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A trade and domestic tax reform in imperfectly competitive markets

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Abstract

This paper develops a model of an export oligopoly to examine the welfare effects of an export tax reduction and a production tax increase that makes the foreign country no-worse off. Whether or not entry into the oligopolistic industry is free, the proposed policy reform is shown to reduce welfare of the policy-implementing country and the world. Relating this result to the perfectly competitive case, we closely discuss its implications.

Keywords: welfare; export tax; production tax; restricted entry; free entry

JEL Classifications: F12; F13

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1 Introduction

Reductions in trade taxes have profoundly progressed over the last few decades. Trade theory suggests that they are welfare-improving, but there are countries against trade liberalization. The arguably biggest reason is that trade taxes have a large share in government revenue, which typically applies to low-income developing countries.¹ In order to cope with the prospective revenue loss associated with trade liberalization, the IMF and the World Bank have been suggesting an integrated reform of reducing trade taxes and adjusting domestic taxes such as consumption taxes and/or production taxes.

Focusing on export taxes, this paper examines the welfare effects of a reform composed of reducing export taxes and raising production taxes.² While a large literature addresses the welfare effects of reducing import tariffs and raising consumption taxes, the case of export taxes has received less attention.³ To our knowledge, Emran (2005) and Emran and Stiglitz (2005) are the only exceptions. Emran (2005), on the one hand, demonstrates that replacing export taxes with production taxes in a proper way ensures welfare and revenue improvements. Emran and Stiglitz (2005), on the other hand, consider the welfare effects of revenue-neutral export tax reductions and consumption tax increases.

This paper is along this strand of studies, and shares the same motivation and purpose as Emran (2005) and Emran and Stiglitz (2005), but our aim and methodology are very different from them in the following respects. First, we investigate a reform of export tax reductions and production tax increases that makes the trading country as well off as before the reform is made. There are at least two reasons to focus on this specific reform. For one thing, this requirement does not induce the foreign country to retaliate since it is a non-beggar-thy-neighbor policy. For another thing, we can evaluate the proposed policy reform from a *strict* Pareto improvement criterion. In the literature, a policy reform is often judged to be *potentially* desirable by demonstrating that both countries' welfare rises if an appropriate lump-sum transfer is allowed for. However, such an international income transfer is in reality quite difficult to implement, and thus it is more relevant to seek the possibility of strict Pareto improvements, i.e. both countries' welfare rises without any income transfer. For these two reasons, this paper will consider a tax reform that fixes the trading country's welfare. As will be clear, this policy reform is equivalent to a world-price-fixing reform.

Second, we allow the product market to be imperfectly competitive. For simplicity, we assume an export oligopoly serving both the domestic and exporting markets.⁴ Third, we cover both the case of restricted entry and

free entry in a unified way since the difference in entry modes often leads to contrasting results.⁵ We demonstrate that whether or not entry is free, the world-price-fixing reform of export tax reductions and production tax increases lowers welfare of the policy-implementing country while fixing the trading country's welfare, and hence the world loses from the reform. After proving this result in non-competitive settings, we discuss its implications in relation to the perfectly competitive case.

This paper is organized as follows. Sections 2 and 3 consider the welfare effects of the reciprocity-based tax reform in the case of restricted and free entry, respectively. Section 4 gives two notes to our results. Section 5 concludes.

2 Restricted entry

2.1 Model

This section explores a reform of export tax reductions and production tax increases that fixes the world price and the trading country's welfare. For this purpose, we present a simple model of an export oligopoly. There are two countries (Home and Foreign) and two goods (Goods 1 and 2). An asterisk (*) is attached to all the Foreign variables. The utility function of Home and

Foreign is given by

$$U = u(C_1) + C_2, \quad U^* = u^*(C_1^*) + C_2^*, \quad (1)$$

where U, C_1 and C_2 are utility, consumption of Good 1 and consumption of Good 2 of Home, respectively, and the Foreign variables are analogously defined. The functions $u(\cdot)$ and $u^*(\cdot)$ are strictly increasing and strictly concave. Letting p denote the consumer price of Good 1 in Home measured by Good 2 and the world price of Good 1, utility maximization subject to the budget constraint yields the demand functions $D(p) \equiv u'^{-1}(p)$ and $D^*(p^W) \equiv u^{*\prime-1}(p^W)$.⁶

The Home government levies an export tax t and a production tax s both of which take a specific (per-unit) form while laissez-faire prevails in Foreign.⁷ The world market is integrated, and oligopolized by $n \geq 1$ Home firms. Then, there is a relationship between the two domestic prices such that $p + t = p^W$, and the world market-clearing condition is

$$D(p) + D^*(p + t) = \sum_{j=1}^n x_j \equiv X, \quad (2)$$

where x_j is the output of firm j , and X is the aggregate output. Solving (2) for p yields $p(X, t)$ that has the following properties:

$$p_X(X, t) \equiv \frac{\partial p(X, t)}{\partial X} = \frac{1}{D' + D^{*\prime}} < 0 \quad (3)$$

$$p_t(X, t) \equiv \frac{\partial p(X, t)}{\partial t} = -\frac{D^{*\prime}}{D' + D^{*\prime}} < 0. \quad (4)$$

Additionally, we make a simplifying assumption that demand is linear so that the second derivatives of $p(\cdot)$ are zero.

