Gone for Good? Subsidies with Export Share Requirements in China: 2002-2013

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Abstract

This paper presents a simple model of subsidies with export share requirements (ESR) in a heterogeneous firm environment. A two-country general equilibrium version of the model with a single 100% ESR is calibrated using firm-level data from the 2002 wave of the Business Environment and Enterprise Performance Survey collected by the World Bank for China. The calibrated model is used to gauge the change in subsidies with ESR that is consistent with the fall in the share of pure exporters, firms exporting all their output, observed in China, from 25.7% in 2002 to 11.1% in 2013. Our results indicate that a 6.9% reduction in the ad-valorem subsidy rate available to firms that export all their output is consistent with the observed fall in their share of exporting firms. Expenditure in subsidies (as a share of value-added) falls by 66% and welfare in China increases by 1.76% while real income in the rest of the world falls by 0.59%.

Keywords: Trade Policy; Export Subsidies; Export Share Requirements; China
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1 Introduction

China's integration into the world economy has been marked by vigorous export promotion combined with a steadfast commitment to protecting its domestic market. The dual nature of China's trade policy regime in which export-oriented firms coexist alongside highly protected state-owned enterprises, has been aptly described by Feenstra (1998) as "one country, two systems." A crucial element of China's export promotion strategy has been the use of subsidies with export share requirements (ESR). These 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 conditional on their export intensity (i.e. the share of total sales accounted for by exports) exceeding a given threshold.[1] Quite often firms are required to export all their output to benefit from the subsidies.

Although it is not possible to directly observe if a firm receives subsidies with ESR, it is possible to identify firms that are likely to benefit from these subsidies based on their observed export intensity. Thus, Defever and Riaño (2014) back out the unobserved subsidies following a calibration strategy 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.[2]

The World Bank's Business Environment and Enterprise Performance Survey (BEEPS) reveals that the share of exporters selling all their output abroad, which we denote 'pure exporters', experienced a dramatic fall from 25.7% to 11.1% of exporting firms between 2002 and 2013 (see Figure 1). This pattern is consistent with a reduction in subsidies with ESR by the Chinese government in response to greater international scrutiny of its trade policies.

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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.

[2] The main identifying assumption is that high export intensity exporters arise because of the use of subsidies with ESR by the Chinese Government. Defever and Riaño (2014) show that these subsidies target primarily three types of firms, foreign-invested enterprises, export processing establishments and firms located in Free Trade Zones, and that the vast majority of high-intensity exporters belong to one of these groups.

Figure 1: Export Intensity Distribution of Exporters in China
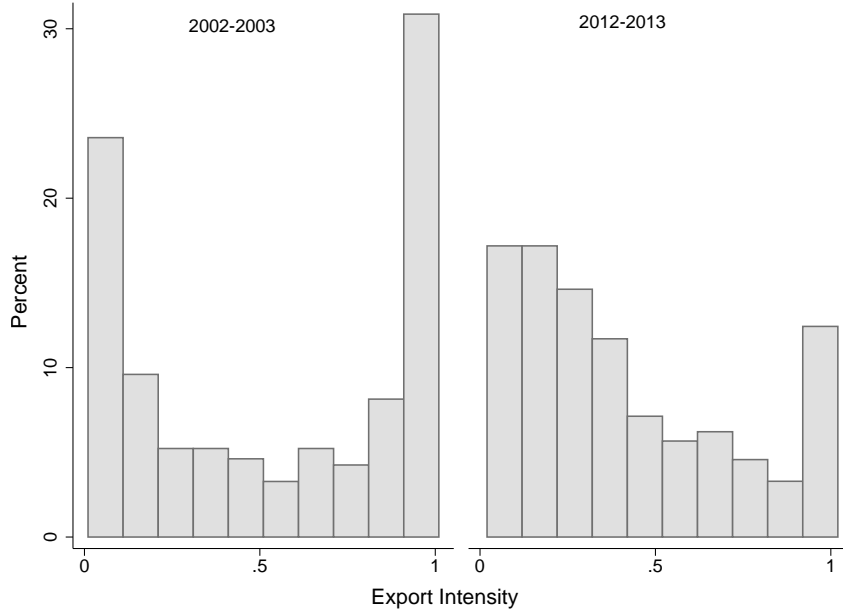
Source: World Bank BEEPS, 2002-03 and 2012-13 waves.

