Pure-Exporter Subsidies: The Non-Reform of China's Trade Policy.*

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Abstract

In this paper we document a wide range of policies used in China which provide incentives for manufacturing firms to export a substantial share of their output. Between 2000 and 2006, more than a third of exporting firms in China sold more than 90% of their production abroad. We study the impact of this type of policy, largely ignored in the literature, on China and its trading partners' welfare. To do so, we develop a heterogeneous-firm model of trade in which firms have the option of becoming 'pure exporters', that is, export all their output in return for an ad-valorem sales subsidy. We show that when pure exporters emerge, they do so in the middle of the productivity distribution. A pure-exporter subsidy reduces a country's welfare through a reduction in the mass of varieties available for consumption combined with lower terms-of-trade. However, we show that unlike a traditional ad-valorem export subsidy, subsidies favoring pure-exporters provide heightened protection to low-productivity domestic firms. We find support for the hypothesis that pure-exporters have an intermediate level of productivity between that of domestic producers and regular exporters using firm-level data for the Chinese manufacturing sector for the period 2000-2006. Calibrating our model to match the shares of different types of firms in China, we find that eliminating the policies favoring pure-exporters would increase China's welfare by 3.23%, while it would decrease welfare abroad by 1.09%.

Keywords: Trade Policy; Export Subsidies; Heterogeneous Firms; China.
JEL classification: F12, F13, O47.

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"In certain zones, companies are apparently only allowed to locate when they enter obligations to export a certain minimum percentage amount of their production. [C]an China please explain how such practices are compatible with the obligations resulting from the accession protocol [?]"

Questions by the European Communities with regard to China's Transitional Review Mechanism on Subsidy Practices. World Trade Organization, 21 September 2004.

1 Introduction

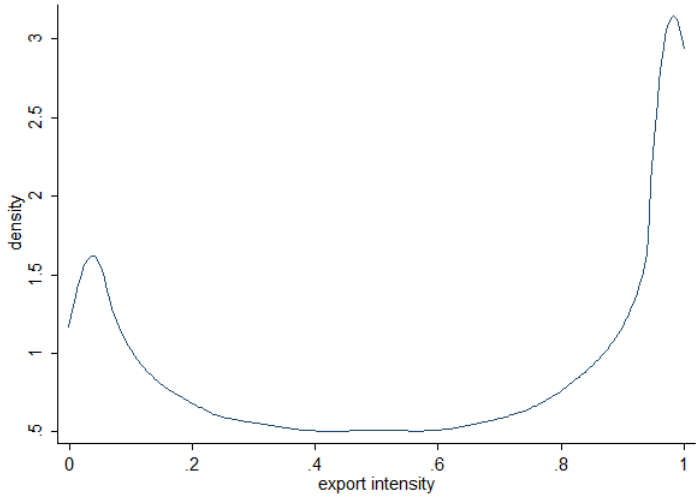
In recent discussions at the World Trade Organization (WTO), the European Communities questioned the case of the "Shanghai Foreign Investment Center" where firms *exporting the majority of their production*, enjoy various preferential policies, such as "priority in the supply of water, electricity, transport and telecommunication charged at the same price as state owned companies," "priority for short term funds or other necessary loans," and "preferential charge for land use." Besides facilitating the operation of firms located there, Shanghai's local government also offers large tax reductions for firms exporting all or most of their production. The WTO document mentions that firms *exporting more than 70% of their production* benefit from an exemption from local income tax and a 10% reduction on their tax rate.[1]

Overall, these policies generate a large numbers of 'pure exporters', i.e. firms producing almost exclusively for the foreign market. Figure 1 presents the distribution of Chinese manufacturing exporters in terms of their export intensity, the share of their total sales accounted by exports. For the period 2000-2006, more than a third of Chinese manufacturing exporters sold 90% or more of their output abroad. In contrast, Bernard et al. (2003) and Eaton et al. (2011) show that for most exporting firms in the U.S. and France respectively, foreign sales constitute a very small share of total sales.

For the first time, this paper documents a wide range of policies favoring pure exporters in China. To study the welfare effect of this type of policies in China and its trading partners we propose a two-country, heterogeneous-firm model of trade in which China is characterized by a dual export system. That is, firms in China can sell their output in the foreign market in two ways, by paying a fixed cost as in Melitz (2003), which allows them to sell a share of their output abroad, or,

[1] Questions by the European Communities with regard to China's Transitional Review Mechanism on Subsidies and Countervailing Measures, 30 September 2003 (references G/SCM/Q2/CHN/5 and G/SCM/Q2/CHN/7).

Figure 1: Export Intensity Distribution for Chinese Manufacturing Firms, 2000-2006.



The figure depicts the kernel density of export intensity, defined as the share of exports in total sales, for firms reporting a positive value of exports for the period 2000-2006. We provide a detailed description of the data used in the empirical analysis in Section 4.

they can pay the same fixed cost and export the totality their output. Firms that follow the latter alternative, which we refer to as pure exporters, receive an ad-valorem sales subsidy. Our modeling approach seeks to encompass in a parsimonious way a wide range of trade and investment policies that are contingent on firms selling the majority of its output abroad, in order to investigate their impact on welfare both in China and abroad.

In our model, firms can choose to operate in one of three different production regimes: domestic, regular exporter and pure exporter, based on their idiosyncratic productivity. We show that, under the standard assumption that fixed costs are such that the most productive firms select themselves into exporting in the absence of subsidies, firms will not choose to become pure exporters unless the government provides a sufficiently large subsidy. This lower bound falls when the foreign market is larger relatively to the domestic one, when transportation costs are low and when the fixed cost of exporting is not too large relative to the domestic fixed cost. Moreover, we find that when pure exporters start to arise, it is firms in the middle of the productivity distribution, more specifically firms around the no-subsidy export productivity cutoff, that choose to start selling their entire production abroad. Using firm-level data for the Chinese manufacturing sector for the period 2000-2006, and identifying pure exporters as firms exporting more than 90% of their output, we find

support for this testable hypothesis.

To gain a better understanding about the general equilibrium effects of pure-exporter subsidies, we conduct a comparative statics exercise in which we compare an increase in the pure-exporter subsidy to a regular ad-valorem export subsidy, i.e. a subsidy that is only contingent on exporting. This exercise shows that an increase in the pure-exporter subsidy is worse for China's overall welfare than a revenue-neutral increase in the regular export subsidy. Both instruments increase the share of firms selling abroad as well as aggregate exports and produce a worsening of China's terms-of-trade. The main difference between the two types of subsidies is that the pure exporter subsidy results in less intense competition in the China, which in turn allows more low-productivity firms to operate there. In the rest of the World, the opposite effect occurs: having a greater mass of varieties sold at lower prices (due to the subsidy), intensifies competition inducing low-productivity firms to stop producing. Regular export subsidies on the contrary, increase real wages, driving low-productivity firms out of the market at home and abroad. This feature of the pure-exporter subsidy resembles what Rodrik (1999) denominates a 'heterodox opening', i.e. a policy that results in high returns to exporting while segmenting this sector from the rest of economy, and which he credits as a key driver behind Mauritius' growth miracle. Our comparative statics shows however, that in the context of our model, where the operation of pure-exporters is not associated with any sort of productivity spillover effect, and in the absence of other market failures (for instance, in the labor market), the use of pure-exporter subsidies is detrimental for China's welfare.[2] In fact, for a given level of expenditure in export subsidies, the pure-exporter subsidy is worse in welfare terms for China than a regular ad-valorem export subsidy.

We calibrate our model to match the share of firms operating under the three production regimes described above, as well as the average export intensity of regular exporters. We then use our model to ask, what would be the welfare impact in China and the rest of the World if the Chinese government eliminated all pure-exporter subsidies? Our model indicates that if China were to remove all support to firms exporting all their output, welfare in China would increase by 3.23%. This welfare improvement follows from a reduction in protection enjoyed by low-productivity firms,

[2] As discussed in Section 2, one of the main objectives of policies favoring pure-exporters is to attract foreign-invested enterprises with the hope of generating positive externalities associated to technology transfer, imitation of best practices, worker training, and several other channels. Hale and Long (2011) however, find no evidence of systematic positive productivity spillovers from FDI in China. A similar conclusion is reached in the survey by Görg and Greenaway (2004).

which would face stronger competition in the domestic market as well as from a 6.68% increase in the mass of available varieties for consumption in China (even though the mass of operating firms in China actually decreases by 2.69%), all in all, producing a reduction in the domestic price index in China of 2.58%. Conversely, eliminating the export subsidy hurts the rest of the World as the terms-of-trade from China's perspective improve, resulting in a reduction in welfare for the rest of the World of 1.09%.

Given the pivotal role of preferential policies targeted towards pure-exporters in China's trade policy, our paper intends to contribute towards the growing body of research studying the consequences of China's unique strategy of insertion to the World economy both for its own economy and its trading partners (Bajona and Chu, 2010; Khandelwal et al., 2011; Hsieh and Ossa, 2011). Our findings are also related to the literature on trade policy in a heterogeneous-firm environment (Chor, 2009; Demidova and Rodríguez-Clare, 2009; Felbermayr et al., forthcoming) as well as to the more established body of work investigating the welfare implications of export-processing zones (Hamada, 1974; Miyagiwa, 1986).

There are three papers that are closely related to ours, both in terms of their aim and methodology: Lu (2010), Lu et al. (2011) and Heid et al. (forthcoming). Lu (2010) is the first paper that documents the large number of firms exporting all their output in the Chinese manufacturing sector. She explains the prevalence of pure-exporters by a combination of capital-intensity differences across sectors combined with convex marketing costs as in Arkolakis (2010).

Lu et al. (2011) follow a closer approach to ours and use an extension of Melitz (2003) in which firms face fixed costs of *selling* at home and abroad in addition to fixed costs of production. In their model pure exporters are also predicted to have an intermediate level of productivity, greater than that of domestic firms but below that of regular exporters. However, in their model pure exporters only arise when the domestic market is sufficiently small relative to the foreign one, an assumption that might be problematic when considering the particular case of China, a country that currently accounts for approximately 10% of the World's GDP. Moreover, our work goes beyond that of Lu et al. in that we explore the general equilibrium consequences of an increase in the share of pure exporters.

Our use of a calibration exercise to quantify the welfare effect of pure-exporter subsidies follows a similar approach to Heid et al. (forthcoming), who seek quantify the welfare impact of the rapid

expansion of the *maquila* sector, i.e. a whole sector populated by pure-exporters, in Mexico during the 1990s. Unlike them, we do no assume the existence of pure-exporters, we instead study under what conditions they would arise given the vast array of policies favoring them in China. Moreover, our use of a two-country model rather than the small economy variant used by Heid et al., allows us to investigate how pure-exporter subsidies affect China's trading partners.

The rest of the paper is organized as follows: Section 2 provides an overview of Chinese policies favoring pure exporters. Section 3 presents our theoretical model and spells out the conditions under which pure exporting firms arise. Section 4 describes the data used in our empirical analysis and shows how do we take the testable hypotheses developed in Section 3 to the data. Section 5 presents a comparative statics exercise where we compare the outcomes produced by a pure-exporter subsidy to those of a traditional ad-valorem export subsidy for China and its trading partners. In Section 5 we also conduct a counterfactual policy experiment in which we ask what would be the welfare effect of completely eliminating pure exporter subsidies both for China and the rest of the world. Section 6 concludes.

