's bilateral proximities with the other goods that the locality exports with comparative advantage. High density values for the pair locality l-product k indicate that locality l has comparative advantage in many industries that are closely related to sector k: this sector is then densely-connected to the local productive structure. The density variable being the sum of bilateral product proximities which are determined world-wide cannot be suspected of being endogenous. The sum furthermore excludes the sector k, as such it does not incorporate any information on the export flows for sector k. High density values indicate that locality l has comparative advantage in many industries that are closely related to sector k: this sector is then densely-connected to the local productive structure.

As in Kali et al. (2013), Hidalgo et al. (2007) and Poncet and Starosta de Waldemar (2015), density is considered as a proxy for product spillovers emanating from consistent specialization, such as knowledge externalities and economies of scale and scope spillovers. We expect the relative rise in sector-level exports following the EPZ policy to be larger in cities with comparative advantage in many industries that are closely related to sector k, i.e. high density for that location-product pair. Hence larger export gains should be observed in the computer sector in cities with great knowledge and competencies in televisions production than in the textile sector.

A DIFFERENCE-IN-DIFFERENCE APPROACH TO ASSESS THE EXPORT PROCESSSING ZONES'EFFICIENCY

Our paper investigates **the effect of the establishment of Export Processing Zones on Chinese exports.** The analysis is at the location-sector level. We exploit information on the sectors that are treated as priorities by the local government in their efforts to develop export processing activities.

Our identification exploits variations in the expected export gains of the EPZ policy by sector. We furthermore investigate whether the effect depends on the local availability of the necessary capabilities and resources, as proxied by the density of the linkages between EPZ activities and local specialization (which is a locality-sector specific feature). This approach allows us to determine the causal effect of the EPZ policy on exports, even if the selection of EPZs and targeted sectors was not exogenous to economic activity. As industries vary in terms of their intrinsic density of links to the local productive structure, we expect preferential EPZ policies to have a greater effect on activities when there is more pre-existing productive knowledge.

We thus filter out the impact of the EPZ policy using the density index, which captures the intrinsic predisposition to benefit from export-promoting policies. This strategy is conceptually similar to a triple-difference estimation. We compare i) locations before and after the introduction of the EPZ policy (the first difference), ii) targeted vs. non-targeted sectors (the second difference), and iii) sectors with higher vs. lower density (the third difference).

RESULTS SUGGEST THAT INDUSTRIAL-POLICY EFFECTIVENESS IS MAGNIFIED BY PRE-EXISTING PRODUCTIVE KNOWLEDGE

We find **positive export repercussions from the EPZ establishment which are stronger for sectors that have dense links with those currently produced in the locality**.
Several thought experiments can provide an idea of the magnitude of EPZ-efficiency magnification from pre-existing productive knowledge measured so far.

We first explore by how much exports grow following the EPZ establishment when comparing a sector at the median of the distribution of density in the city to another sector characterized by a one standard deviation higher density. Based on the within-city distribution of the density measure, an increase of a one standard deviation over the mean in within-city product density amounts to a 5% higher density. Such a difference in the density of links across sectors leads to a relative increase in annual exports of 9%. This is an economically significant change. We can nonetheless put this in perspective by comparing it to the substantial average annual figure for export growth of 16% over this period. Zooming on the sectors that are treated as priorities by the local government in their efforts to develop export-processing activities, we find that the observed magnification effect of a 5% density rise on EPZ-policy efficiency is further reinforced for those targeted sectors which are the most exposed to the policy. Our results suggest an additional 1.1 percentage point of exports for sectors that are awarded priority status.

Another approach to illustrate the results on the key role of the density of links is to compare the export gains from the establishment of an EPZ for a sector at the 10th percentile and a sector at the 90th percentile of the within-city distribution of density. Our empirical estimates indicate that, all things being equal, the export gains from the establishment of an EPZ are higher for a sector at the 90th percentile relative to a sector at the 10th percentile of the distribution of density, by a factor of 1.24 for the non-targeted sectors. This factor is reinforced for sectors that are selected to benefit from the EPZ policy and rises to 1.27 for these targeted sectors. We hence find additional export gains for the priority sectors that are economically significant.

THE NEED TO THINK CAREFULLY ABOUT SECTORAL TARGETING

Our results hence suggest that **the consistency of the policy's focus on activities for which the required capabilities and resources are available magnifies EPZ efficiency**. However, only 17 among the 47 Chinese EPZs have a correct targeting, defined as the selection of well-connected sectors. By contrast for 18 other EPZs none of the targeted sectors have strong links with the local production structure. We leave it to future research to determine what may hinder the capacity of authorities to choose the sectoral focus properly.

More work is also required to allow us to explain the exact channels via which the sectoral density of links enhances the efficiency of EPZ policy. In addition, our approach does not allow us to determine what is behind these export gains. It remains an open question whether the better export performance from adequate sectoral focus comes from firms in EPZs or from spillovers from EPZ firms to non-EPZ areas of the locality. In the former case it would be interesting to know whether the EPZ firms are newly-established firms or whether they relocated to the EPZ from other areas in the locality. In the latter case of spillovers to non-EPZ exporters, it would be useful to know whether the benefits relate to technological or export spillovers.

TO GO FURTHER 2017

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