In this paper, we gauge the change in subsidies with ESR which is consistent with the decline in the share of pure exporters observed in China over the last decade. To do so, we consider a simplified version of the model proposed by Defever and Riaño (2014), featuring a single ad-valorem sales subsidy associated with a 100% export share requirement. The parameters of the general equilibrium model are calibrated using Chinese firm-level data from the 2002 wave of BEEPS. We use the model to quantify the effect of a reduction in subsidies with ESR on the total expenditure on subsidies, aggregate exports and welfare for China and the rest of the world. Our results provide a first assessment of the extent to which China has reformed its dual export system over the last decade.

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 World Trade Organization (WTO) in 2001, the use of export subsidies in China, and those featuring export requirements in particular, was hardly curbed during this wave of reforms.

3

This course of action has proven to be highly controversial. Under the terms of its accession protocol, China was required to notify the WTO of any export subsidies in place ahead of the annual Transitional Review Mechanism, the procedure monitoring China's compliance with its WTO commitments. However, despite its commitment, China only submitted *two* subsidy notifications in 2006 and 2011. Both of these were deemed to be highly incomplete because they did not disclose the level of expenditure of a large number of subsidy programs listed in each notification. Additionally, subsidies granted at the sub-national, provincial and local level, which are widely considered to be important instruments of export promotion, were excluded from both notifications.[3]

After 2006, the US, EU and other WTO member countries have actively challenged Chinese subsidies with ESR. This pressure in turn has led to the gradual dismantlement of several subsidy programmes. For instance, the corporate income tax deduction available to export-oriented foreign-invested enterprises was terminated in 2008. Similarly, the preferential treatment for domestically-owned firms located in Special Economic Zones and exporting more than 70% of their output was also terminated in 2008. In both cases, a five-year transition period was established so that the new tax legislation became operational in 2012. At the same time, several financial incentives conditional on a firm's export intensity still remain in place, and even new ones have been introduced over the last decade. For instance, the first pilot "Export Processing Zones" which were established in 2000 and feature strict limitations on firms' domestic sales, have tripled in number by 2010. Similarly, the "Famous Brands" initiative, a large umbrella of export support programs which included 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 the year before. The "Auto Export Base" program introduced in 2009, was also challenged in 2012 by the Obama Administration during the 2012 presidential election. These examples illustrate how difficult it is to evaluate the extent to which the dual trade policy regime in China has been reformed.

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

Our results show that a reduction of 6.9% in the ad-valorem sales subsidy rate offered to pure exporters (from 30 to 27.53%) suffices to replicate the observed decline in their share among exporting firms. This small reduction, however, produces a significant fall in the total expenditure in export subsidies over GDP from 1.23% in 2002 to 0.42% in 2013, a reduction of 66%. As the distortions generated by the subsidy are lessened, China's terms-of-trade improve and the average productivity of Chinese firms increases as well due to stronger import competition. Both effects increase welfare (measured as real income) in China by 1.76%. Conversely, the rest of the world experiences a welfare loss of 0.59% due to the higher price of Chinese imports.

The paper is organized as follows: Section 2 introduces a 100%-ESR subsidy in a simple partial equilibrium model of trade with heterogeneous firms. We characterize the conditions under which pure exporters arise and coexist in equilibrium with domestic firms and firms serving 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 moments calculated using firm-level data from the 2002-2003 wave of BEEPS. Finally, Section 4 analyzes how a fall in subsidies consistent with the reduction in the share of pure exporters observed between 2002 and 2013 affects total expenditure in subsidies, aggregate exports and welfare in China and the rest of the world.

2 Model

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 because it faces a 100% export share requirement.[4] The latter option requires the firm to pay a fixed cost f_x and 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:

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

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 transport 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 if $\pi^p(\varphi, s) \geqslant \pi^d(\varphi)$, $\pi^p(\varphi, s) \geqslant \pi^x(\varphi)$ 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) for which 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

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[4]Defever and Riaño (2014) study the general case in which export share requirements can take an arbitrary value.