2 Overview of Policies Favoring Pure Exporters

Over the last two decades China has promoted capitalism and western management practices through different policies, several of which rely heavily on export promotion but at the same time maintaining a significant degree of protection in the domestic market (Naughton, 1996; Feenstra, 1998). Three major elements of this general set of policies can be identified: the attraction of Foreign-Invested Enterprises (FIEs), the promotion of Processing Trade Enterprises (PTEs) and the establishments of Free-Trade Zones (FTZs). All these policies have in common to incentivize firms to export all or most of their output. Despite substantial modifications following China's accession to the WTO in December 2001, the dual export system still plays a predominant role in China's trade regime. We now discuss in detail, the different tax benefits available to firms exporting a certain share of their output.

Foreign-Invested Enterprises

In accordance with its industrial policy, China encourages the "establishment of enterprises with foreign investment which export all or the greater part of their production"[3]. Thus, until 2001 many Foreign-Invested Enterprises (FIEs) had domestic sales ratios specified by contract. Firms could be punished by mainland authorities in the case of non-compliance with these requirements. For instance, foreign investors were required to repay 60% of the tax refunded if the enterprise did not meet the target for export-oriented enterprises within three years from the day when it began production. After China's accession to the WTO, the law of The People's Republic of China on Foreign Capital Enterprises revised in October 2000, lifted the requirement for FIEs to export all or most of their products.

Nevertheless, many incentives in favor of pure exporters still exist today. For instance, Table 1 presents the corporate income tax rates for firms operating in China. For Chinese-owned firms outside an economic zone the income tax rate is 30%. For Foreign-Invested Enterprises (FIEs) outside an economic zone, on the other hand, the 1986 Provisions for the Encouragement of Foreign Investment reduced the income tax rate from 30% to 15% for all enterprises that export more than 70% of their production, a regulation still in place today. FIEs located in a Free-Trade Zone (FTZ), face an income tax rate of 15% (or 24% in a costal zone). However, if the FIE exports more than 70% of its production, the income tax rate is further reduced to 10%.

Additionally, the "Regulations for Guiding the Direction of Foreign Investment" also incorporates restrictions on local sales for FIEs. For instance, the Guiding Regulations classifies all foreign investment projects into four categories: encouraged, permitted, restricted and prohibited projects. Restricted projects must be examined and approved by the relevant authorities. However, restricted projects that export at least 70% of their total sales may be deemed as permitted.[4] This rule still apply today, even though China has largely revised the list of restricted products after its entry into the WTO. A new element has been introduced in the 2002 regulation, which permits projects that export all of their products directly to be considered encouraged projects automatically and so, enjoy preferential treatments. For instance, FIEs under "encouraged category" are entitled to

[3]Reference: ZHU XI LING [45] 1991.4.9, Source: Kaizen Corporate Services Limited

[4]The first 10 listed products by the 1995 Catalogue for the Guidance of Foreign Investment Industries (in order of appearance) are : Machinery, assemblage of movements of digital watches and finished watches, bikes, knitting machines, Electric appliances: washing machines, refrigerators, freezers, tins.

Table 1: Corporate income tax rate

	National tax rate	Special Economic Zones	Coastal Development Zones	Yangtze and Pearl Economic Zones	Industrial Parks*
Export sales ratio					
			Foreign-Invested Entreprises		
Below 70%	30%	15%	24%	24%	15%
Over 70%	15%	10%	10%	10%	10%
			Production Enterprises		
Below 70%	30%	15%	15%	15%	15%
Over 70%	30%	10%	10%	10%	10%

* Industrial Parks includes "Economic and Technological Development Zones", "High-Technology Industrial Development Zones" and "Export Processing Zones."

full VAT rebate on the purchase of domestically-produced equipment.

Processing Trade Enterprises

A strict control remains in place regarding the domestic sales of Processing Trade Enterprises (PTEs). This legal status refers to production enterprises or factories established by business enterprises but with independent accounting and their own business licence. The Ministry of Commerce of The People's Republic of China refunds tariffs and value-added taxes to companies that export their processed merchandize using processing trade regime. This rule systematically applies to PTEs which are subject to very different policy treatment compared to other firms. These enterprises are allowed to import inputs duty free as long as they are not used for domestic consumption. If sold on the domestic market for special reasons, firms must promptly pay the tariffs and VAT on the imported materials. More importantly they must obtain approval from both the provincial commerce authorities and customs for an import licence. Failing to do so translates into a penalty ranging from 30% to 100% of the declared value of the imported materials and parts.[5] As a consequence, the Hong Kong Trade Development Council (HKTDC, 2009) reports that "most traditional processing trade factories are still export-oriented, the share of domestic sales of these factories is negligible".[6]

[5] resources.alibaba.com: Guide to Doing Business in China 2 Processing Trade part2

[6] http://www.hktdc.com/info/vp/a/prd/en/1/6/1/1X001DX0/Turning-From-Export-Processing-To-Domestic-Sales.htm

To enjoy autonomy in domestic sales, processing trade factories have to change their registrations into FIEs and temporarily stop their production for auditing by customs. The consulting company Li & Fung Group (2012) estimates that "production stoppage can take 9 to 12 months." Furthermore, the transformation from processing trade to FIEs "involves the work of more than 10 government departments" and might require a substantial tax repayment.[7]

Free Trade Zones

The third major aspect of China's trade policy is the establishment of Free-Trade Zones (FTZs), free of import and export duties and of value-added tax. This location either provide large subsidies to "pure exporters" or have strict requirement in term of firms local sales ratio. Foreign-Invested Entreprises (FIEs), Processing Trade Entreprises (PTEs) but also Chinese-owned entreprises are encouraged to locate in these zones in return for subsidies under some export sales ratio requirements. FTZs provide additional incentives for "pure exporters" in addition to the ones already mentioned in the previous sections. Notably, in all FTZs, such as the Special Economic Zones, Coastal Development Zones, Yangtze and Pearl River Delta Economic Zones as well as some smaller industrial parks[8], where the tax rate is already at 15%, entreprises exporting more than 70% of their production benefit from a 10% income tax, independently of their ownership or of their trade regime. In addition, many FTZs have introduced additional incentives for export-oriented firms. For instance, Standard Chartered (2007) reports the case of Shenzhen city, China first free economic zone with a total area of 493 km^2, where firms that can prove they have paid all their value-added taxes on inputs and that export all their production qualify for a 5% sales cash subsidy. The Shenzhen Special Economic Zone also reduces to half the "land use fee" charged on certified "enterprises-for-export".

Some other zones, such as most of the "export processing zones", have strict requirement in term of firms local sales ratio – usually 30% of the total volume of sales. The first 15 pilots of this new type of zones were set up in 2000, and their number have more than triple during the last decade. The Chinese government seems keen to experiment with new strategies to encourage firms exporting most of their production.

[7] What do Experts Say? "Ten Highlights of China's Commercial Sector, 2011-2012" - Li & Fung Group

[8] Industrial Parks includes "Economic and Technological Development Zones", "High-Technology Industrial Development Zones" and "Export Processing Zones".

3 The Model

Our model is an extension of Melitz (2003) in which firms have the option to export all their output in return for an ad-valorem revenue subsidy. We denote the firms that choose to do this, 'pure exporters.'

There are two countries, China (c) and the rest of the world (f). Each country $i = c, f$, is inhabited by L_i identical consumers, each supplying one unit of labor inelastically. The utility of the representative consumer in country i is given by:

$$\mathcal{U}_i = \left(\int_{\omega \in \Omega_i} q(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right)^{\frac{\sigma}{\sigma-1}}, \quad i \in \{c, f\}, \tag{1}$$

where Ω_i denotes the set of goods available for consumption in country i, including domestically-produced and imported varieties; $q(\omega)$ is the quantity consumed of good ω and $\sigma > 1$ is the elasticity of substitution. Demand for good ω in country i is

$$q(\omega) = E_i P_i^{\sigma-1} p(\omega)^{-\sigma}, \tag{2}$$

where E_i denotes country i's aggregate expenditure and $P_i = \left[\int_{\omega \in \Omega_i} p(\omega)^{1-\sigma} d\omega \right]^{1/1-\sigma}$ is the ideal price index associated to (1).

Production

Production is carried out by monopolistically-competitive firms which can potentially sell their output to consumers in both countries. Firms produce using a linear technology with labor as the sole input, i. e. $q = \varphi l$, where φ is a firm-specific productivity index. Firms in country i hire workers in a competitive labor market at a wage w_i.

There is an unbounded mass of potential producers of intermediate goods in each country. Firms wishing to produce need to incur in an initial investment f_e to learn their idiosyncratic productivity.[9] Once the entry cost has been paid, firms draw their productivity from a distribution $G_i(\varphi)$, which can differ across countries. After observing their productivity realization, firms that decide to remain in the market choose their mode of operation. There are three potential modes

[9] All fixed costs in both countries are denominated in units of labor.

of operation available to Chinese firms: (i) produce for the domestic market alone, (ii) become a regular exporter selling both in China and abroad, and (iii) become a pure exporter, a firm that exports all its output, thus receiving an ad-valorem subsidy s on its sales. Firms from the rest of the world can only operate domestically or as regular exporters. The profit maximization problem of firms from the rest of the world is equivalent to that of Chinese firms without the option of operating as a pure exporter, therefore, we only describe the problem from the perspective of Chinese firms below.[10]

Let $k \in \{d, x, p\}$ index the three possible modes of production, domestic, regular and pure exporter respectively. Given the demand function in both countries (2) and letting $A_i \equiv E_i P_i^{\sigma-1}$ denote the aggregate market size of country i, profits for a firm of with productivity φ operating under production mode k in China are given by:

$$\pi_c^k(\varphi) = \begin{cases} \left(p_{cc}(\varphi) - \frac{w_c}{\varphi}\right) A_c p_{cc}(\varphi)^{-\sigma} - f_d w_c, & \text{if } \ k = d, \\ \left(p_{cc}(\varphi) - \frac{w_c}{\varphi}\right) A_c p_{cc}(\varphi)^{-\sigma} + \left(p_{cf}(\varphi) - \frac{\tau w_c}{\varphi}\right) A_f p_{cf}(\varphi)^{-\sigma} - (f_d + f_x) w_c, & \text{if } \ k = x, \\ \left((1+s) p_{cp}(\varphi) - \frac{\tau w_c}{\varphi}\right) A_f p_{cp}(\varphi)^{-\sigma} - f_x w_c, & \text{if } \ k = p, \end{cases} \tag{3}$$

where $p_{cc}(\varphi)$ denotes the price charged by Chinese firms in the domestic market, $p_{cf}(\varphi)$ the price charged by regular exporters in the foreign market and $p_{cp}(\varphi)$, the price charged by pure exporters. Both regular and pure exporters face an iceberg transportation cost $\tau \geq 1$ when selling their output abroad.

Profit maximization yields the standard condition that a firm's output price is a constant markup over its marginal cost:

$$p_{cc}(\varphi) = \frac{\sigma}{\sigma - 1} \frac{w_c}{\varphi}; \quad p_{cf}(\varphi) = \tau p_{cc}(\varphi); \quad p_{cp}(\varphi) = \frac{\tau}{1+s} p_{cc}(\varphi). \tag{4}$$

Plugging the optimal prices back into (3) provides the maximum level of profits that a firm using

[10] In the benchmark model we do not allow firms from the rest of the world to open plants in China operating as pure exporters.

operation mode k can attain:

$$\pi_c^k(\varphi) = \begin{cases} \kappa A_c(\varphi/w_c)^{\sigma-1} - f_d w_c, & \text{if } \ k = d, \\ \kappa[A_c + \tau^{1-\sigma} A_f](\varphi/w_c)^{\sigma-1} - (f_d + f_x) w_c, & \text{if } \ k = x, \\ \kappa(1+s)^{\sigma} \tau^{1-\sigma} A_f (\varphi/w_c)^{\sigma-1} - f_x w_c, & \text{if } \ k = p, \end{cases} \tag{5}$$

where $\kappa \equiv (\sigma - 1)^{\sigma-1}\sigma^{-\sigma}$.

