Gone for Good? Pure Exporter Subsidies in China: 2002-2013

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1 Introduction

A strong reliance on export promotion while at the same time protecting the domestic market has been a cornerstone of China's transition towards a market economy (Naughton, 2007). The dualistic nature of China's trade policy regime in which a system of export-oriented enclaves coexists alongside a highly protected domestic economy, has been aptly described by Feenstra (1998) as "one country, two systems." A key element of China's export promotion strategy in place since the beginning of its liberalization reforms has been the use of subsidies with export share requirements (ESR). These subsidies encompass a wide range of fiscal advantages such as tax deductions, access to soft loans, duty-free imports of intermediate and capital goods and priority access to infrastructure and land, accruing to firms which export more than a certain share of their production abroad.[1]

Despite undertaking wide-reaching trade liberalization reforms such as expanding trading rights, lowering import tariffs and eliminating non-tariff barriers in anticipation to joining the WTO in 2001, China's use of export subsidies, and those featuring export requirements in particular, was hardly curbed during this wave of reforms. This course of action has been cause of substantial controversy over the last decade. Under the terms of its accession protocol China was required to notify the WTO of any export subsidies in place ahead of the Transitional Review Mechanism, the annual procedure monitoring China's compliance with

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[1] Defever and Riaño (2014) provide a detailed description of subsidies featuring export share requirements available in China between 2000 and 2006.

its WTO commitments. Despite this obligation, China only submitted two notifications in 2006 and 2011. Both were deemed to be highly incomplete because neither disclosed the level of expenditure on a large number of subsidy programs listed in each notification. Additionally, subsidies granted at sub-national, provincial and local level, which are widely considered to be important instruments of trade promotion, were excluded from both notifications.[2]

Although subsidies with ESR are not directly observable in the data, they target primarily three types of firms: (i) foreign-invested enterprises, (ii) establishments engaged in export processing activities and (iii) firms located in Free Trade Zones. Thus, it is possible to identify firms that are likely to benefit from these subsidies based on their observed export intensity (i.e. the share of total sales accounted for by exports). Defever and Riaño (2014) back out the unobserved subsidies following a calibrating procedure which utilizes data on the overall export intensity distribution of a country and the productivity premia estimated for exporters identified as enjoying subsidies with ESR relative to exporters that do not benefit from this policy and domestic firms.

After 2006, the US, EU and other WTO member countries have aggressively challenged China's subsidies with ESR. This in turn has to the gradual dismantlement of several of these subsidy programmes. For instance, the corporate income tax deduction available to foreign-invested enterprises and domestically-owned firms exporting more than 70% of their output was terminated in 2008 with a transition period lasting until 2012. Similarly, the 'Famous Brands' initiative, a large umbrella of export support programs which featured several subsidies contingent on export performance, was introduced in 2005, and was only abandoned in 2009 after being challenged by the US and the EU at the WTO one year before. Using data from the World Bank's Business Environment and Enterprise Performance Survey (BEEPS) dataset reveals that the share of exporters selling all their output abroad, which we denote 'pure exporters', has experienced a dramatic fall from 9% in 2002 to 3.6% in 2012. This pattern is consistent with a reduction in subsidies with ESR by the Chinese government

[2]See "Request from the United States to China," October 11, 2011, reference G/SCM/Q2/CHN/42.

in response to greater international scrutiny of its trade policies.

In this paper we make use of the model of subsidies with export share requirements developed in Defever and Riaño (2014) to quantify the implied reduction in subsidies with a 100% export share requirement, or 'pure exporter' subsidies, that is consistent with the drastic decline in the share of this type of exporter between 2002 and 2013. We calibrate the general equilibrium model's parameters using data from the 2002 wave of BEEPS, and by doing so, we determine how the fall in subsidies affects the level of competition and aggregate welfare in China and the rest of the world.

Our results show that only a 6.25% reduction in the ad-valorem subsidy granted to pure exporters is necessary to explain to reproduce the observed decline of these exporters. This small reduction, however, can result in a significant increase in the level of competition in China inducing the exit of 1.26% of firms operating there. The reduction in the distortion generated by the subsidy (which produces an improvement in China's terms-of-trade) together with the higher average productivity of Chinese firms, result in an overall welfare gain in China of 1.61%. Conversely, the rest of the world experiences a loss of 0.54% in real income due to the increase in the price of Chinese imports.

