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Who Benefits from the Export Tax Rebate Policy? Evidence from the Chinese Fishery Sector

The export tax rebate policy in China is under dispute, especially in agricultural sectors, as it is claimed that it works as a subsidy for foreign consumers rather than domestic producers. Surprisingly, little research has investigated the distribution of benefits of this policy. In this paper, we examine this in a partial equilibrium framework. We find that the effects of the export tax rebate on domestic producers depend on the relative magnitude of the export supply and import demand elasticities. The model is then applied to the Chinese fishery sector, a perfect example to illustrate the policy debate. Simulation results indicate that, although the export tax rebate increases Chinese producers' welfare, foreign consumers capture most of its welfare benefits (60%-75%). Furthermore, the results imply that the welfare gain for Chinese producers is overestimated if the vertical linkage between the retail and the farm markets is ignored.

Keywords: Welfare Distribution, Export Tax Rebate, Value-Added Tax, Fishery Sector, Retail market, Farm Market

JEL classifications: F13, Q17, C63

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Introduction

China first implemented the export tax rebate policy in 1985. This policy enables export companies to get a partial or total refund for the indirect tax paid during the production and distribution processes. In the agricultural sectors, the export tax rebate is implemented not only in order to provide the exporting firms with a higher profit, but also in order to enhance the income of farm producers. This is due to the connection between the retail and farm markets, and thus the tax rebate is considered to alleviate the poverty of China's rural population (which accounted for 50.32% of the total population in 2016, according to FAO data).

However, this policy imposes a heavy fiscal burden on the Chinese government, and the large size of the rebates can be said to crowd out government expenditures on education, social security, etc. (Cui, 2003). An export tax rebate can be split between an increase in the domestic price and a reduction in the export price, and thus improves foreign consumers' welfare. Many financial commentators point out that in some industries, the tax rebate is decreasing the export price to a larger extent than increasing the domestic supply price. Hence it works more to subsidise foreign consumers than domestic producers. As a result, the debate over whether this policy should be abolished in certain sectors continues.

The effects of the export tax rebate have attracted much attention in the literature. Most studies find a positive relationship between the tax or tariff rebate and exports (Chao et al., 2001; Chandra and Long, 2013; Chen et al., 2006; Gourdon et al., 2017), except for one case in the agricultural and food industry (Chao et al., 2006). However, when it comes to welfare effects, studies on export tax rebates or export subsidies mainly focus on the whole country's welfare (e.g., Brander and Spencer, 1985; Chao et al., 2006; Jarvis, 2012; Yin and Yin, 2005). Few discuss how the welfare gains or losses are distributed among different groups in a specific sector, including domestic producers, domestic consumers, and foreign consumers at the retail level, or among suppliers of different inputs. An export promotion policy (such as an export subsidy or export tax rebate) increases the domestic price and thus, according to the price theory, such a policy improves the domestic producers' welfare at the expense of domestic consumers' surplus. However, is it possible that the beneficiaries are foreign consumers, instead of domestic producers? What affects the welfare distribution effects of such policy? Moreover, in an agricultural sector, how does such a policy affect the farm and non-farm input producers? As mentioned before, the export tax rebate imposes a heavy fiscal burden on the government, and may be detrimental to domestic consumers; thus, it is important to address these questions.

This paper attempts partially to fill this gap by simulating the incidence of the export tax rebate, including the price effects and the distribution of welfare gains among different groups in an agricultural sector with a partial equilibrium approach. Then, the model is applied to the Chinese fishery sector, which provides a typical context for the disputes on the export tax rebate policy. In 2008, the rebate rate for several types of fishery products[1] was increased from 5% to 13%. Critics have pointed out that the export tax rebate is subsidising foreign consumers and that domestic producers are getting few benefits, and thus this policy results in a waste of taxpayers' money.

In this paper, we first use an equilibrium displacement model (EDM) to investigate the effects of the export tax rebate on prices and trade flows. EDMs are widely used to evaluate the effects of exogenous shocks in food and agriculture sectors, especially those caused by government policies (Dhoubhadel et al., 2015; Gardner, 1975; Kinnucan and Cai, 2011; Leister et al., 2015; Wohlgenant, 1989). Then, following the method of Sun and Kinnucan (2001), we calculate the distribution of welfare changes for Chinese domestic producers, domestic consumers, and foreign consumers using the EDM simulation results.

[1] They include frozen tilapia, frozen tilapia fillets, frozen crustacean, molluscs, etc.

Although the policy is implemented at the retail level, we also consider the farm level and the linkage between the two levels, as not considering such vertical linkage may produce inaccurate results. In this paper, Wohlgenant's (1989) method is followed since the retail and the farm markets are linked through the retail price and the farm price. In this way, we are able to obtain not only more accurate results for the retail market, but also a realistic estimate of the benefits' allocation between producers of farm and non-farm inputs at the input level.