Following Melitz (2003), we assume that every period firms exit the market with probability $\delta \in (0, 1)$. Therefore, the expected present discounted value of a Chinese firm of productivity φ operating under production mode k is $v_c^k(\varphi) = \max_k\{\pi_c^k(\varphi)/\delta\}$. Firms choose the mode of production that maximizes their expected present discounted value.

Pure Exporters

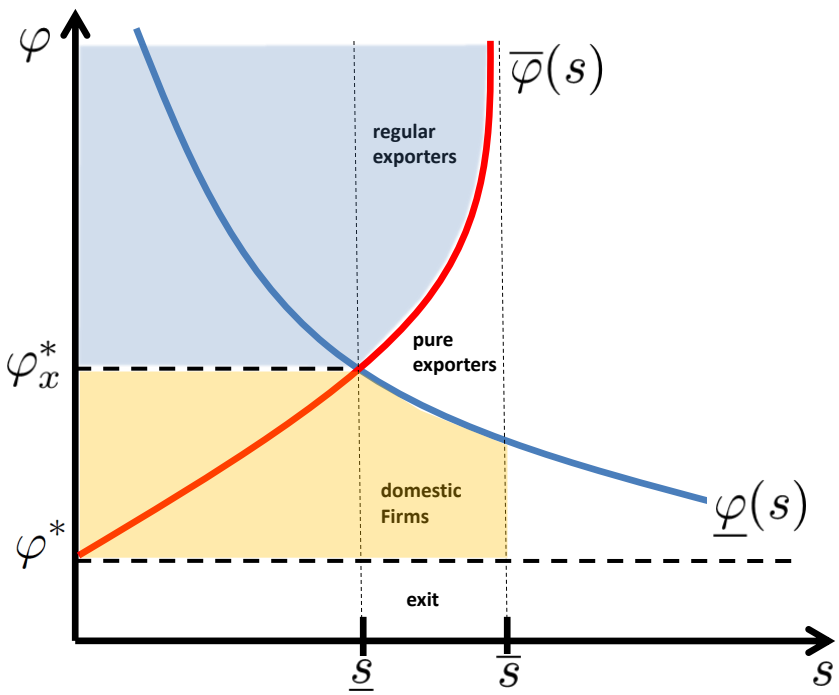
We now turn to the choice of production mode by Chinese firms to determine under which conditions do pure exporters arise. For a given pure-exporter subsidy, s, define $\underline{\varphi}(s)$ as the productivity level such that a firm would be indifferent between selling only in the domestic market and exporting all its output as a pure exporter. That is, $\underline{\varphi}(s)$ is defined implicitly by $\underline{\varphi}(s) = \{\varphi : \pi_c^p(\underline{\varphi}, s) = \pi_c^d(\underline{\varphi})\}$, which results in:

$$\underline{\varphi}(s) = \left(\frac{w_c^{\sigma}(f_x - f_d)}{\kappa(\tau^{1-\sigma} A_f (1+s)^{\sigma} - A_c)} \right)^{\frac{1}{\sigma-1}}. \tag{6}$$

Similarly, $\overline{\varphi}(s)$ is the productivity level at which a firm would be indifferent between being a regular or a pure exporter, i. e. $\overline{\varphi}(s) = \{\varphi : \pi_c^p(\overline{\varphi}, s) = \pi_x^c(\overline{\varphi})\}$. Thus, $\overline{\varphi}(s)$ is given by:

$$\overline{\varphi}(s) = \left(\frac{w_c^{\sigma} f_d}{\kappa(A_c - \tau^{1-\sigma} A_f [(1+s)^{\sigma} - 1])} \right)^{\frac{1}{\sigma-1}}. \tag{7}$$

Figure 2: Choice of Mode of Operation with Pure Exporters



Finally, we define the two standard cutoffs φ^* and φ_x^* that identify domestic firms and regular exporters in the standard Melitz model in the absence of pure exporters:[11]

$$\varphi^* = \left(\frac{w_c^\sigma f_d}{\kappa A_c}\right)^{\frac{1}{\sigma-1}}, \tag{8}$$

$$\varphi_x^* = \tau \left(\frac{w_c^\sigma f_x}{\kappa A_f}\right)^{\frac{1}{\sigma-1}}. \tag{9}$$

To insure that in a situation without the pure-exporter subsidy exporters are more productive than domestic firms in China, we assume that $(f_d/f_x) < [A_c/(\tau^{1-\sigma} A_f)]$. Figure 2 shows the relationship between the different cutoffs. In order for a Chinese firm of productivity φ to prefer to operate under regime p, we need that $\pi_c^p(\varphi) \geq \max\{\pi_c^d(\varphi), \pi_c^x(\varphi), 0\}$, or equivalently, that $\pi_c^p(\varphi) \geq \pi_c^d(\varphi)$, $\pi_c^p(\varphi) \geq \pi_c^x(\varphi)$ and $\pi_c^p(\varphi) \geq 0$ hold altogether. In terms of the cutoffs defined above, this happens when s is such that $\underline{\varphi}(s) \leq \overline{\varphi}(s)$ is satisfied, as can be seen in Figure 2. This condition defines a

[11] These two cutoffs are respectively, the productivity level above which a Chinese firm would find profitable to produce for the domestic market alone $\{\varphi : \quad \pi_c^d(\varphi^*) = 0\}$, and the productivity level necessary for a firm to choose to become a regular exporter $\{\varphi : \quad \pi_c^x(\varphi_x^*) = 0\}$. Since the marginal cost of production is constant, it is sufficient for a firm to achieve non-negative export profits to find it optimal to be a regular exporter.

lower bound of the subsidy necessary for pure exporters to appear, $s^{\min}$:

$$s^{\min} = \left(1 + \frac{A_c}{\tau^{1-\sigma} A_f} - \frac{f_d}{f_x}\right)^{\frac{1}{\sigma}} - 1 > 0. \tag{10}$$

Inspection of the cutoffs (6)-(9) shows that $\overline{\varphi}(\cdot)$ is strictly increasing, with $\overline{\varphi}(0) = \varphi^* < \varphi_x^*$. Thus, given our assumption that the most productive firms select into exporting, being a pure exporter is a dominated alternative for firms if there is no subsidy available for pure exporters. Under these circumstances, pure exporters would be foregoing strictly positive profits in the domestic market while achieving the same profit abroad as regular exporters.

Figure 2 also reveals that $\underline{\varphi}(s^{\min}) = \overline{\varphi}(s^{\min}) = \varphi_x^*$. This means that as s increases enough to make up for the loss of domestic profits of a former regular exporter (a firm with productivity above φ_x^*), then it is necessarily the case that the subsidy will be more than enough to compensate highly productive domestic firms which are on the brink of becoming regular exporters for their foregone profits in the domestic market. Therefore, when $s > s^{\min}$, pure exporters start to arise around the no-subsidy export cutoff, φ_x^*. This is the first testable hypothesis derived from our model: *we should expect firms exporting all their production to be more productive than domestic firms, but also to be less productive than firms that serve both the domestic and foreign market.*

As s increases, the share of active firms operating as pure exporters increases as well at the expense of both domestic firms and regular exporters. In fact, if s is high enough, either domestic firms or regular exporters will disappear. To insure that in equilibrium all three types of firms coexist in China, we require the pure exporter subsidy to be not too high. Proposition 1 summarizes these results.

Proposition 1 *Assuming that* $(f_d/f_x) < [A_c/(\tau^{1-\sigma} A_f)]$*, we observe firms in China using the three modes of production* $k \in \{d, p, x\}$*, if the subsidy provided to pure exporters,* s*, is such that:*

$$s \in \left(s^{\min}, \min\{s_1^{\max}, s_2^{\max}\}\right),$$

with $s^{\min}$, $s_1^{\max}$ and $s_2^{\max}$, defined implicitly by:[12]

$$
\begin{aligned}
(1+s^{\min})^{\sigma} &\equiv 1+\frac{A_c}{\tau^{1-\sigma}A_f}-\frac{f_d}{f_x},\\
(1+s_1^{\max})^{\sigma} &\equiv 1+\frac{A_c}{\tau^{1-\sigma}A_f},\\
(1+s_P^{\max})^{\sigma} &\equiv \left(\frac{f_x}{f_d}\right)\left(\frac{A_c}{\tau^{1-\sigma}A_f}\right).
\end{aligned}
$$

The choice of a Chinese firm's production mode is given by:

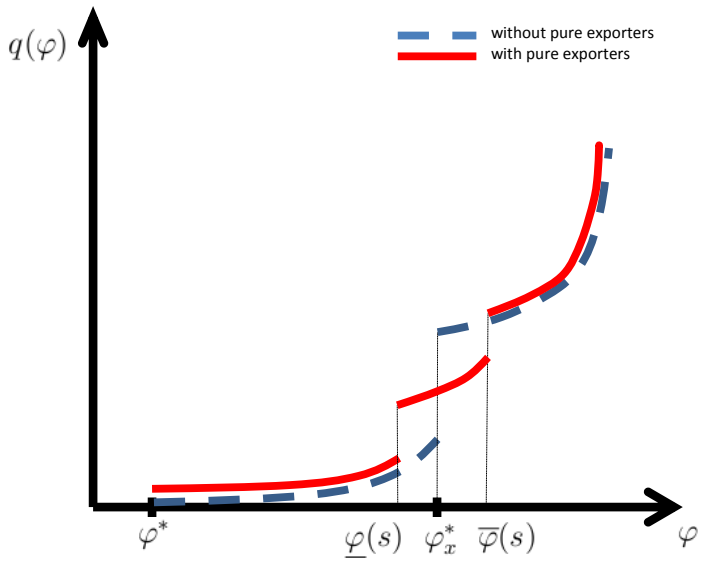
$$
k_c(\varphi)=\begin{cases} d & \text{if } \varphi\in[\varphi^*,\underline{\varphi}(s)),\\ p & \text{if } \varphi\in[\underline{\varphi}(s),\overline{\varphi}(s)],\\ x & \text{if } \varphi>\overline{\varphi}(s).\end{cases}
$$

Differences in the relative market size (A_c/A_f) affect the likelihood of observing pure exporters for a given subsidy rate. If the size of the Chinese market is small relative to that of the rest of the world, it would require a relatively low subsidy to induce firms to become pure exporters because the foreign market is more profitable than the domestic one. The relationship between relative market size and the ratio of exporting to domestic fixed costs of operation (f_x/f_d) determines which group of firms, domestic or regular exporters, is most affected by an increase in s. For instance, if the fixed costs of operation are relatively similar (so that φ^* and φ_x^* are close to each other), it implies that most active firms are regular exporters. As s increases, being a purely domestic firm stops being attractive for any firm regardless of its productivity. Conversely, when regular exporters are in the minority in the equilibrium without subsidies, a continuous rise in s would eventually result in firms stop choosing to operate as regular exporters.