Section 2 introduces pure exporter subsidies, i.e. subsidies with a 100% export share requirement in a simple partial equilibrium model of trade with heterogeneous firms. We show in the context of the model under which conditions pure exporters arise and coexist in equilibrium with domestic firms and firms that serve both domestic and foreign markets, which we denote 'regular exporters'. Section 3 briefly describes how a general equilibrium version of the model in Section 2 is calibrated, matching using firm-level data for 2002. Finally, Section 4 analyzes how a fall in subsidies consistent with the reduction in the share of pure exporters observed between 2002 and 2013 has affected the level of competition and welfare both in China and the rest of the world.

2 A Simple Model of Pure-Exporter Subsidies

Assume that Chinese firms can sell their output in China (c) and the rest of the World (f). The demand function faced by a firm producing variety φ selling in market i is:

$$q_i(\varphi) = A_i p_i(\varphi)^{-\sigma}, \quad i \in \{c, f\}, \tag{1}$$

where $p_i(\varphi)$ is the price of good φ charged in market i, A_i is a country-specific demand shifter and σ is the elasticity of demand. Each variety is produced by a monopolistically-competitive firm with technology $q = \varphi l$, where l denotes labor input and φ is a firm-specific productivity index.

A Chinese firm can choose between three potential modes of operation: (i) produce for the domestic market alone, which entails paying a fixed cost f_d, (ii) become a regular exporter selling both domestically and abroad, by paying a fixed cost of exporting f_x in addition to the fixed cost of operating in the domestic market or (iii) become a pure exporter, i.e. a firm that exports all its output. The latter option requires the firm to pay a fixed cost f_x but enables it to receive an ad-valorem subsidy s on its sales. Let $k \in \{d, x, p\}$ index the three possible modes of production: domestic, regular and pure exporter respectively. The profit that a firm of productivity φ attains in operation mode k is:

$$\pi^k(\varphi, s) = \begin{cases} \kappa A_c(\varphi)^{\sigma-1} - f_d, & \text{if } \ k = d, \\ \kappa[A_c + \tau^{1-\sigma} A_f](\varphi)^{\sigma-1} - (f_d + f_x), & \text{if } \ k = x, \\ \kappa(1+s)^{\sigma} \tau^{1-\sigma} A_f(\varphi)^{\sigma-1} - f_x, & \text{if } \ k = p, \end{cases} \tag{2}$$

where $\kappa \equiv (\sigma - 1)^{\sigma-1} \sigma^{-\sigma}$ and the wage in China has been normalized to 1. Both regular and pure exporters face an iceberg transportation cost $\tau \geqslant 1$ when selling their output abroad.

A Chinese firm with productivity φ chooses to operate under the pure-exporter mode $k = p$ if $\pi^p(\varphi, s) \geqslant \max\{\pi^d(\varphi), \pi^x(\varphi), 0\}$, or equivalently that $\pi^p(\varphi, s) \geqslant \pi^d(\varphi)$, $\pi^p(\varphi, s) \geqslant$

$\pi^x(\varphi)$ and $\pi^p(\varphi, s) \geqslant 0$ hold together. We characterize this set of conditions by defining four different productivity cutoffs that describe combinations of productivity and subsidy rates (φ, s) so that a firm is indifferent between a given pair of production modes.

We start with the two standard cutoffs φ^* and φ_x^* that identify domestic firms and regular exporters in the Melitz (2003) model in the absence of pure exporters,

$$\varphi^* = \left(\frac{f_d}{\kappa A_c}\right)^{\frac{1}{\sigma-1}}, \tag{3}$$

$$\varphi_x^* = \tau \left(\frac{f_x}{\kappa A_f}\right)^{\frac{1}{\sigma-1}}. \tag{4}$$

These two cutoffs are respectively, the productivity level above which a Chinese firm would find it profitable to produce for the domestic market alone $\{\varphi : \quad \pi^d(\varphi^*) = 0\}$, and the productivity level necessary for a firm to choose to become a regular exporter $\{\varphi : \quad \pi^x(\varphi_x^*) = 0\}$. We assume that in the absence of pure exporter subsidies, exporters are more productive than domestic firms in China, i.e. we assume that $f_d/f_x \leqslant A_c/(\tau^{1-\sigma} A_f)$, which implies $\varphi^* \leqslant \varphi_x^*$.