Methodology

Model

Consider a simplified situation in which retail producers purchase inputs from the farm market to produce a homogeneous product and sell them in both domestic and export markets. An export tax rebate is implemented in the retail market for the export goods. The industry is assumed to be competitive within the country[2] and the Law of One Price holds. The economy is large in that it affects the world price. Ignoring all tariffs and other trade barriers, the initial equilibrium of an agricultural sector can be defined as follows:

Retail market:

$$D_R = D_R(P_R^D) \quad \text{(Domestic demand)} \quad (1)$$
$$P_R^S = P_R^S(S_R, P_F, P_N) \quad \text{(Inverse supply)} \quad (2)$$
$$X_R = X_R(P_R^X) \quad \text{(Export demand)} \quad (3)$$
$$P_R^D = P_R^S \cdot VAT \quad \text{(Domestic price)} \quad (4)$$
$$P_R^X = P_R^S \cdot VAT / ETR \quad \text{(Export price)} \quad (5)$$
$$S_R = D_R + X_R \quad \text{(Market clearing)} \quad (6)$$

Farm market:

$$P_F = P_F(D_F, P_R^S, P_N) \quad \text{(Inverse demand)} \quad (7)$$
$$S_F = S_F(P_F) \quad \text{(Supply)} \quad (8)$$
$$S_F = D_F \quad \text{(Market clearing)} \quad (9)$$

In this model for China, D_R and S_R are the retail-level domestic demand and supply, respectively; X_R is the retail-level export; P_R^D is the retail-level domestic demand price; P_R^X is the retail-level export price; P_R^S is the retail-level supply price; D_F and S_F are the farm-level demand and supply, respectively; and P_F is the farm-level price. The variables *VAT* and *ETR* represent the value-added tax and the export tax rebate[3], respectively. Then, an isolated increase in *VAT* increases both domestic and export prices, while an isolated increase in *ETR* increases the domestic price and reduces the export price. Finally, P_N is the price of non-farm inputs. The retail- and farm-level markets are linked by the domestic retail-level supply equation and the farm-level demand equation. Overall, this model contains nine endogenous variables (D_R, S_R, X_R, P_R^D, P_R^X, P_R^S, D_F, S_F, and P_F) and three exogenous variables (*VAT*, *ETR*, and P_N).[4]

By taking the total differential, the model can be written in the equilibrium displacement form, which characterizes the change in equilibrium prices and quantities from shifts in *VAT* and *ETR*, as follows:

Retail market:

$$D_R^* = \eta_R^D P_R^{D*} \quad (10)$$
$$P_R^{S*} = S_R^* / \varepsilon_R + \phi_{RF} P_F^* + \phi_{RN} P_N^* \quad (11)$$
$$X_R^* = \eta_R^X P_R^{X*} \quad (12)$$
$$P_R^{D*} = P_R^{S*} + VAT^* \quad (13)$$
$$P_R^{X*} = P_R^{S*} + VAT^* - ETR^* \quad (14)$$
$$S_R^* = k_D D_R^* + k_X X_R^* \quad (15)$$

Farm market:

$$P_F^* = D_F^* / \eta_F + \phi_{FR} P_R^{S*} + \phi_{FN} P_N^* \quad (16)$$
$$S_F^* = \varepsilon_F P_F^* \quad (17)$$
$$D_F^* = S_F^* \quad (18)$$

Here, the asterisked variables refer to approximate relative changes (e.g., $P_F^{D*} = dP_R^D / P_R^D$,). Parameters are defined in Table 1. For normal sloping supply and demand curves, $\eta's < 0$ and $\varepsilon's > 0$.

The distribution of benefits brought by the export tax rebate can be measured in two ways: by the passing on of the export rebate to Chinese producers and foreign consumers and by the welfare distribution among each group.

The pass-through of the export tax rebate

By imposing the market clearing conditions and dropping equations (12) and (14), China's export supply equation can be obtained as follows:

$$X_R^* = \varepsilon_R^X P_R^{S*} + \varepsilon_F^X P_F^* + \varepsilon_N^X P_N^* - (k_D \eta_R^D / k_X) VAT^* \quad (19)$$

where $\varepsilon_R^X = (\varepsilon_R - k_D \eta_R^D) / k_X$ is China's export supply elasticity with respect to the retail supply price. For normal parameter values, $\varepsilon_R^X > 0$, indicating that the increase in the supply price increases the export supply to the international market. $\varepsilon_F^X = -\phi_{RF} \varepsilon_R / k_X$ and $\varepsilon_N^X = -\phi_{RN} \varepsilon_R / k_X$ are the export supply elasticities with respect to the farm price and the price of non-farm inputs, respectively. Both of them are negative, implying that a higher input price reduces the export supply. The effect of the value-added tax on the export supply is indicated by $-k_D \eta_R^D / k_X$, which takes positive values. This means that a higher value-added tax on the retail domestic market increases the export supply.