The combination of a revenue subsidy and the restriction that all their output has to be sold abroad, distorts the production decision of pure exporters vis-à-vis the situation where this mode of operation is not available. Figure 3 depicts the optimal output for a firm as a function of its productivity. However, in a situation without pure exporters, a discrete jump in output is observed at φ_x^* when firms start exporting. In a scenario in which pure exporters arise, we observe that pure

[12] When $s\to s_1^{\max}$, $\overline{\varphi}(s)\to+\infty$, which means that no firm would find it profitable to be a regular exporter; when $s=s_2^{\max}$ on the other hand, we have that $\underline{\varphi}(s_2^{\max})=\varphi^*$, implying that since $\underline{\varphi}(\cdot)$ is strictly decreasing, for subsidies greater than $s_2^{\max}$ Chinese firms would not find profitable to produce for the domestic market alone.

Figure 3: Optimal Production



exporters that would have otherwise served the domestic market alone increase their production as the subsidy they receive allows them to charge a lower price and increase their sales; conversely, firms that would have been regular exporters produce less. Although the subsidy also allows them to charge lower prices abroad than they would have done so had they been regular exporters, the increase in export output is more than compensated by the reduction in domestic production. Thus, policies inducing firms to export all (or at least a substantial share) of their output generate resource misallocation both on the intensive margin (i. e. affecting a firm's optimal scale) and on the extensive margin, influencing a firm's mode of operation. Thus, we can establish that:

Proposition 2 *Assuming that* $s \in \left(s^{\min}, \min\{s_1^{\max}, s_2^{\max}\}\right)$*, we always have that*

$$q_c^d(\varphi) \leq q_c^p(\varphi) \leq q_c^x(\varphi).$$

Aggregate Variables

Having described an individual firm's problem, we now present the equilibrium conditions that close the model. Firms in country i will continue to enter the market until their expected present

discounted value equals the entry cost,

$$\int v_i^k(\varphi)\mathrm{d}G_i(\varphi) = f_e w_i, \quad i \in \{c, f\}.$$

Let $\chi_i(\varphi) \in \{0, 1\}$ denote the operation decision rule of a firm with productivity φ located in country i, with $\chi_i(\varphi) = 1$ if the firm has chosen to operate and 0 otherwise. Thus, we can define the expected probability of successful entry in country i as $p_{in,i} = \int \chi(\varphi) dG_i(\varphi)$. The steady-state condition for the mass of firms in country i requires that $p_{in,i} M_{ei} = \delta M_i$, where M_{ei} is the mass of entrants and M_i denotes the mass of operating firms in country i.

With $\mu_i(\varphi)$ representing the ex-post distribution of operating firms across productivity levels in country i, we can write the labor market clearing condition in country i as:

$$M_i \left[\sum\nolimits_k \int l_i^k(\varphi)\mathrm{d}\mu_i(\varphi) \right] + M_{ei} f_e = L_i, \quad i \in \{c, f\},$$

where $l_i^k(\varphi)$ is the optimal labor demand for a firm with productivity φ using production mode k in country i.[13] Price indices in each country are given by:

$$P_c = \left[\int p_{cc}(\varphi)^{1-\sigma} M_c^d \mathrm{d}\mu_c(\varphi) + \int p_{cc}(\varphi)^{1-\sigma} M_c^x \mathrm{d}\mu_c(\varphi) + \int p_{fc}(\varphi)^{1-\sigma} M_f^x \mathrm{d}\mu_f(\varphi) \right]^{\frac{1}{1-\sigma}},$$

and,

$$P_f = \left[\int p_{ff}(\varphi)^{1-\sigma} M_f \mathrm{d}\mu_f(\varphi) + \int p_{cf}(\varphi)^{1-\sigma} M_c^x \mathrm{d}\mu_c(\varphi) + \int p_{cp}(\varphi)^{1-\sigma} M_c^p \mathrm{d}\mu_c(\varphi) \right]^{\frac{1}{1-\sigma}},$$

where M_i^k is the mass of firms using mode of operation k in country i.[14] We assume that the Chinese government levies lump-sum taxes from households in order to finance the pure-exporter subsidy, and it runs a balanced budget:

$$T_c = \frac{s}{1+s} \left[\int r_c^p(\varphi) M_c^p \mathrm{d}\mu_c(\varphi) \right],$$

where $r_c^p(\varphi)$ denotes the after-subsidy revenue earned by a pure exporter with productivity φ and

[13] Note that $l_i^k(\varphi)$ is inclusive of the amount of labor used for the fixed costs of operation.

[14] Formally, $M_i^k \equiv M_i \int \mathbb{I}_k(\varphi)\mathrm{d}\mu_i(\varphi)$, where $\mathbb{I}_k(\varphi)$ is an indicator function that takes the value of 1 if a firm with productivity φ uses mode of operation k.

T_c is the aggregate tax collection in China.[15] Since free entry implies that aggregate income spent on entry costs, $M_{ei} f_e w_i$, is exactly compensated by aggregate profits, Π_i, aggregate expenditure in country i is given by $E_i = w_i L_i + T_i$. Finally, the trade balance condition reads:

$$\int r_c^x(\varphi) M_c^x \mathrm{d}\mu_c(\varphi) + \int r_c^p(\varphi) M_c^p \mathrm{d}\mu_c(\varphi) = \int r_f^x(\varphi) M_f^x \mathrm{d}\mu_f(\varphi).$$

Taking the wage in the rest of the world, w_f, as the numéraire, equilibrium in the model is defined by a vector of endogenous variables $\Big(M_h, M_f, P_h, P_f, E_h, E_f, w_h\Big)$, such that labor market clearing, free entry and aggregate expenditure are satisfied in both countries, and the balanced trade condition holds.

4 Data

We make use of the annual survey of Chinese manufacturing firms compiled by the National Bureau of Statistics (NBS) for the years 2000 to 2006. The dataset consists of private and state-owned enterprises with sales above five million Chinese Yuan. The dataset contains detailed balance sheet information as well as firms' ownership status and total export sales. The survey covers approximately 95% of China's industrial output and 98% of its manufacturing exports.[16] After cleaning up the data, the final sample consists of 1,072,986 firm-year observations with 380,821 different firms.

For the purposes of our empirical analysis, we define a **pure exporter** as a firm exporting more than 90% of its production in a given year; a firm reporting a positive value of export sales with an export intensity below 90% is classified a **regular exporter**, and a domestic firm is a firm that does not export at all. As can be seen in Table 2, pure exporters account for 8.6% of manufacturing firms in our sample and for about one-third of all exporting firms; Figure 4 also shows that pure exporters are fairly common in most 2-digit industries.

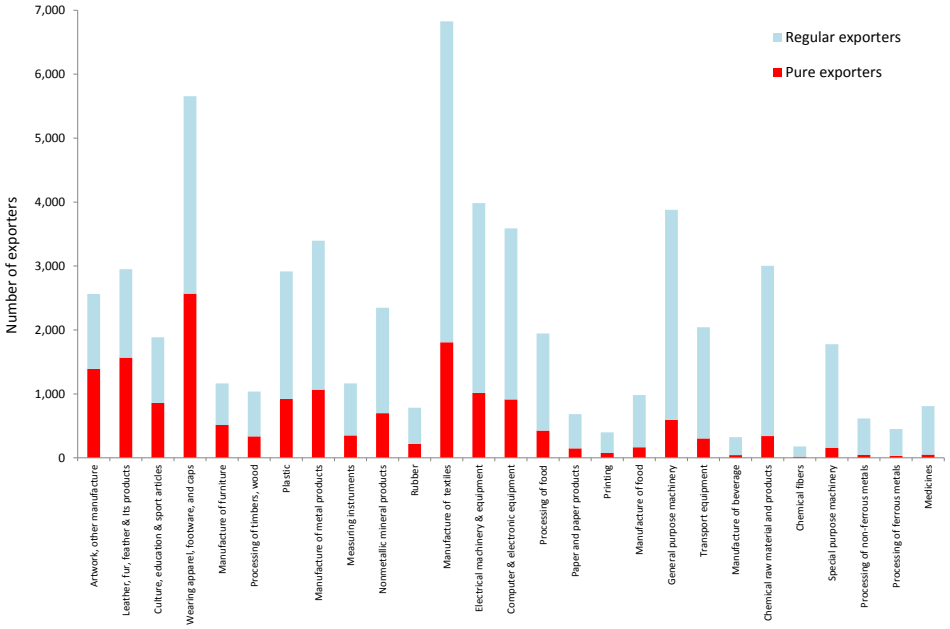
[15] Since we assume that the rest of the world is not conducting any fiscal policy, we have that $T_f = 0$.

[16] To clean the data and rule out outliers we follow Brandt et al. (2012) and drop firms reporting less than 8 employees, or reporting missing or incoherent values for our key variables. We drop observations that report missing, null or negative values for total output, employment, intermediate inputs, fixed capital, value-added or if the ratios export/sales or value-added tax/value-added, output tax/output, income tax/value-added exceeds one. We also exclude firms with the operating status recorded as 'inactive', 'bankrupt' or 'closed'. Also based on their work, we use industry concordances to obtain a coherent and comparable classification over time.

Table 2: Summary Statistics

	Manufacturing Survey, 2000-2006			Matched Data, 2000-2006		
	# firms	% firms	% exporters	# firms	% firms	% exporters
Pure exporters	90,235	8.59	32.32	46,400	5.07	32.02
Regular exporters	188,918	17.99	67.68	98,517	10.76	67.98
Domestic firms	771,021	73.42		771,021	84.18	
Total	1,050,174	100	100	915,938	100	100

Figure 4: Regular and Pure Exporters by 2-digit Industries



Industries are sorted according to the share of pure exporter firms in decreasing order, ranging from 54.4% in artwork and other manufactures to 6.4% in the production of medicines.

As discussed in Section 2, policies favoring pure exporters are primarily aimed at three groups of firms: Foreign-invested Enterprises (FIEs), Processing Trade Enterprises (PTEs) and firms located in Free-Trade Zones (FTZs). Although the NBS data allows us to identify firms' ownership structure, it does not allow us to distinguish PTEs from FIEs because the survey does not provide information on the value of exports sold using the processing regime. To obtain information about a firm's reliance on processing exports, we combine the 2000-2006 NBS dataset with a transaction-level customs data for the period 2000-2006 from the Chinese General Administration of Customs. For each year, we follow Wang and Yu (2011) and match the two datasets using firms' names as

a common variable, which results in approximately 40% of manufacturing exporters in the NBS sample matched with the customs records. While both data use different firm identifiers, firm's name is a reliable match variable. By law, two firms cannot have the same name in the same administrative region. Although matching both datasets is a difficult task, it is reassuring that the share of pure exporters in the matched sample is almost identical to the one we find in the NBS data.[17]

For each year and matched firm we calculate the average share of exports sold under the processing trade regime. We observe a clear bimodal distribution of firms' export processing share: 72.1% of firms use the processing regime for less than 10% of their exports, while 15.5% sell more than 90% of their exports under this regime. Hence, we define Processing Trade Enterprises (PTEs) as firms selling more than 90% of their exports through the processing trade regime. In our definition, PTEs encompass both firms that export all their output as well as firms selling domestically and using the processing regime to serve foreign markets. We then identify FIEs as firms with a positive amount of foreign capital but that do not satisfy our criteria to be considered a PTE described above.