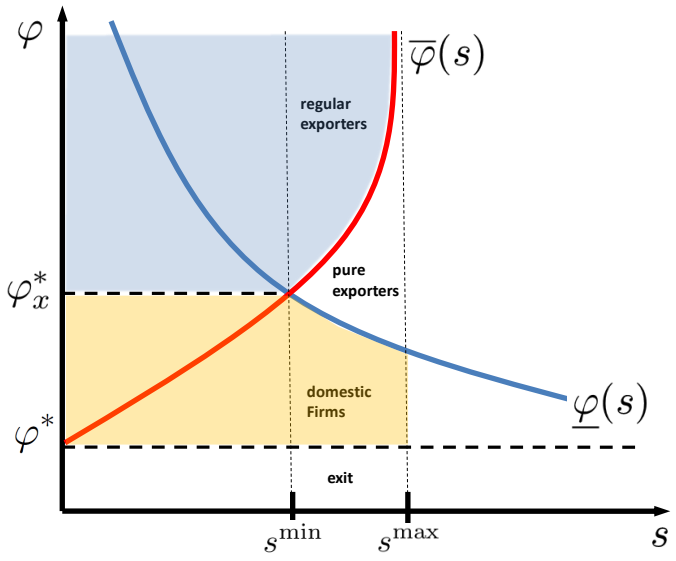
We define two additional cutoffs that arise in the presence of a pure exporters. Let $\overline{\varphi}(s)$ be the productivity level at which a firm would be indifferent between being a regular or a pure exporter, i. e. $\overline{\varphi}(s) = \{\varphi : \pi^p(\overline{\varphi}, s) = \pi^c(\overline{\varphi})\}$. Thus, $\overline{\varphi}(s)$ is given by,

$$\overline{\varphi}(s) = \left(\frac{f_d}{\kappa(A_c - \tau^{1-\sigma} A_f[(1+s)^\sigma - 1])}\right)^{\frac{1}{\sigma-1}}. \tag{5}$$

Inspection of (5) reveals that $\overline{\varphi}(s)$ is strictly increasing in s, with $\overline{\varphi}(0) = \varphi^*$ and $\overline{\varphi}(s_1^{\max}) \to \infty$, with $s_1^{\max}$ defined below. In order for a firm to choose to operate as a pure rather than a regular exporter, it must be the case that the subsidy it receives is greater than the profits it could earn in the domestic market. Thus, high productivity firms require high subsidy rates to be swayed towards operating as pure exporters.

Similarly, let $\underline{\varphi}(s)$ be the productivity level such that a firm would be indifferent between

Figure 1: Choice of Mode of Operation with Pure Exporters



selling only in the domestic market and operating as a pure exporter. That is, $\underline{\varphi}(s)$ is defined implicitly by $\underline{\varphi}(s) = \{\varphi : \pi^p(\underline{\varphi}, s) = \pi^d(\underline{\varphi})\}$. This condition reads:

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

Under the additional assumption that $f_x > f_d$, it follows that $\underline{\varphi}(s)$ is strictly decreasing in s whenever $s > s^{\min}$, with $s^{\min}$ defined below. Firms with productivity $\varphi \in (\varphi^*, \varphi_x^*)$ which would prefer to operate domestically in the absence of pure-exporter subsidies, find it profitable to change their production mode if the additional revenue they receive because of the subsidy is greater than the difference in fixed costs, $f_x - f_d$. Therefore, domestic firms with relatively high productivity levels would require a lower subsidy to become pure-exporters. Figure 1 plots all the different cutoffs in $\{\varphi, s\}$-space.