Then, by equalizing equations (19) and (12) and substituting (14), the retail supply price can be obtained:

$$\begin{aligned} P_R^{S*} = &-\{(k_X \eta_R^X + k_D \eta_R^D) / [k_X(\eta_R^X - \varepsilon_R^X)]\} VAT^* + \\ &+ [\eta_R^X / (\eta_R^X - \varepsilon_R^X)] ETR^* + [\varepsilon_F^X / (\eta_R^X - \varepsilon_R^X)] P_F^* + \\ &+ [\varepsilon_N^X / (\eta_R^X - \varepsilon_R^X)] P_N^* \end{aligned} \quad (20)$$

[2] According to Enke (1944) and Kinnucan and Zhang (2004), when one takes into account the ability of the government to exercise market power, a country within which there is pure competition amongst buyers and sellers can be treated as a "large economy", which means that when it acts as a collective unit, this country holds monopoly power or monopsony power to influence the world price.

[3] $VAT = 1 + r_V$, where r_V is the rate of value-added tax; $ETR = 1 + r_g$, where r_g is the rate of export tax rebate.

[4] All other exogenous variables that may affect demand and supply are assumed to be constant, and hence are suppressed. P_N (e.g., the price of marketing service) is assumed to be exogenously given to simplify the derivation of the price transmission elasticities (see Appendix A for details).

Table 1: Baseline data and model parameters.

Item	Definition	Value
η_R^D	Retail-level domestic demand elasticity	-0.31, -0.80, -1.40 [a]
ε_R	Retail-level supply elasticity	0.67 [b]
η_R^X	Retail-level export demand elasticity	-0.95 [c]
η_F	Elasticity of demand for farm inputs	-0.27, -0.70, -1.23 [d]
ε_F	Farm-level supply elasticity	0.59 [d]
ϕ_R	Price transmission elasticity from the farm market to the retail market	0.81 [e]
ϕ_{FR}	Price transmission elasticity from the retail market to the farm market	1.26 [e]
k_D	Retail-level domestic quantity share (=D_R/S_R)	0.92 [f]
k_X	Retail-level export quantity share (=X_R/S_R)	0.08 [f]
$P_R^0 S_R^0$	Total revenue of retail-level producers	25,130 [g]
$P_R^0 D_R^0$	Retail-level domestic consumer expenditure	22,640 [g]
$P_R^0 X_R^0$	Foreign consumer expenditure on Chinese fishery products	2,490 [g]
$P_F^0 D_F^0$	Total expenditure on farm-level products	16,780 [g]
$P_F^0 S_F^0$	Total revenue of farm-level producers	16,780 [g]
V_D	Percentage change in the farm price when D_F^* and P_N^* equal zero	0.001 [h]
V_S	Percentage change in the retail price when S_R^* and P_N^* equal zero	0.0004 [h]

[a] Taken from Han et al. (1997), Dey (2008), and Ma (2004), respectively.
[b] Taken from Dey (2008)
[c] Taken from Graham *et al*. (1998)
[d] Computed based on Tewari (2003): as η_R^D changes, η_F varies too
[e] See Appendix A for details
[f] Taken from the Chinese Yearbook of Fishery Statistics (2012) and the United Nations Commodity Trade Statistics Database
[g] Taken from the Chinese Yearbook of Fishery Statistics (2012) and the Report of the Ministry of Agriculture of China. All data include tilapia, crustacean, and molluscs. Unit: million dollars
[h] Computed based on the formulas in Sun and Kinnucan (2000)
Source: own composition

When the linkage between the farm and the retail markets is not considered, the reduced form of the elasticity of supply price with respect to the export tax rebate is represented by $\eta_R^X/(\eta_R^X-\varepsilon_R^X)$, which is restricted to being a positive value, indicating that an export tax rebate on the export products causes the supply price to move up. Hence, the effect of the tax rebate on the supply price is determined by the relative magnitude of the export demand and supply elasticities. When the domestic producers face a perfectly elastic export demand curve or a perfectly inelastic export supply curve, then $\eta_R^X/(\eta_R^X-\varepsilon_R^X)=1$. This means that the export tax rebate is completely passed on to Chinese producers, and thus it has the largest possible effect. In contrast, when China has a perfectly elastic export supply curve or a perfectly inelastic export demand curve, $\eta_R^X/(\eta_R^X-\varepsilon_R^X)=0$, that is, the tax rebate has no impact on domestic producers. As derived above, $\varepsilon_R^X=(\varepsilon_R-k_D\eta_R^D)/k_X$, indicating that a larger retail supply elasticity, domestic demand elasticity or a larger market share of the domestic market increases the export supply elasticity, and thus attenuates the effectiveness of the export rebate. This result is consistent with the study by Ishikawa and Kuroda (2007), which finds that whether or not an export promotion policy improves the welfare of the export country depends on the slope of the inverse demand curve and the market share.