Finally, the Chinese census does not explicitly indicate whether a firm is located in a Free Trade Zones (FTZs), but provide information about the administrative area of location of each firm. FTZs are identified as the prefecture-cities established since 1978 as Special Economic Zones, Coastal Development zones as well as Yangtze and Pearl River Delta Economic Zones.[18] Tracking firms located in a Export Processing Zone is easier since the custom data provides a special coding identifying them. In 2006, only 166 PTEs can be identified as being located in any of these processing zones, and among them, 85% would be located in a city classified as a FTZ in our definition. Given the small number of firms located in these industrial parks and simultaneously outside a FTZ, we abstract from these specific locations. Appendix B provides the exact list of prefecture-cities included in our definition of FTZs.

As pointed out by Naughton (2007), special economic zones have been an essential component of China's economic opening, and the establishment of new types of zones has been a staple of every

[17] Details of the matching procedure are described in detail in the appendix of Wang and Yu (2011).

[18] The Shanghai Economic area established in 1982 does not cover entirely the Shanghai prefecture, and notably does not include the city center of Shanghai. We make use of the firm postcode to exclude firms located in the city center from our definition of FTZ, i.e. postcode starting with "2000".

major wave of liberalization. Figure 6 presents the location of these FTZs at the prefecture and prefecture-city level. Figure 6 clearly shows that the vast majority of FTZs were located along the coast. Map 7 depicts the share of pure exporters among the total number of exporters and suggests that pure exporters are highly concentrated in locations where FTZs have been established.

Descriptive statistics

Table 4 presents the shares of all exporters and pure exporters across the different firm categories discussed above. Together, PTEs and FIEs account for two-third of the exporters; conversely, firms located outside a FTZ and which are neither FIEs nor PTEs, constitute only 12% of all exporting firms. It is also clear from Table 4 that a substantial number of PTEs and FIEs are pure exporters (53.7 and 33.4% of exporters in each group respectively). Finally, we observe that pure exporters, regardless of their ownership status or the customs regime used to sell their output, are more likely to be located within a FTZ.[19] Figure 5 shows the distribution of export intensity across the four groups of firms described in Table 4. Pure exporters are more prevalent among PTEs, while FIEs and firms located in a FTZ display a more bimodal distribution. The distribution of export intensity for the residual group of firms shows a majority of firms selling a small share of their output abroad, the more common pattern found in other countries.

For each firm category, Table 4 provides the number of exporting firms, the percentage of pure exporters and the ownership structure of firms. The NBS survey allow us to distinguish between foreign investment originating from Hong Kong, Macau or Taiwan or from other source, and whether the firm is a joint venture with Chinese domestic investors or not. First, almost half of foreign-invested exporting firms are owned by foreign investors from Hong-Kong, Macao and Taiwan. Second, half of the PTEs and two-third of the FIEs are realized through join-ventures with a Chinese partner. Looking at the percentage of pure exporters, the share is higher in the case of PTEs than of FIEs and is lower in the case of Joint-Ventures (JV), which appears to be more domestically oriented. The number of Chinese-owned enterprises seems rather limited with only 698 firms.

[19] Wang and Wei (2010) have also drawn attention to the importance of the processing regime and special economic zones in China's aggregate exports. However, they do not discuss the high prevalence of pure exporters among these firms.

Figure 5: Export Intensity Distribution by Firm Type and Location

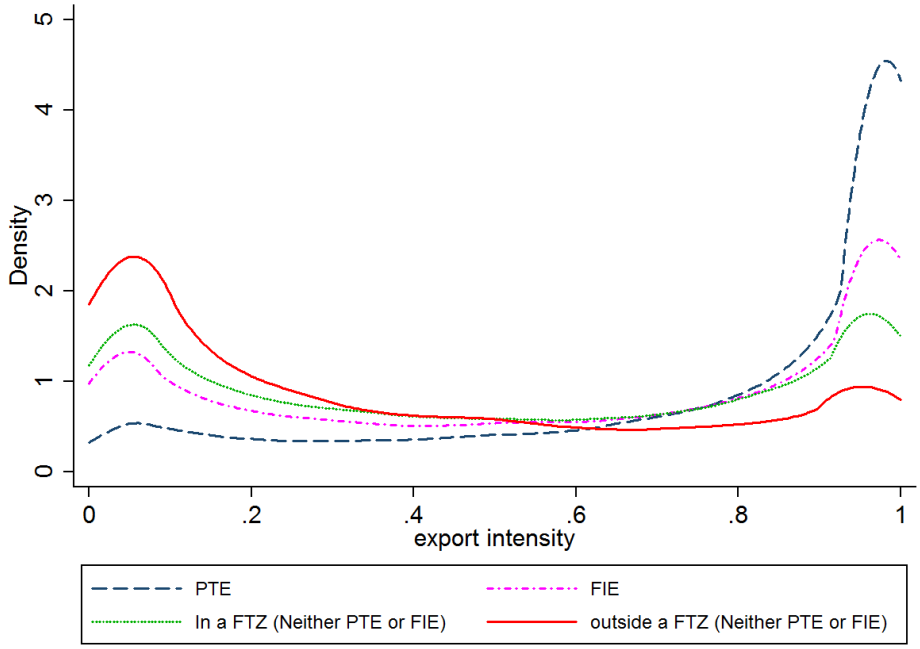


Table 3: Pure Exporters Across Different Firm Categories

	PTE		FIE		Neither FIE nor PTE	
Location	% exp	% pure exp	% exp	% pure exp	% exp	% pure exp
In a FTZ	18.17	53.75	36.09	33.43	26.60	20.38
Outside a FTZ	1.17	39.53	6.09	27.41	11.89	16.49
Total	19.34		42.18		38.48	

Table 4: PTEs, FIEs and Ownership

	PTE		FIE		Neither FIE or PTE	
Investor	% exp	% pure exp	% exp	% pure exp	% exp	% pure exp
Hong-Kong, Macao, Taiwan	6.25	61.76	8.68	36.90		
Other Foreign Origins	5.51	54.76	9.82	36.80		
Hong-Kong, Macao, Taiwan JV	3.23	52.48	10.02	28.26		
Other Foreign Origins JV	3.08	45.28	13.67	29.93		
Privately-Owned Enterprises	0.99	24.09			33.52	21.23
State-Owned Enterprises	0.28	8.89			4.96	5.35
Total	19.34		42.18		38.48	

Figure 6: Free Trade Zones established between 1979 and 2000.

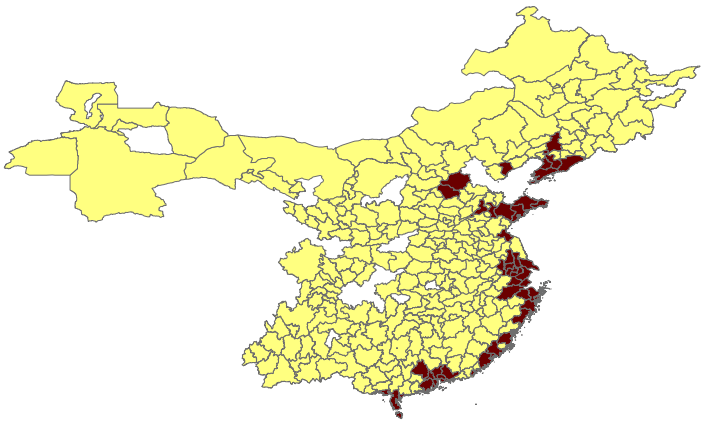
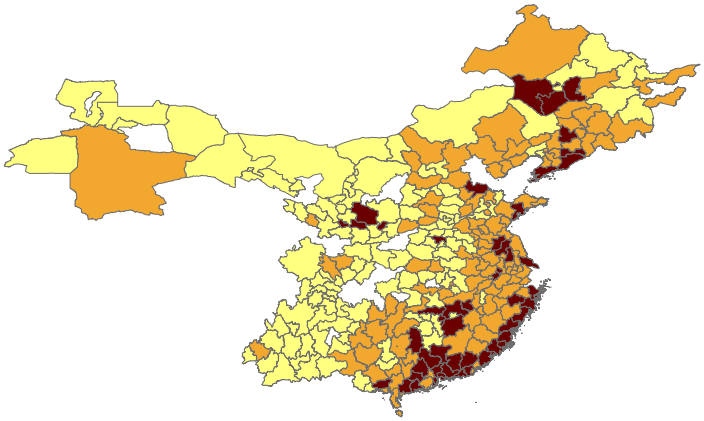


Figure 7: Quartiles of the share of pure exporters .



A detailed description of the Free Trade Zones is included in Appendix B.

The WTO agreement requires China to apply and administer its law uniformly across its entire customs territory, including Special Economic Zones or any other economic zone with special

regimes. In addition, providing benefits contingent upon export performance falls into category of "forbidden subsidies" spelled out in Article 3 of the WTO Agreement on Subsidies and Countervailing Measures (ASCM).

Table 5 reports the average export intensity of Chinese firms in 2000 and 2006. Despite China joining the WTO at the end of 2001, little change can be observed in firms' export intensity of over time. The share of pure exporters has decreased slightly between 2000 and 2006, going from 32.6% to 31.2%. In addition, the proportion of pure exporters among of group of firms that have entered or exited between these two points of time is similar to the one associate with the group of firms that stayed active in the market.

Table 5 reports the share of pure-exporters in 2000 and in 2006. Despite the entry of China into the WTO at the end of 2001, little change can be observed in the number of firms exporting all their output over time. The share of pure exporters has decreased slightly between 2000 and 2006, from 32.6% to 31.2%. In addition, the proportion of pure exporters among of group of firms that have entered or exited between these two points of time is similar to the one associate with the group of firms that stayed active in the market.

Columns (2) and (3) of Table 5 report the export sales distribution for the FIEs and PTEs. Overall, the changes in term of export-sales ratio of FIEs and PTEs before and after the entry of China into the WTO has only been marginal. As explained in Section 2, the majority of policies favoring pure exporters are still effective. For instance, despite the restrictions on local sales of FIEs have been lifted in 2001, new constraints on local sales been reintroduced in 2002.

Finally, Column (4) of Table 5 presents the evolution of the export sales distribution in the case of the Textile and Clothing sector. Since 1974, exports of Chinese textile and clothing manufacturers to the EU countries, the US and Canada were restricted by binding import quotas under the MultiFiber Arrangement/Agreement on Textiles and Clothing (MFA/ATC) regime. The abrupt end of the quota restriction on Chinese textiles has lead to a massive increase in the number of exporters during the year 2005. In addition, it also end the quota licence attribution by the Chinese government.

Table 5: Share of Pure Exporters, 2000 vs. 2006

	% Pure exporters				
	Manufacturing Survey		Matched Data		
Year	All exporters	Textile sector	FIEs	PTEs	FTZs
2000	30.36	42.67	32.23	52.28	40.23
2006	40.59	53.95	38.57	57.55	39.09
Stay	38.95	53.21	35.90	58.66	41.49
New in 2006	40.77	54.02	38.92	57.33	38.75
Exited in 2006	29.03	41.71	31.80	51.47	39.39

Firm-level evidence

Productivity

To evaluate Proposition 1 established in section 2, we compute total factor productivity (TFP) for each firm over the period 2000 to 2006 and for each of the 27 (2-digit) sectors. As it requires real values for intermediate inputs, output and capital stock, we use deflators computed by Brandt et al. (2012).[20] TFP is estimated as the residual of a two-factor Cobb-Douglas production function: $Q_{it} = \lambda_0 + \lambda_K K_{it} + \lambda_L L_{it} + \varphi_{it} + \epsilon_{it}$, where Q_{it}, L_{it} and K_{it} denote firm i's value-added, labor and capital stock respectively (all in logs), and ϵ_{it} stands for measurement error in output. Real value added is obtained from subtracting the deflated value of intermediate inputs used in the production to the firm's deflated output. As explained by Feenstra et al. (2012), it is preferable to estimate a valued-added based production function when dealing with Chinese firms. In fact, processing trade account for a large faction of the imported intermediate inputs. Not only imported and domestic intermediate inputs may have different prices, but also the prices reported for imported intermediate inputs under ordinary or processing regimes may be quite different. We calculate TFP using both OLS and the semiparametric methodology proposed by Levinsohn and Petrin (2003) (LP).