Comparing all four cutoffs (3)-(6), it follows that pure-exporters arise when s is such that $\underline{\varphi}(s) \leqslant \overline{\varphi}(s)$. The minimum subsidy necessary for firms to choose the pure exporter

operation mode, $s^{\min}$, is given by,

$$s^{\min} = \left(1 + \frac{A_c}{\tau^{1-\sigma} A_f} - \frac{f_d}{f_x}\right)^{\frac{1}{\sigma}} - 1 > 0. \tag{7}$$

Moreover, Figure 1 shows that $\underline{\varphi}(s^{\min}) = \overline{\varphi}(s^{\min}) = \varphi_x^*$. Therefore, when $s \geqslant s^{\min}$, pure exporters start to arise around the no-subsidy export cutoff, φ_x^*. This implies that pure exporters are more productive than domestic firms, but less so than regular exporters. Defever and Riaño (2014) show that this prediction requires that the effective fixed cost of operation of pure exporters to be higher than that of domestic firms. If the converse is true, for instance if pure exporters also receive subsidies affecting their fixed cost (e.g. reduced land rental rates or public utilities), then firms choosing to operate as pure exporters would exhibit lower productivity than domestic firms. Defever and Riaño (2014) find that pure exporters are indeed more productive than domestic firms and less productive than regular exporters. The latter prediction of the model should hold regardless of the whether the subsidy is applied to sales or fixed costs as long as domestic firms coexist alongside pure and regular exporters in equilibrium.

As s increases, the share of active firms operating as pure exporters increases at the expense of domestic firms and regular exporters. In fact, if s is sufficiently high, either domestic firms or regular exporters would disappear. As noted above, let $s_1^{\max}$ be the value of subsidy for which $\overline{\varphi}(s) \to \infty$, that is,

$$s_1^{\max} \equiv \left(1 + \frac{A_c}{\tau^{1-\sigma} A_f}\right)^{\frac{1}{\sigma}} - 1, \tag{8}$$

meaning that no firm would find it profitable to be a regular exporter. If on the other hand, it is the case that a very large pure-exporter subsidy stops firms from producing uniquely for the domestic market, we can define $s_2^{\max}$ as the subsidy value for which $\underline{\varphi}(s_2^{\max}) = \varphi^*$, i.e.

$$s_2^{\max} \equiv \left(\frac{f_x}{f_d} \frac{A_c}{\tau^{1-\sigma} A_f}\right)^{\frac{1}{\sigma}} - 1. \tag{9}$$

Proposition 1 summarizes the conditions under which the three modes of production arise in equilibrium.

Proposition 1 *Assume that* $f_d/f_x \leqslant A_c/(\tau^{1-\sigma}A_f)$ *and* $f_d < f_x$*, the three modes of production* $k \in \left\{d, p, x\right\}$ *coexist in the presence of a positive and sufficiently large pure-exporter subsidy* s*, such that* $s \in \left(s^{\min}, \min\left\{s_1^{\max}, s_2^{\max}\right\}\right)$*. Firms with productivity* $\varphi \in \left[\varphi^*, \underline{\varphi}(s)\right)$ *only operate domestically, firms with productivity levels* $\varphi \in \left[\underline{\varphi}(s), \overline{\varphi}(s)\right)$ *choose to operate as pure exporters, and firms with* $\varphi \geqslant \overline{\varphi}(s)$ *self-select into regular exporters.*

3 General Equilibrium and Calibration

We follow Defever and Riaño (2014) and introduce pure exporter subsidies in an otherwise standard two-country, general equilibrium of trade with heterogenous firms as in Melitz (2003). We assume that only one country (i.e. China) uses pure exporter subsidies.

There are two countries in the world, China (c) and the rest of the World (f), each of size L_i, $i \in \{c, f\}$. Consumers in each country have CES preferences that yield demand functions like (1), with $A_i \equiv E_i P_i^{\sigma-1}$, where E_i denotes country i's total expenditure and P_i is the ideal price index in the same country. Labor is the only input of production; there is a mass of potential entrants who draw their idiosyncratic productivity from a Pareto distribution $G(\varphi) = 1 - \varphi^{-a}$ after paying a sunk cost f_e.[3] The problem for Chinese firms is identical to the one described in Section 2, while producers in the rest of the world cannot operate as pure exporters.

Equilibrium in the model is characterized by a vector of wages, mass of active firms and price indices such that in both countries the labor market clears, there is free entry, and aggregate income equals aggregate expenditure (i.e. trade is balanced). Pure exporter subsidies in China are financed via lump-sum taxes levied on households and the government's budget is balanced.