If, instead, the linkage between the farm and retail markets is taken into consideration, the reduced-form supply price is as follows:

$$P_R^{S*}=-\{(k_X\eta_R^X+k_D\eta_R^D)/[k_X(\eta_R^X-\varepsilon_R^X+\xi)]\}VAT^*+ \\ +[\eta_R^X/(\eta_R^X-\varepsilon_R^X+\xi)]ETR^*+ \\ +\{\varepsilon_N^X/[(\eta_R^X-\varepsilon_R^X)(\eta_R^X-\varepsilon_R^X+\xi)]\}P_N^* \tag{21}$$

where $\xi=(\varepsilon_R^X\phi_{FR}\eta_F)/(\eta_F-\varepsilon_F)>0$, suggesting that after taking into account the farm-retail linkage, the effects of the export tax rebate on Chinese producers' supply price become larger.

When one turns to the effects of this policy on the farm price, the relationship between the farm and the retail supply prices can be obtained by imposing the market clearing condition in the farm market:

$$P_F^*=[(\phi_{FR}\eta_F)/(\eta_F-\varepsilon_F)]P_F^{S*}+ \\ +[(\phi_{FN}\eta_F)/(\eta_F-\varepsilon_F)]P_N^* \tag{22}$$

where the coefficient $[(\phi_{FR}\eta_F)/(\eta_F-\varepsilon_F)]>0$, indicating that the effects of a value-added tax or an export tax rebate on the farm price are in the same direction as the effects on the retail supply price. Therefore, an increase in the value-added tax in the export market depresses the farm price. In other words, the farm price can be increased by an export tax rebate. For the farm price, the effectiveness of the export tax rebate is determined not only by the relative magnitude of the demand and supply elasticities of export and by the market shares, but also by the relative magnitude of the demand and supply elasticities at the farm level and the price transmission elasticity from the retail market to the farm market. A higher price transmission elasticity implies a larger effect of the export rebate on the farm price. Since $0<[\eta_F/(\eta_F-\varepsilon_F)]<1$, $[(\phi_{FR}\eta_F)/(\eta_F-\varepsilon_F)]$ has an upper limit of ϕ_{FR} and a lower limit of 0.

The measure for welfare

According to Alston et al. (1995), in a multi-stage market, the measurement of welfare change is not affected by the choice of the market level to be measured. To avoid double counting, in this paper, we choose the retail market to measure welfare changes in the industry. Following Sun and Kinnucan (2001), by assuming parallel shifts of demand and supply curves, the welfare changes for Chinese domestic producers, domestic consumers, and foreign consumers are approximated by the following formulas:

$$\Delta CS_D = -P_R^0 D_R^0 P_R^{D*}(1+0.5D_R^*) \quad (23)$$

$$\Delta PS_D = -P_R^0 S_R^0 (V_S - P_R^{S*})(1+0.5S_R^*) \quad (24)$$

$$\Delta CS_X = -P_R^0 X_R^0 P_R^{X*}(1+0.5X_R^*) \quad (25)$$

where ΔCS_D is the change in domestic consumer surplus associated with the export tax rebate changes; ΔPS_D is the change in producer surplus at the retail level; ΔCS_X is the change in the foreign consumer surplus due to a change in the export tax rebate. Moreover, $P_R^0 D_R^0$ is the retail-level domestic consumer expenditure in the initial equilibrium; $P_R^0 S_R^0$ is the total revenue of Chinese producers for both domestic and export markets in the initial equilibrium; and $P_R^0 X_R^0$ is the foreign consumer expenditure on Chinese products. P_R^{D*}, P_R^{S*}, and P_R^{X*} are the relative changes in retail-level domestic demand price, supply price, and export price, respectively. Similarly, D_R^*, S_R^*, and X_R^* are the relative changes in retail-level domestic demand, total supply, and exports associated with the changes in the export tax rebate, respectively. Finally, V_S is the percentage change in the retail price when the changes in both quantity and non-farm price equal zero.

As mentioned before, considering a multi-stage market allows us not only to represent a more realistic setting, but also to obtain the producer surplus changes in the farm market as follows:

$$\Delta PS_F = -P_F^0 S_F^0 P_F^*(1+0.5S_F^*) \quad (26)$$

where ΔPS_F is the change in farm producer surplus associated with a change in the export tax rebate; $P_F^0 S_F^0$ is the revenue of farm producers in the initial equilibrium; P_F^* is the relative change in the farm price; and S_F^* is the relative change in farm supply. V_D is the percentage change in the farm price when the changes in both quantity and non-farm input price equal zero.