In Table 6, we regress firm-level characteristics on a set of dummy variables. After inclusion of year, sector and prefecture-cities-specific effects, an indicator for pure exporters and regular

[20] Nominal values of output and capital are deflated using two-digit sectoral price indexes. The deflators are obtained from the system of national accounts of the Chinese Bureau of Statistics. The 2-digit intermediate input deflators have been computed using both output deflators and the 2002 Chinese input-output.

Table 6: Productivity Premium of Pure Exporters Relative to Domestic Firms and Regular Exporters

		Comparison group: Domestic Firms					
		Manufacturing survey			Matched data		
		(1)	(2)	(3)	(4)	(5)	(6)
		log sales	TFP LP	TFP OLS	log sales	TFP LP	TFP OLS
Pure exporter		0.467^a	0.308^a	0.012^a			
		(0.007)	(0.006)	(0.005)			
	FIE				0.569^a	0.396^a	0.097^a
					(0.012)	(0.010)	(0.009)
	PTE				0.972^a	0.603^a	-0.016
					(0.019)	(0.015)	(0.012)
	Sino				0.697^a	0.446^a	0.075^a
					(0.016)	(0.013)	(0.011)
Regular exporter		0.887^a	0.608^a	0.157^a			
		(0.006)	(0.005)	(0.004)			
	FIE				0.914^a	0.671^a	0.262^a
					(0.012)	(0.010)	(0.008)
	PTE				1.315^a	0.895^a	0.269^a
					(0.020)	(0.016)	(0.012)
	Sino				1.182^a	0.781^a	0.165^a
					(0.012)	(0.010)	(0.007)
Year fixed effects		✓	✓	✓	✓	✓	✓
Sector fixed effects		✓	✓	✓	✓	✓	✓
Prefecture-city fixed effects		✓	✓	✓	✓	✓	✓
# Obs		1,100,600	1,100,600	1,100,600	945,711	945,711	945,711
# firms		386,185	386,185	386,185	348,860	348,860	348,860
R^2		0.165	0.223	0.281	0.178	0.227	0.287

exporters provides a measure of the premium in the variable of interest of these firms relative to domestic firms. Column (1) shows that total sales of pure exporters are significantly higher than those of domestic producers but smaller than that of regular exporters (Both differences are significant at 1%). Columns (2) and (3) of Table 6 report estimates of the firm-level productivity premium of pure exporters and regular exporters. Exporters are more productive than non-exporters, which is line with the literature, e.g. **?**. Nevertheless, the productivity premium of Chinese exporters compared to that of domestic firms has been found to be rather small. Our paper provides an explanation of why it is the case. A large share of the exporters are actually pure exporters, only selling abroad, with intermediate level of productivity. In addition, the results provide support for

our theoretical prediction that pure exporters show an intermediate level of productivity, greater than that of domestic firms but lower than that of regular exporters. Here again, both differences are significantly different from zero at the 1% level. For both pure and regular exporters, columns (4), (5) and (6) show a positive and significant size and productivity premium of FIEs, PTEs and other type of firms relative to domestic firms. Additionally, it can be seen that for each type of firm, regular exporters are systematically larger and more productive than pure exporters.

Firm-level taxes

After controlling for sector, year and province-specific effects, Table **??** presents the difference in the amount of taxes paid by different types of firms. While total taxes and sales tax are computed as a share of a firm's sales (Columns (1) and (2)), income tax and the Value-Added Taxes (VAT) are calculated as a share of a firm's value added. "Total taxes over sales" represents the overall tax paid e.g. sales tax, income tax and value-added tax, per Chinese Yuan of output sold. Domestic firms and regular exporters pay significantly more taxes than pure exporters. Columns (2), (3) and (4) present the tax premium paid by domestic firms and regular exporters compared to pure exporters for each of these three tax categories respectively.

5 Economic Implications of Pure-Exporter Subsidies

In this section we conduct a comparative statics exercise with respect to s, the pure-exporter subsidy, while we keep track of key variables generated by our two-country model. In order to gain a better understanding of the distinct features of the pure-exporter subsidy in general equilibrium, we contrast our results with those of a model in which the Chinese government uses a traditional ad-valorem export subsidy, s_x, that applies to all firms selling abroad regardless of how much they choose to sell in China, a similar problem as that studied by Felbermayr et al. (forthcoming) and Demidova and Rodríguez-Clare (2009). Note that the rest of the world does not engage in any kind of trade policy.

We solve the model presented in Section 3 numerically, and use as our benchmark a scenario in which both countries are identical in terms of their size and the vector of parameters faced by firms and consumers. This means that if we set $s < s^{\min}$, so that there are no pure exporters in China, all

Table 7: Tax Premium paid by domestic firms relative to pure and regular exporters

		Comparison group: Domestic Firms					
		Manufacturing survey			Matched data		
		(1)	(2)	(3)	(4)	(5)	(6)
		income tax	VAT	Sales tax	income tax	VAT	Sales tax
		as share of value-added			as share of value-added		
Pure exporter		-0.700[a]	-3.347[a]	-1.082[a]			
		(0.019)	(0.042)	(0.023)			
	FIE				-1.123[a]	-5.934[a]	-2.095[a]
					(0.037)	(0.080)	(0.033)
	PTE				-1.114[a]	-8.656[a]	-2.023[a]
					(0.034)	(0.072)	(0.032)
	Sino				-0.208[a]	-3.251[a]	-0.859[a]
					(0.053)	(0.102)	(0.050)
Regular exporter		-0.230[a]	-1.462[a]	-0.911[a]			
		(0.017)	(0.030)	(0.019)			
	FIE				-0.804[a]	-3.193[a]	-2.046[a]
					(0.033)	(0.063)	(0.030)
	PTE				-0.798[a]	-4.331[a]	-1.787[a]
					(0.044)	(0.091)	(0.040)
	Sino				0.324[a]	-1.990[a]	-0.677[a]
					(0.037)	(0.056)	(0.031)
Year fixed effects		✓	✓	✓	✓	✓	✓
Sector fixed effects		✓	✓	✓	✓	✓	✓
Prefecture-city fixed effects		✓	✓	✓	✓	✓	✓
# Obs		1,100,600	1,100,600	1,100,600	945,711	945,711	945,711
# firms		386,185	386,185	386,185	348,860	348,860	348,860
R^2		0.120	0.057	0.102	0.118	0.057	0.120

endogenous variables would be the same in China and the rest of the world. We set the elasticity of substitution between varieties, $\sigma = 3$, the same value used by Hsieh and Ossa (2011), which is very close to the median of the estimates presented by Broda and Weinstein (2006) for 3 and 5-digit industries in the U.S. Because the product of the sunk entry cost, f_e, and the probability of exiting, δ, simply re-scales the mass of operating firms, we follow Bernard et al. (2007) and set these parameters to 2 and 0.025 respectively. The fixed cost of operation in the domestic market is normalized to 0.4. Country sizes, as noted above, are identical and normalized to 1. We assume that firms in both countries draw their productivity from the same Pareto distribution with lower bound 1 and shape parameter $a = 2.76$.

This leaves us with three parameters left to be calibrated, the fixed cost of exporting, the iceberg transportation cost faced by exporters and the pure-exporter subsidy, (f_x, τ, s). We choose these three parameters to match simultaneously three target moments calculated from the 2000-2006 NBS dataset: (i) a mean share of regular exporters of 17.99%, (ii) an average export intensity for regular exporters of 39.2% and (iii) an average share of pure exporters among all exporting firms of 32.32%. Table 8 presents the parameters used to solve the model and the fit of the benchmark model is reported in Table 9.

Table 8: Simulation Parameters

Parameter	Description	Value
L_i	Country i's size, $i \in \{c, f\}$	1.00
σ	Elasticity of substitution	3.00
δ	Probability of exit shock	0.025
f_e	Entry cost	2.00
f_d	Fixed cost of operation in the domestic market	0.40
$\underline{\varphi}$	Lower bound of Pareto distribution support	1.00
a	Pareto distribution shape parameter	2.76
$\mathbf{f_x}$	**Fixed cost of exporting**	**0.757**
τ	**Iceberg transportation cost**	**1.208**
$\mathbf{s}$	**Pure-exporter subsidy**	**0.281**

Parameters in bold are chosen to match calibration targets defined in Table 9.

Table 9: Target Moments

Statistic	Data	Model
Share of regular exporting firms in China	0.179	0.183
Export intensity of regular exporters in China	0.392	0.390
Share of pure exporters among all exporters in China	0.323	0.320

All moments used are means for the period 2000-2006 and are calculated using the NBS dataset.

Our model parametrization implies an exports/GDP ratio in China of 33.2%, very similar to the 27.4% average for the period 2000-2006 observed in the data and an aggregate expenditure in export subsidies that accounts for 1.53% of GDP. The relative size of fixed costs implied by our calibration yield an average productivity premium of regular exporters vis-à-vis domestic firms of

172%, substantially larger than the 83.7% premium reported in the second column of Table 6.[21] However, the 36.1% productivity premium of pure-exporters relative to domestic firms implied by our model is much closer to our estimate using the NBS data of 31%.[22]

In order to compare the effect of the pure-exporter subsidy s with the regular ad-valorem subsidy to export sales, s_x, we keep track of endogenous variables in China and the rest of the world for a given level of expenditure in export subsidies.[23] Since the pure-exporter subsidy is only operational when the subsidy rate s is above a threshold $s^{\min}$, the same level of expenditure in export subsidies results from very different rates when compared to a traditional ad-valorem export subsidy. Thus, the total subsidy expenditure in our benchmark calibration follows from the Chinese government offering a subsidy rate of 28.1% to pure-exporters compared to a 4.65% subsidy rate offered to all exporting firms.

An increase in the pure-exporter subsidy above $s^{\min}$ defined in equation (10), widens the gap between $\underline{\varphi}(s)$ and $\overline{\varphi}(s)$, as can be observed in the second panel of Figure 8, inducing more firms with productivity levels around the export cutoff to become pure exporters. Although the share of regular exporters in China declines, this is more than compensated by the increase in pure exporters, thus resulting in a larger share of Chinese firms selling their output abroad. Both types of subsidy increase China's aggregate exports, but in our chosen parametrization, for the same outlay in export subsidies, the pure-exporter subsidy results in 1.13% larger aggregate exports.

Holding the aggregate market size A_i in both countries constant, an increase in the pure-exporter subsidy increases the expected profits of potential entrants in China. This means that in order to maintain the free-entry condition, either the expected profits of domestic firms or those of regular exporters, or both, need to fall.