[3] All fixed costs are denominated in units of labor.

Both countries are assumed to be identical in terms of size and the vector of parameters faced by firms and consumers. We calibrate the model following a similar strategy as Defever and Riaño (2014). Table 1 presents the parameters used to solve the model.

Table 1: Simulation Parameters

Parameter	Description	Value
L_i	Country i's size, $i \in \{c, f\}$	1.00
σ	Elasticity of substitution	3.00
f_e	Entry cost	1.00
a	Pareto distribution shape parameter	2.76
$\mathbf{f_d}$	**Fixed cost of operating in the domestic market**	**0.46**
$\mathbf{f_x}$	**Fixed cost of exporting**	**0.71**
τ	**Iceberg transportation cost**	**1.29**
$\mathbf{s}$	**Pure exporter subsidy**	**0.30**

The parameters (f_d, f_x, τ, s) are chosen to match four moments: (i) shares (among all active firms) of regular (ii) and pure exporters (i.e. firms exporting more than 97% of their sales) of 26 and 9% respectively, (iii) an export/sales ratio for regular exporters of 36.1%, and a (iv) productivity premium of pure exporters vis-à-vis domestic firms of 37.6%. The first three moments are calculated using data from the BEEPS dataset for the year 2002; the total factor productivity premium is estimated using the Levinsohn and Petrin (2003) algorithm with data for the period 2000-2006 from the annual survey of Chinese manufacturing firms compiled by the National Bureau of Statistics (NBS). The magnitude of the calibrated transport cost and the fixed cost of exporting (relative to the domestic fixed cost) are within the range of estimates commonly reported in the literature. More importantly, a 30% ad-valorem sales subsidy with a 100% ESR is required to match the share of pure exporters operating in China in 2002. The calibrated subsidy is slightly smaller than the 33.2% inferred in the richer model used in Defever and Riaño (2014), which features multiple export share requirements, not only a 100% one as in the current exercise; total expenditure on pure exporter subsidies accounts for 1.23% of GDP in the benchmark model.

4 Decreasing Subsidies with ESR

We can use the calibrated model to infer the reduction in subsidies with ESR that is consistent with the decline in the share of pure exporters observed between 2002 and 2013 in the BEEPS data. We can also quantify how the fall in subsidies affected total expenditure in subsidies, exports and welfare both in China and in the rest of the world (ROW). The results of this experiment are presented in Table 2.

Table 2: Reduction in the 100%-ESR Subsidy Rate from 30 to 27.8%

Variable	% Change
Share of pure exporters, China	-56.19
Pure exporter subsidy rate	-6.25
Subsidies/GDP, China	-59.80
Exports/GDP, China	-2.81
Price index, China	-1.32
Price index, ROW	0.54
Exit cutoff, China	0.46
Exit cutoff, ROW	0.54
Welfare, China	1.61
Welfare, ROW	-0.54

Maintaining all other parameters constant, a reduction in the pure exporter subsidy rate from 30 to 27.8% is necessary to match the reduction in the share of pure exporters from 8.2 to 3.6% of operating firms in China. As shown in Figure 1, the share of pure exporters is highly responsive to changes in the subsidy rate. Similarly, total expenditure in export subsidies falls by almost 60%.

The fall in pure exporter subsidies reduces the price index in China and increases it in ROW. This follows because Chinese consumers now get to enjoy a set of goods which were previously produced there but were only available to foreign consumers; conversely, in ROW, consumers face higher prices on imported goods from China. Tougher competition in China (lower price index) in turn induces exit of low productivity firms. The increase in the exit

productivity cutoff results in a fall of 1.26% in the number of operating firms in China.

Overall, reducing pure exporter subsidies increases China's welfare, measured as real disposable income, by 1.61%. The tax burden on consumers is lessened, and consumers are able to enjoy a greater variety of goods (which due to the 'love-of-variety' of preferences increases welfare directly) at lower prices. Welfare for ROW falls as its imports become more expensive, experiences a terms-of-trade loss; the welfare loss of foreign consumers is more than compensated by the gain experienced by China.

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