Parameterization

To apply the above model to Chinese fishery sector, we survey the empirical literature to determine or derive the "best-bet" values for the numerical values of the elasticities of demand, supply, and price transmission. These values, combined with other necessary data in Table 1, are then used to simulate the effects of *VAT* and *ETR* on prices, trade flows, and welfare distribution. Among the parameter values, there is a large variation in the value of domestic demand elasticity reported by different studies. Thus, a sensitivity analysis is performed by considering alternative values of this parameter to determine sensitivity, and to highlight the finding that a higher domestic demand elasticity (which implies a higher export supply elasticity) impairs the effectiveness of the export tax rebate policy. Moreover, two scenarios are considered, depending on whether the vertical linkage between farm and retail markets is considered or not (Scenario 1 and Scenario 2, respectively).

Results

Pass-through of the export tax rebate

The incidence of the export tax rebate in the Chinese fishery sector is shown in Table 2. For example, the reduced-form elasticity of the domestic supply price with respect to the export tax rebate indicates the percentage change in the supply price associated with a percentage change in *ETR*. As mentioned before, $\xi > 0$ means that the linkage between farm and retail markets is considered. Since the non-farm price P_N^* is used to derive the parameters, we will not discuss its effects.

Focusing first on the retail market, when $\xi > 0$, a 1% increase in *VAT*[5] is split between a 0.13%-0.55% increase in export price (as well as domestic demand price) and a 0.45%-0.87% decrease in the Chinese supply price. Chinese producers have a heavier burden as the domestic demand elasticity rises. The higher domestic demand price reduces the quantity demanded in the domestic market by about 0.17%-0.21%. The lower supply price reduces the quantity of supply by about 0.17%-0.21%.

When it comes to the effects of the export tax rebate, Table 2 shows that a 1% increase in *ETR* is split between a 0.05%-0.09% increase in the retail supply price and a 0.91%-0.95% decrease in the export price. In other words, the export tax rebate has a much larger effect on reducing the foreign consumers' price than on improving the domestic producers' one. As a result, the quantity of export is increased by 0.86%-0.90%, whereas the quantity of domestic supply is only increased by at most 0.04%.

As the sensitivity analysis suggests, the domestic producers' benefits get smaller when the domestic demand becomes more price elastic, which in turn increases the magnitude of the export supply elasticity. This highlights the fact that the positive effect of the export tax rebate on the supply price depends on the relative magnitude of the export supply and demand elasticities. Specifically, if the export supply elasticity is much larger than the export demand elasticity, an export tax rebate has a small effect on increasing the domestic supply price, but a large one on reducing the export price.

Then, when one focuses on the farm market, an increase in the value-added tax reduces the quantity of supply at the retail level, and thus depresses the price at the farm level and reduces the quantity of farm supply and demand. On the other hand, a 1% increase in *ETR* increases the farm quantity by 0.03% (which is insensitive to the change of η_d), and increases the farm price by 0.04-0.06%. Based on the foregoing results presented in Section 2, the reason for such results is clear: the retail supply is enlarged by an export tax rebate, and thus quantity and price for the farm are also enhanced.

[5] It should be noted that a 1% change in variable *ETR* equals a 1% change in $(1+r_E)$ instead of a 1% change in r_E. Similarly, a 1% change in variable *VAT* equals a 1% change in $(1+r_V)$, instead of a 1% change in r_V.

Table 2: Reduced-form elasticities.

Endogenous Variable	Exogenous Variable					
	VAT***	***ETR******	***VAT******	***ETR******	***VAT******	***ETR******
$\xi > 0$						
	$\eta_d = -0.31$		$\eta_d = -0.80$		$\eta_d = -1.40$	
D_R^*	-0.17	-0.03	-0.21	-0.06	-0.18	-0.07
S_R^*	-0.20	0.04	-0.21	0.02	-0.17	0.01
X_R^*	-0.53	0.86	-0.25	0.88	-0.12	0.90
P_R^{D*}	0.55	0.09	0.26	0.07	0.13	0.05
P_R^{X*}	0.55	-0.91	0.26	-0.93	0.13	-0.95
P_R^{S*}	-0.45	0.09	-0.74	0.07	-0.87	0.05
D_F^*	-0.12	0.03	-0.35	0.03	-0.51	0.03
S_F^*	-0.12	0.03	-0.35	0.03	-0.51	0.03
P_F^*	-0.21	0.04	-0.59	0.06	-0.87	0.05
$\xi = 0$						
	$\eta_d = -0.31$		$\eta_d = -0.80$		$\eta_d = -1.40$	
D_R^*	-0.20	-0.02	-0.36	-0.04	-0.36	-0.04
S_R^*	-0.23	0.05	-0.37	0.03	-0.37	0.03
X_R^*	-0.62	0.88	-0.43	0.90	-0.43	0.90
P_R^{D*}	0.65	0.07	0.45	0.05	0.45	0.05
P_R^{X*}	0.65	-0.93	0.45	-0.95	0.45	-0.95
P_R^{S*}	-0.35	0.07	-0.55	0.05	-0.55	0.05