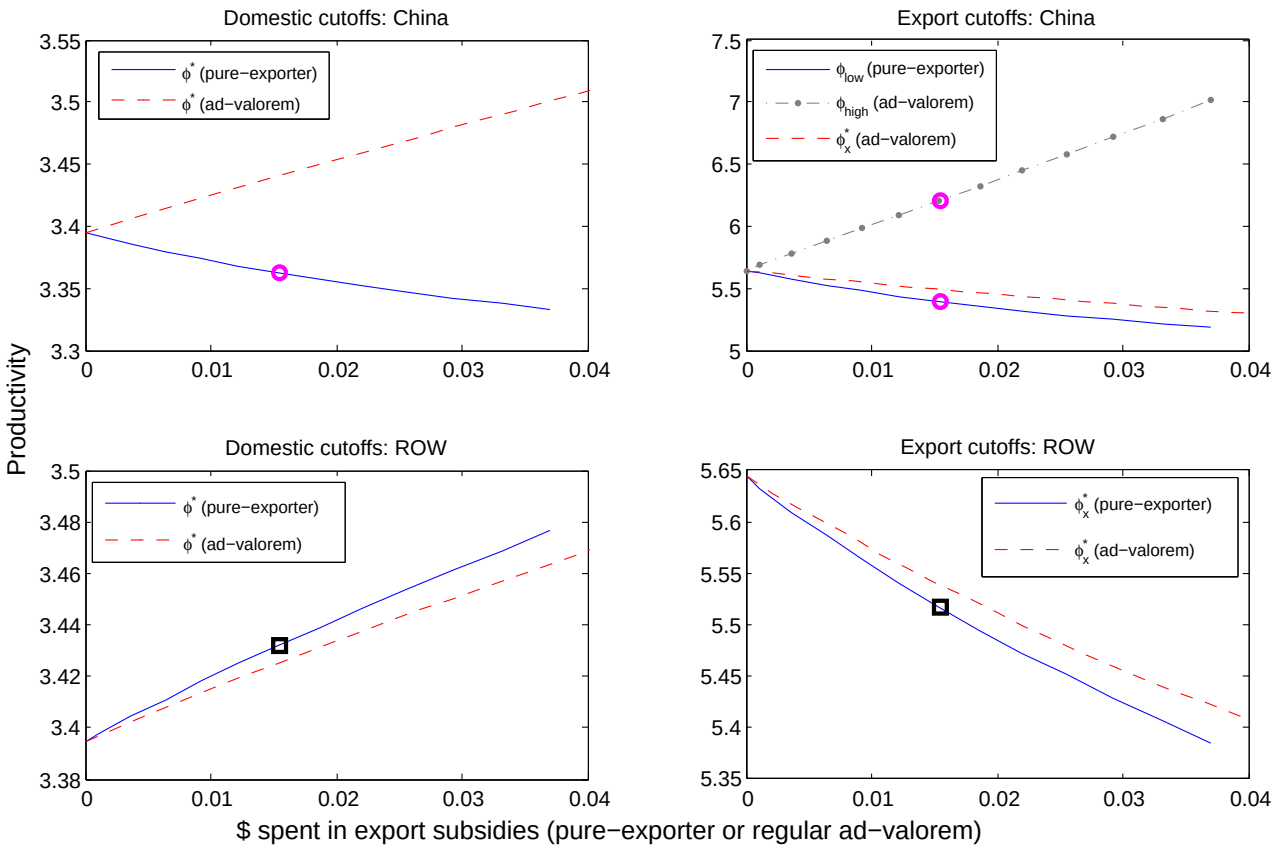
Since operating in the pure-exporter regime requires firms to sell their output in the foreign market alone, we have that a larger mass of varieties M_c^p is no longer available to Chinese consumers. Because preferences exhibit love-of-variety, this reduction in product variety translates into a higher price index in China. The higher price index lessens competition in China, increases the profitability of selling there and results in entry of low-productivity domestic firms. This effect is also evident

[21] $\exp(0.608) - 1$.

[22] $\exp(0.308) - 1$.

[23] Across all comparative statics figures, a circle (square) denotes the equilibrium value for the variable of interest in China (rest of the world) using the parameters presented in Table 8 to solve the model.

Figure 8: Comparative Statics: Productivity Cutoffs



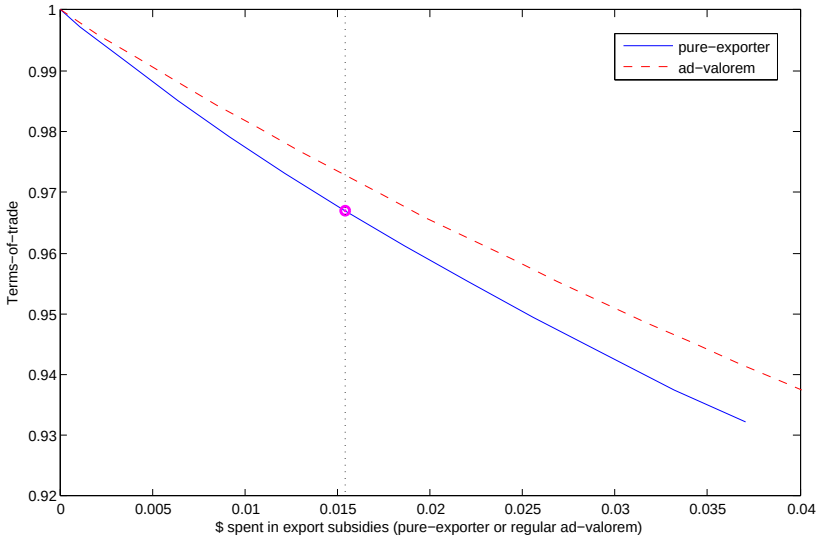
in the reduction in the productivity cutoff for domestic production φ^* shown in the first panel of Figure 8. The reduction in the domestic cutoff is directly linked to an increase in the mass of operating firms through the labor market clearing condition. Notice that although the total mass of firms producing in China, M_c, increases with the pure-exporter subsidy, the mass of varieties available for consumption in China, $M_c\Big[1-\mu_c(\overline{\varphi}(s))+\mu_c(\underline{\varphi}(s))\Big]$, falls. The increase in China's price index improves the domestic profits of regular exporters based in China but hurts their export profits, as they become less competitive relative to firms abroad, as can be seen in Figure 9, which shows the effect that both types of export subsidy have on the terms-of-trade (ToT).[24]

The lower degree of competition in China and the corresponding increase in the mass of firms operating there following an increase in the pure-exporter subsidy contrast with the outcome of using a regular ad-valorem export subsidy. In this case, a higher export subsidy in China results in

[24]The price index associated with China's exports relative to that of its imports.

the reallocation of market shares from low to high-productivity firms due to a higher real wage, with a corresponding reduction in the mass of operating firms. Demidova and Rodríguez-Clare (2009) studying a small economy environment with heterogeneous firms note that an export subsidy has an ambiguous effect on the ToT. On the one hand, continuing exporters increase their foreign sales lowering export prices, while on the other, new exporters which are less productive and therefore charge higher prices, produce the opposite effect. Both channels are also in operation when the pure-exporter subsidy is used. However, it is important to remember that for firms to choose to be pure-exporters, we need $s \geq s^{\min}$. This means that given the expenditure in export subsidies in our benchmark equilibrium, the pure-exporter subsidy rate, s, has to be substantially larger than the regular export subsidy rate (28.10% vs 4.65%, respectively). Therefore the pure-exporter subsidy generates a larger distortion among the targeted firms than the regular export subsidy. The large subsidy required for firms to choose to become pure-exporters tilts the balance in favor of lower export prices and consequently, lower ToT.

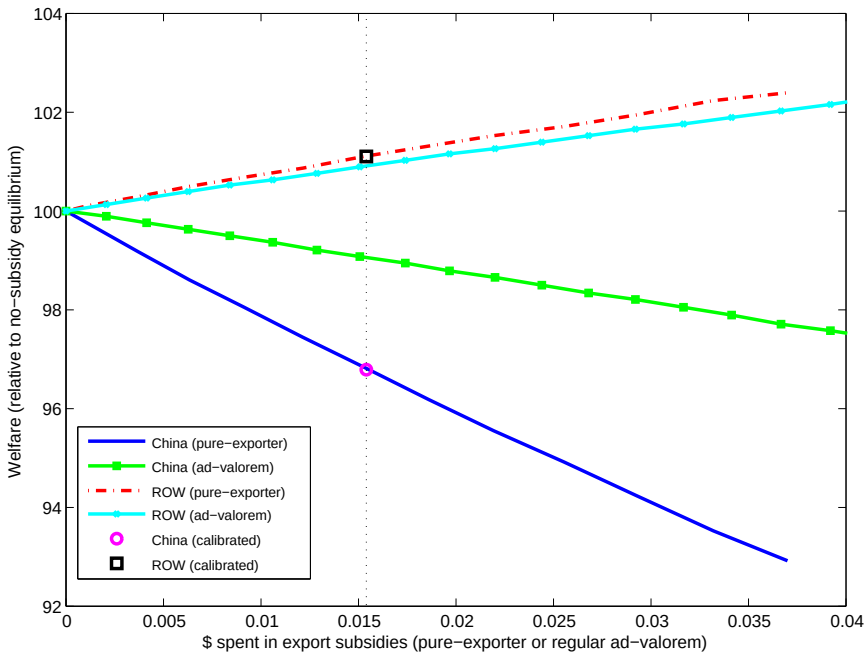
Figure 9: Comparative Statics: Terms-of-Trade



From the perspective of China's trading partners, both types of subsidies yield similar consequences. As Figure 8 shows, the response of the domestic and export cutoffs abroad follow the same pattern regardless of the policy instrument used. However, it can also be seen that the two cutoffs are more responsive when the pure-exporter subsidy is used. Stronger import competition

from Chinese producers reduces the price index P_f abroad, inducing exit of the least productive domestic firms there. On the other hand, a higher price index in China boosts export profits, lowering the threshold for firms to start exporting, thus maintaining balance trade.

Figure 10: Comparative Statics: Welfare



Using our calibrated model, we can quantify the welfare gains that would accrue to China if it were to eliminate its policies favoring pure-exporters. Figure 10 shows that China's welfare would increase by 3.23%, whereas the rest of the world would see welfare reduction of 1.09%. The elimination of pure-exporter subsidies would have a negative impact on the total mass of operating firms in China, which would fall by 2.69%. This reduction in the mass of firms, is in turn accompanied by the exit of the 0.01% lowest productivity firms producing in China when pure-exporter subsidies are available.

6 Conclusion

In this paper we have provided evidence on a wide range of economic policies used in China that are contingent on firms' exporting a substantial share of their output. We study the welfare implications of this type of policy by augmenting an otherwise standard model of trade with heterogeneous firms

with the option of firms operating as pure-exporters, selling all their output abroad in return for an ad-valorem subsidy. We have shown that when pure-exporter firms arise, they do so around the no-subsidy productivity cutoff, which means that they tend to have an intermediate level of productivity, greater than that of domestic firms but lower than that of firms that sell at home and abroad. We provide empirical evidence supporting this testable hypothesis using a rich dataset of Chinese manufacturing firms for the period 2000-2006.

Turning to the general equilibrium implications of this type of subsidies, we find that for a given level of expenditure in export subsidies, the use of a pure-exporter subsidy reduces welfare and China and its even worse from the point of view of welfare than a regular ad-valorem export subsidy. However, the fact that the pure-exporter subsidy forces a set of firms to only sell abroad, reduces the degree of competition in the domestic market, thus providing heightened protection for low-productivity domestic firms, a feature that might explain the popularity of similar policies such as the establishment of export-processing zones in many developing countries. Finally, we calibrate our model to match the share of Chinese manufacturing firms in each mode of production in our model as well as the average export intensity of regular exporters. Given this parametrization, we answer the following counterfactual question: what would be the welfare impact in China and the rest of the World if the Chinese government eliminated all pure-exporter subsidies? Our model suggests that China would experience a welfare increase of 3.23% while the rest of the World would see their welfare fall by 1.09% if pure-exporter subsidies were eliminated.