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 $\{\varphi : \pi^d(\varphi^*) = 0\}$, and the productivity level necessary for a firm to choose to become a regular exporter $\{\varphi : \pi^x(\varphi_x^*) = 0\}$. We assume that in the absence of 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 $\overline{\varphi}(s_1^{\max}) \rightarrow \infty$, 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 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:

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

7

Figure 2: Choice of Mode of Operation with Pure Exporters
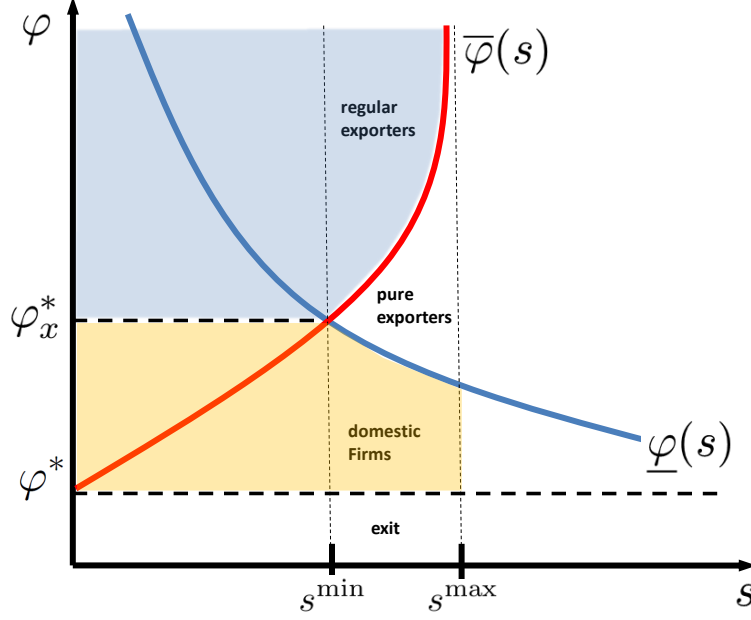
Under the additional assumption that $f_x > f_d$, it follows that $\underline{\varphi}(s)$ is strictly decreasing in s whenever $s > s^{\min}$, with $s^{\min}$ defined below. Firms with productivity $\varphi \in (\varphi^*, \varphi_x^*)$ which would prefer to operate domestically in the absence of subsidies, 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 2 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,

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

Figure 2 also 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.[5]

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 operate as a regular exporter. If on the other hand, it is the case that a very large 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 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.*

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[5]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 be less productive than domestic firms. Empirically, Defever and Riaño (2014) find that pure exporters in China 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.

3 General Equilibrium and Calibration

We follow Defever and Riaño (2014) and introduce subsidies with ESR 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 these 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.[6] 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). Subsidies with ESR in China are financed via lump-sum taxes levied on households and the government's budget is balanced.

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.

The parameters (f_d, f_x, τ, s) are chosen to match four moments: (i) the 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

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

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
f_d	**Fixed cost of operating in the domestic market**	**0.46**
f_x	**Fixed cost of exporting**	**0.71**
τ	**Iceberg transportation cost**	**1.29**
s	**100%-ESR subsidy**	**0.30**

2002; the total factor productivity premium is for the year 2002 and 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 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 use the calibrated model to infer the reduction in subsidies with ESR that is consistent with the share of pure exporters declining from 25.7% of all exporters in 2002-2003 to 11.1% in 2012-2013 in the BEEPS data. We then evaluate how the fall in subsidies with ESR 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: Fall in the Share of Pure Exporters (among exporting firms) from 25.7% to 11.1%

Variable	2002	2013	% Change
100%-ESR subsidy rate	30.00%	27.53%	-6.90
Subsidies/GDP, China	1.23%	0.42%	-65.85
Exports/GDP, China	30.93%	29.97%	-3.10
Welfare, China			1.76
Welfare, ROW			-0.59

A reduction in the 100%-ESR subsidy rate from 30 to 27.53% matches the reduction in the share of pure exporters among exporting firms in China. As shown in Figure 2, the share of pure exporters is highly responsive to changes in the subsidy rate. Similarly, total expenditure in export subsidies falls by a staggering 65%.

Reducing subsidies with ESR improves China's welfare, measured as real disposable income, by 1.76%. The tax burden on Chinese consumers is lessened, and they are now able to enjoy a greater variety of goods which were previously produced in China but were only available to foreign consumers (a 'love-of-variety' effect increases welfare directly). Moreover, because of tougher domestic competition, the price index in China also falls. Welfare for ROW falls as its imports become more expensive, experiencing a terms-of-trade loss.

5   Conclusion

The results of our exercise suggest that indeed China has gradually diminish the degree of dualism in its trade policy regime over the last decade. Phasing out the advantages granted to export-oriented firms has reduced the tax burden on consumers, improved terms-of-trade and produced sizable welfare gains. However, there is still scope for further reform. Our simple model suggests that China would stand to realize an additional 1 percent increase in real income if it were to fully eliminate subsidies with export share requirements.

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