Source: own composition

Results of Scenario 2 are also shown in Table 2. The comparison implies that, as indicated before, the change in the domestic supply price will be underestimated if the vertical linkage is not considered. However, the supply quantity will be overestimated; thus, the welfare effects of not considering the farm-retail linkage are ambiguous, a topic which will be discussed in detail in the next subsection.

Distribution of the welfare gains

In order to simulate the distribution of welfare gains caused by the changes in *ETR*, inserting the reduced-form elasticities in Table 2 into equations (23)-(25) yields:

$$\Delta CS_D = -P_R^0 D_R^0 [(P_R^{D*}/ETR^*)ETR^*] \\ [1 + (0.5D_R^*/ETR^*)ETR^*] \tag{27}$$

$$\Delta PS_D = -P_R^0 D_R^0 [V_S - (P_R^{S*}/ETR^*)ETR^*] \\ [1 + (0.5S_R^*/ETR^*)ETR^*] \tag{28}$$

$$\Delta CS_X = -P_R^0 X_R^0 [(P_R^{X*}/ETR^*)ETR^*] \\ [1 + (0.5X_R^*/ETR^*)ETR^*] \tag{29}$$

where P_R^{D*}/ETR^*, P_R^{S*}/ETR^*, P_R^{X*}/ETR^*, D_R^*/ETR^*, S_R^*/ETR^*, and X_R^*/ETR^* are set equal to the corresponding reduced-form elasticities given in Table 2.

The "best-bet" measure of the welfare changes is presented in Table 3. All results are for a 1% increase in *ETR*. The third, fifth, and seventh columns show how an increase in welfare is distributed between Chinese producers and foreign consumers. Generally, under both scenarios, the total welfare gains (*TWG*) range from 32.93-42.61 million dollars, most of which go to foreign consumers (60%-75% of *TWG* under Scenario 1, and 57%-73% under scenario 2). This implies that, as highlighted by some financial commentators and taxpayers, with the "best-bet" parameter values, the export rebate in the Chinese fishery sector is subsidising foreign consumers more than domestic producers.

The value and percentage of the benefits for Chinese producers are enhanced even without considering the farm-retail connection, but such an increment is not sufficient to alter the conclusion that foreign consumers are the major beneficiaries of the export tax rebate policy. The comparison between the two scenarios indicates that if we do not consider the farm market, the simulation results on values and percentage of domestic producer gains would be overestimated, and the loss for Chinese consumers would be underestimated. This sheds light on the importance of considering the farm-retail linkage even when the input markets are not of interest.

The sensitivity analysis shows that the total welfare gains are increasing with the growth of the domestic demand elasticity with respect to price. Under both scenarios, the gains for domestic producers and the loss for domestic consumers are both decreasing when the domestic demand becomes more price elastic (which makes the export supply become more elastic as well). This is consistent with the last section, in which we conclude that as the export supply elasticity of an industry rises, *ceteris paribus*, we expect the effects of the export tax rebate on domestic producers to decline. Therefore, reducing the export supply elasticity (e.g., by improving the reliance on imports to reduce the domestic demand elasticity) may be helpful to enhance the effectiveness of the export rebate.

Dividing the welfare measurements of Scenario 1 in Table 3 by 25.11 million dollars (the government spend-

Table 3: Welfare distribution at the retail level (million dollars).

Item	Welfare Changes	Share of Gains	Welfare Changes	Share of Gains	Welfare Changes	Share of Gains
$\xi > 0$	$\eta_d = -0.31$		$\eta_d = -0.80$		$\eta_d = -1.40$	
ΔPS_D	15.75	40%	11.58	32%	8.17	25%
ΔCS_X	23.53	60%	24.21	68%	24.76	75%
ΔCS_D	-15.74	-	-11.58	-	-8.17	-
TWG	39.28	1.00	35.79	1.00	32.93	1.00
$\xi = 0$	$\eta_d = -0.31$		$\eta_d = -0.80$		$\eta_d = -1.40$	
ΔPS_D	18.53	43%	12.89	34%	9.39	27%
ΔCS_X	24.08	57%	24.69	66%	25.07	73%
ΔCS_D	-12.37	-	-8.60	-	-6.27	-
TWG	42.61	1.00	37.58	1.00	34.46	1.00

Note: *TWG* represents total welfare gains, $TWG = \Delta PS_D + \Delta CS_X$
share of gains $= \Delta PS_D (or\ \Delta CS_X)/TWG$
Source: own composition

ing corresponding to a 1% increase in the export tax rebate) yields the marginal benefit-cost ratios (MBCRs) shown in Table 4.