We conclude this paper by addressing two important issues that we have abstracted from. Our model does not feature any market failures such as unemployment or the existence of non-rival productivity spillovers that could result from foreign-owned enterprises setting up pure-exporter facilities to serve third markets. Both labor market failures and the possibility of stimulating technological transfers, knowledge spillovers and demonstration effects are perhaps the two most common objectives that governments ascribe to policies favoring pure-exporters. It would be interesting to explore whether pure-exporter subsidies might arise as second-best policies in the presence of these distortions.

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A Laws and Regulations Favoring Pure Exporters

A.1 Foreign-Invested Enterprises

A.1.1 Basic Regulations

Corporate Income Tax Law of the People's Republic of China, 9 April 1991, Basic Regulations. 8.1 (ZHU XI LING [45] 1991.4.9)
"The State shall, in accordance with its industrial policies, guide the orientation of foreign investment and encourage the establishment of enterprises with foreign investment which adopt advanced technology and equipment and export all or the greater part of their production."
Source and translation: Kaisen Corporate Service Limited.
http://www.by-cpa.com/html/news/20079/1058.html

Corporate Income Tax Law of the People's Republic of China, 30 June 1991, Article 8.4.4 (GUO WU YUAN LING [85] 1991.6.30)
"Where a newly established or expanded enterprise, in which a foreign investor makes reinvestment, fails to meet the standards of an export-oriented enterprise, or is no longer recognized as a technologically advanced enterprise within three years after it goes into production or operation, the foreign investor shall pay back 60% of the tax refunded."
Source and translation: Kaisen Corporate Service Limited.
http://www.by-cpa.com/html/news/20079/1058.html

Circular of the Ministry of Foreign Trade and Economic Cooperation on Submission of Import and Export Plans for Enterprises with Foreign Investment, October 25, 2000(Wai Jing Mao Zi Tong Jin Han Zi [2000] No.768).
"In order to ensure the continuity and stability of the production in foreign-invested enterprises [...] the authorities of foreign trade and economic co-operation shall formulate a complete plan according to the business scopes, production scales and the ratio between domestic sale and export in the contracts."
Source and translation: Asian Legal Information Institute.
http://www.asianlii.org/cn/legis/cen/laws/cotmoftaecosoiaepfewfii20011453/

A.1.2 Corporate Income Tax

Corporate Income Tax Law of the People's Republic of China, 30 June 1991 (GUO WU YUAN LING [85] 1991.6.30)
"Export-oriented enterprises with foreign investment may, upon the expiration of the tax exemption and reduction period as provided for in the Tax Law, enjoy a further 50% reduction in Enterprise Income Tax based on the rate stipulated by the Tax Law, if the value of their exported products of the year exceeds 70% of the total value of their products of the year. But for the Special Economic Zones and the Economic and Technological Development Zones and other export-oriented enterprises where Enterprise Income Tax has already been reduced to 15% and the above requirements are met, the Enterprise Income Tax shall be levied at 10%."
Source and translation: Kaisen Corporate Service Limited.
http://www.by-cpa.com/html/news/20079/1058.html

A.1.3 Project types

1995 law relative to the Foreign investment project types:

"Regulations for Guiding the Direction of Foreign Investment" Approved by the State Council on June 7, 1995, Article 11.
"Restricted foreign investment projects (Group A) within the category provided in subparagraph 1 of Article 6, may be deemed as permitted foreign investment projects, and not subject to the restriction of Article 9 of these provisions with approval, if the export sales of products amount to over 70 percent of the total sales of products."
Source and translation: Asian Legal Information Institute.
http://www.asianlii.org/cn/legis/cen/laws/ipogfid604/

The Asian Legal Information Institute also provides the full list of restricted products. The first 10 products listed (in order of appearance) are: Machinery, assemblage of movements of digital watches and finished watches, bikes, knitting machines, Electric appliances: washing machines, refrigerators, freezers, Tins.
Source and translation: Asian Legal Information Institute.
http://www.asianlii.org/cn/legis/cen/laws/ipogfid604/

Change of the 1995 law relative to the Foreign investment project types:

Regulations for Guiding the Direction of Foreign Investment, Approved by the State Council on February 11, 2002
"Article 9: [Encouraged projects] enjoy the preferential treatments according to the provisions of the relevant laws and administrative regulations[...]
Article 10: The permitted projects with foreign investment of which the products are all directly exported shall be regarded as the encouraged project with foreign investment; the restricted projects with foreign investment of which the export sales accounts for more than 70% of their total amount of sales may be regarded as the permitted projects with foreign investment [...]."
Source and translation: Asian Legal Information Institute.
http://www.asianlii.org/cn/legis/cen/laws/pogtoofi613/

General Administration of Customs and State Administration of Taxation on 4 September 2002
"Implementation procedures for the adjustment of polices applicable to the Permitted Category of Foreign Investment Projects that Directly Export all its Products (hereafter, the All-for-export Project) as defined in the Foreign Investment Industrial Guidance Catalogue.

All equipment imported under an All-for-Export Project that is approved as of the implementation date of the policy adjustment shall invariably be subject to the levy of import duty and import-stage value-added tax in accordance with the regulations. As of the date when the project is put into production, a joint verification team shall be formed by the Ministry of Foreign Trade and Economic Cooperation (MOFTEC) in conjunction with relevant departments to verify the direct export of products. The verification term shall be five years. Specific verification procedures shall be formulated by MOFTEC in conjunction with relevant departments. If exports are proven to be true after the verification, 20% of paid taxes shall be refunded each year, i.e., all paid taxes shall be refunded within five years; and, if exports are proven to be untrue, the taxes paid in the relevant year shall not be refunded and tax payments already refunded for the project shall be

recovered together with legally-prescribed penalties."
Source and translation: en8848.com.cn.
$http://www.en8848.com.cn/e/DoPrint/?classid=9687\&id=93235$

A.2 Processing Trade Enterprises

Circular of the MOFTEC and the general administration of customs on relevant issues in imported equipment for processing trade, March 16, 1998 (Wai Jing Mao Zheng Fa No.383).
"Imports exempted from taxes and use of non-price setting equipment provided by foreign businessmen must conform to one of the following conditions:
- Having independent factories or workshops exclusively for processing trade (i.e, not producing products processed for home sale) and that the non-price setting equipment shall be used only within the factories or workshops;
- For those processing trade enterprises which have no such factories or workshops and engage in processing trade based on their existing production capacity and use of non-price setting equipment for processing production, in the terms of their processing trade contract (agreement), over 70% of their yearly produced processing products must be exported."
Source and translation: Asian Legal Information Institute.
http://www.asianlii.org/cn/legis/cen/laws/cotmatgaocoriiiefpt1177/

A.3 Free Trade Zones

Corporate Income Tax Law of the People's Republic of China, 16 September 1991, Article 5 (GUO SHUI HAN [663] 1991.9.16)
"Income Tax shall be levied at the reduced tax rate of 10% if the output value of exported products manufactured by development zones enterprises is over 70% of the total output value upon the verification of the taxation authorities."
Source and translation: Kaisen Corporate Service Limited.
http://www.by-cpa.com/html/news/20079/1058.html

Circular of the state council concerning the approval of the national development zones for New and High Technology Industries and the relevant policies and provisions, March 6, 1991.
"Article 4 The income tax of development zone enterprises shall be levied at a reduced rate of 15 percent from the date of their acknowledgement and determination.
Article 5 When the output value of export of a development zone enterprise exceeds 70 percent of its total annual output value, the income tax shall be levied at a reduced rate of 10 percent after being verified by the taxation authorities." Source and translation: Asian Legal Information Institute.
http://www.asianlii.org/cn/legis/cen/laws/cotscctaotndzfnahtiatrpap1530/

The "Provisional Measures Governing the Processing Trade in Export Processing Zones", Chapter I General Provisions, November 22, 2005.
Article 2: An export processing zone is a special area established upon the approval of the State Council and supervised by the customs in a closed way.

Article 3: "Processing trade in an export processing zone" shall refer to the production and business operation activities that the enterprises inside the zone purchase raw materials, parts and components, elements, packing materials, etc. from the outside or inside the territory of China, and transport the finished products processed or assembled to outside the territory of China.
Article 16: The goods carried between the enterprises in an export processing zone and the domestic enterprises outside the zone (including domestic sale of goods from the export processing zone), shall be handled in accordance with the relevant provisions on the import and export of goods. If the import and export permit administration is involved, the relevant certificates must be provided to the administrative department. The leftover pieces, defective products and wasters caused by the enterprises inside a zone during processing and production shall be treated in accordance with the relevant provisions. Source and translation: Asian Legal Information Institute.
http://www.asianlii.org/cn/legis/cen/laws/pmgtptiepz824/

B List of Free Trade Zones

B.1 Special Economic Zones

Special Economic Zones include the six prefectures: Shenzhen, Zhuhai, Shantou Shi, Xiamen, Haikou, Sanya and the entire province of Hainan.

B.2 Coastal Development Zones

Coastal Development Zones include the Shanghai Economic area established in 1982. This zone does not cover entirely the Shanghai prefecture, and notably does not include the city center of Shanghai. We make use of the firm postcode to exclude firms located in the city center from our definition of FTZ, i.e. postcode starting with "2000".

Coastal Development Zones also include the prefecture-cities of Dalian, Qinhuangdao, Tianjin, Yantai, Qingdao, Lianyungang, Nantong, Shanghai, Ningbo, Wenzhou, Fuzhou, Guangzhou, Zhanjiang,Beihai, Zhangzhou, Quanzhou. Shijiazhuang, Langfang, Baoding, Yingkou, Dandong, Anshan, Shenyang, Zibo, Weihai, Weifang, Jinan.

B.3 Yangtze River Delta Economic Zone

Yangtze River Delta Economic Zone includes cities located in the Yangtze River Delta but also some cities located outside the area due to mutual economic development. In 1982, the Chinese government set up the Shanghai Economic Area. Besides Shanghai, 4 cities in Jiangsu (Suzhou, Wuxi, Changzhou, Nantong) and 5 cities in Zhejiang (Hangzhou, Jiaxing, Shaoxing, Huzhou, Ningbo) were included. In 1992, a 14-city cooperative joint meeting was launched. Besides the previous 10 cities, the members included Nanjing, Zhenjiang and Yangzhou in Jiangsu, and Zhoushan in Zhejiang. In 1998, Taizhou has become a new member.

B.4 Pearl River Delta Economic Zone

The boundaries of the Pearl River Delta as an economic zone differ from those associated with the geographic boundaries of the delta. In 1985, the State Council designated the Pearl River Delta as an open economic zone. It contained three Special Economic Zones that were established earlier: Shenzhen, Zhuhai and Shantou.
Other leading cities in the open zone are:
Guangzhou,Dongguan, Foshan, Huizhou, Jiangmen and Zhongshan
"Peripheral" cities that were declared open cities include:
Chaozhou, Heyuan, Jieyang, Maoming, Meizhou, Qingyuan, Shanwei, Shaoguan, Yangjiang, Zhanjiang and Zhaoqing.