Table 4: Marginal benefit-cost ratios for a 1% increase in *ETR* in the Chinese fishery sector.

η_d	$MBCR_1$	$MBCR_2$	$MBCR_3$
-0.31	1.56	0.63	Approximately 0
-0.80	1.43	0.46	Approximately 0
-1.40	1.31	0.33	Approximately 0

Note: $MBCR_1 = TWG/25.11$; $MBCR_2 = \Delta PS_D/25.11$; $MBCR_3 = (\Delta PS_D + \Delta CS_D)/25.11$.
Source: own composition

The results for $MBCR_1$ suggest that the total welfare gains overweigh the government expenditure if TWG is con-sidered as comprising the overall "benefits" of this policy. $MBCR_1$ increases with a reduction in η_d. However, as discussed, the total welfare gains are shared between domestic producers and foreign consumers, and with the "best-bet" elasticities, the latter obtain most of the benefits. Only in the extreme cases where the export demand elasticity approaches 1 or the export supply elasticity approaches 0 can the entire export tax rebate be passed on to Chinese producers. Therefore, the results for $MBCR_2$ are of more interest to us. When the domestic demand elasticity is between -0.31 to -1.40, $MBCR_2$ ranges from 0.33 to 0.63. We also compute $MBCR_3$, which takes the Chinese consumer surplus into account, as Kinnucan and Cai (2011) state that, when analysing the effectiveness of a trade promotion policy, the so called "societal MBCRs" should not be ignored, for they indicate the effectiveness from a societal perspective, instead of an industry one. The results imply that when $MBCR_1$ equals 1.31-1.56, $MBCR_3$ approximates 0, due to the fact that the benefits for domestic producers are almost completely offset by the loss for domestic consumers. This is in line with previous studies (e.g., Alston et al., 1993; Wohlgenant, 1986), which find that with the assumptions of no distortion in other sectors and the opportunity cost of government spending equals the amount of payment, such export promotion policies are a costly way to improve domestic producers' welfare.

According to Alston and James (2002), the changes in retail-level producer surplus equal the sum of changes in the producer surplus for all inputs. Thus, considering the farm-retail linkage enables us to obtain the distribution of the welfare gains for Chinese producers between farm and non-farm input producers. To this end, we rewrite equation (26) as follows, and then calculate the welfare changes of both inputs with equation (30) and the results for ΔPS_D in Table 3. The results are presented in Table 5.

$$\Delta PS_F = P_F^0 S_F^0 [(P_F^*/ETR^*)ETR^*] [1 + (0.5S_F^*/ETR^*)ETR^*] \tag{30}$$

where P_F^*/ETR^* and S_F^*/ETR^* are set equal to the corresponding reduced-form elasticities given in Table 2.

Table 5 indicates that the welfare distribution between producers of farm and non-farm inputs is very sensitive to the variation of η_d. Farmers' share of the welfare gains improves dramatically with the increase in China's domestic demand elasticity in the fishery sector. As the domestic demand becomes more price elastic, farmers gradually become the biggest winners at the input markets. When η_d ranges from -0.31 to -1.40, farmers obtain 7.32 to 9.26 million dollars, accounting for 46% to 99% of the total producer surplus.

Table 5: Welfare distribution at input level (million dollars).

Item	Welfare Changes	Share of Gains	Welfare Changes	Share of Gains	Welfare Changes	Share of Gains
	$\eta_d = -0.31$		$\eta_d = -0.80$		$\eta_d = -1.40$	
ΔPS_F	7.32	46%	9.26	80%	8.12	99%
ΔPS_N	8.43	54%	2.32	20%	0.05	1%
ΔPS_D	15.75	1.00	11.58	1.00	8.17	1.00

Note: *share of gains* $= \Delta PS_F$ (or ΔPS_N) $/\Delta PS_D$
Source: Own composition

Discussion and conclusion

The basic premise of this study is that when considering an export tax rebate, the policymakers should not be indifferent about the benefit distribution among groups. This paper finds that the effectiveness of the export tax rebate on domestic producers depends on the relative magnitude of the export supply and demand elasticities. When the export country has a relatively large export supply elasticity, the benefits of domestic producers are very limited. Applying the model to the Chinese fishery sector, we find that with the "best-bet" parameters, although the total welfare gains overweigh the cost for the government, most of the gains go to foreign consumers. When considering the welfare changes of Chinese consumers, according to Gardner's (1983) criterion[6], the export tax rebate is efficient (under Scenario 1, *dPS/dCS* approaches 1.00). Nevertheless, from a societal perspective, the marginal benefit-cost ratio is almost zero.

Our results are consistent with the previous literature in that when considering an export promotion policy which redistributes welfare among producers, consumers and taxpayers, the policy makers have to assign weightings among these groups (Wohlgenant, 1986). Moreover, this paper emphasizes the importance of considering the transfer from domestic consumers and taxpayers to foreign consumers. Our derivation indicates that the export supply elasticity is determined by the elasticities of supply and domestic demand, and by the relevant market share. Therefore, in an industry with a relatively large domestic market share, a large domestic demand elasticity, or a large retail supply elasticity, the policymakers should be more prudent when considering such policies.

Another policy implication of this paper is that when evaluating a trade promotion policy in an agricultural sector, it is of great importance to take into account the benefits allocation among input producers, which has hardly received attention in the literature. In an industry with a relatively higher domestic demand elasticity, it is expected to have a larger effect on farm producers.

Under the World Trade Organization (WTO) rules, the export tax rebate is not considered as a subsidy as long as the tax rebate does not outweigh the tax paid by companies. The aim is to let the exports enter the international markets at tax-excluded prices and thus avoid double taxation on exports. The reduced-form elasticities indicate that the value-added tax raises the export price and lowers the quantity of exports. Hence without the rebate (or with an incomplete rebate), the value-added tax acts as an export tax (Feldstein and Krugman, 1990). Therefore, if the WTO requires its members to phase out export taxes, an export tax rebate system may be utilised as an export tax to realise export control.

Finally, it should be stressed that the model is based on the assumption that the price of non-farm inputs is exogenous. However, this may not be the case in reality. Hence the relaxation of this assumption provides a topic for further research to extend the present analysis. Moreover, the simulation results are based on elasticity values taken from previous studies, some of which are becoming dated. As the market structure may have changed dramatically, econometric efforts are needed to obtain updated estimations of the price elasticities of demand and supply.

[6] Gardner (1983) states that, when *dPS/dCS* approaches 1.00, the deadweight loss per dollar of consumers' welfare transferred to producers is zero at the margin, thus the policy designed to benefit producers is considered efficient.

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Appendix A. Derivation of price transmission elasticities

In a two-input, one-output demand and supply system, the output supply and the input demand functions are given by:

$$S_R = S_R(P_R^S, P_F, P_N) \tag{A.1}$$

$$D_F = D_F(P_R^S, P_F, P_N) \tag{A.2}$$

$$D_N = D_N(P_R^S, P_F, P_N) \tag{A.3}$$

By taking the logarithmic total differential of the first two equations we get:

$$dlnS_R = \varepsilon_R dlnP_R^S + \varepsilon_{RF} dlnP_F + \varepsilon_{RN} dlnP_N \tag{A.4}$$

and

$$dlnD_F = \eta_{FR} dlnP_R^S + \eta_F dlnP_F + \eta_{FN} dlnP_N \tag{A.5}$$

Thus, we get equations as follows:

$$\phi_{RF} = \partial lnP_R^S / \partial lnP_F = |\varepsilon_{RF}| / \varepsilon_R \tag{A.6}$$

and

$$\phi_{FR} = \partial lnP_F / \partial lnP_R^S = \eta_{FR} / |\eta_F|, \tag{A.7}$$

where ε_{RF} and η_{FR} are the elasticity of retail supply with respect to the farm price and the elasticity of farm demand with respect to the retail price, respectively. To obtain the values of ε_{RF} and η_{FR}, the above demand and supply system can be written as:

$$S_R^* = \varepsilon_R P_R^{S*} + \varepsilon_{RF} P_F^* + \varepsilon_{RN} P_N^* \tag{A.8}$$

$$D_F^* = \eta_{FR} P_R^{S*} + \eta_F P_F^* + \eta_{FN} P_N^* \tag{A.9}$$

$$D_N^* = \eta_{NR} P_R^{S*} + \eta_{NF} P_F^* + \eta_N P_N^* \tag{A.10}$$

With the restrictions of homogeneity and symmetry:

$$\varepsilon_R + \varepsilon_{RF} + \varepsilon_{RN} = 0 \tag{A.11}$$

$$\eta_{FR} + \eta_F + \eta_{FN} = 0 \tag{A.12}$$

$$\eta_{NR} + \eta_{NF} + \eta_N = 0 \tag{A.13}$$

$$\varepsilon_{RF} / \eta_{FR} = - P_F F / P_R R \tag{A.14}$$

$$\varepsilon_{RN} / \eta_{NR} = - P_N N / P_R R \tag{A.15}$$

$$\eta_{FN} / \eta_{NF} = P_N N / P_F F \tag{A.16}$$

Together with the values of ε_R, η_F, and η_N, the values of ε_{RF} and η_{FR} can be obtained.