Since the profit of firm i is defined by

$$p(X, t)x_i - c(x_i) - sx_i,$$

the first and second-order conditions for profit maximization are

$$x_i p_X(X, t) + p(X, t) - c'(x_i) - s = 0, \quad 2p_X(X, t) - c''(x_i) < 0, \quad (5)$$

where $c(\cdot)$ is the production cost that is common to all the firms. When all the n firms produce the same output x , the first-order condition is rewritten as

$$xp_X(nx, t) + p(nx, t) - c'(x) - s = 0, \quad (6)$$

which determines the equilibrium output given s and t . Total differentiation yields

$$[(n+1)p_X - c'']dx = -p_t dt + ds, \quad (7)$$

from which we find the effect of s and t on the output:

$$\frac{\partial x}{\partial t} = -\frac{p_t}{(n+1)p_X - c''}, \quad \frac{\partial x}{\partial s} = \frac{1}{(n+1)p_X - c''}. \quad (8)$$

2.2 Reform

In a context of the above model, we now define a trade and domestic tax reform that fixes the world price. Note that this reform also fixes welfare of

Foreign since it adopts a laissez-faire policy. Having this in mind, let us note that the world price $p^W \equiv p(nx, t) + t$ changes as follows:

$$\begin{aligned} dp^W &= \left(np_X \frac{\partial x}{\partial t} + p_t + 1 \right) dt + np_X \frac{\partial x}{\partial s} ds \\ &= \frac{(p_X - c'')p_t + (n+1)p_X - c''}{(n+1)p_X - c''} dt + \frac{np_X}{(n+1)p_X - c''} ds, \end{aligned} \quad (9)$$

associated with an increment in s and t . Hence, the two taxes have to change according to

$$ds = -\frac{(p_X - c'')p_t + (n+1)p_X - c''}{np_X} dt, \quad (10)$$

so as to fix the world price, namely, $dp^W = 0$.

Eq. (10) has an interpretation that is simple but important for interpreting the welfare effect of the tax reform. To know it, let us focus on the special case of constant marginal cost ($c'' = 0$). Then, (10) reduces to

$$ds = -\frac{p_t + n + 1}{n} dt = -\frac{(n+1)D' + D^*'}{n(D' + D^*')} dt, \quad (11)$$

from (3) and (4). Since we are considering export tax reductions $dt < 0$ and its coefficient in the right-hand side is negative, the sign of ds becomes positive, that is, the production tax must be raised in order to fix the world price. In addition, the production tax must be raised by more than the export tax reduction, namely, $|ds| > |dt|$.

These properties of the reform of export tax reductions and production tax increases are explained as follows. Recalling that export taxes have the

effect equivalent to production taxes plus consumption subsidies, a reduction in export taxes encourages production and discourages consumption, leading to an expansion of export supply. Then, the world price would fall if no additional adjustment of domestic taxes would be adopted. In order to prevent the world price from going down, the Home government needs to raise the production tax to suppress the export supply. Moreover, (11) tells that over-taxing production is required since the Home government can change only domestic production with the production tax whereas the initial reduction in export tax affects both production and consumption.⁸

Substituting (10) into ds in the right-hand side of (7), it becomes

$$\begin{aligned} -p_t dt + ds &= \left[-p_t - \frac{(p_X - c'')p_t + (n+1)p_X - c''}{np_X} \right] dt \\ &= -\frac{[(n+1)p_X - c''](p_t + 1)}{np_X} dt. \end{aligned} \quad (12)$$

Then, all we have to do is to compute the comparative statics effects of (12).

A simple manipulation leads to

$$\left. \frac{\partial x}{\partial t} \right|_{dp^W=0} = -\frac{p_t + 1}{np_X}, \quad \left. \frac{\partial X}{\partial t} \right|_{dp^W=0} = -\frac{p_t + 1}{p_X}, \quad (13)$$

which is used to find the welfare effect in the next subsection.

2.3 Welfare effect

This subsection considers a welfare effect of a trade and domestic tax reform given in (10). Note here that we need not consider the effect on Foreign's

welfare since it depends solely on p^W , and hence constant with the suggested reform.

Home's welfare W consists of consumer surplus CS , the aggregate firm profits $n\pi$, and government revenue T :

$$CS \equiv u(D(p(X, t))) - p(X, t)D(p(X, t)) \quad (14)$$

$$n\pi = n[p(X, t)x - c(x) - sx] \quad (15)$$

$$T \equiv sX + t[X - D(p(X, t))]. \quad (16)$$

The change in these components of welfare is respectively obtained as

$$\left. \frac{\partial CS}{\partial t} \right|_{dp^W=0} = - \left(p_X \left. \frac{\partial X}{\partial t} \right|_{dp^W=0} + p_t \right) D = D \quad (17)$$

$$\begin{aligned} \left. \frac{\partial(n\pi)}{\partial t} \right|_{dp^W=0} &= n \left[(n x p_X + p - c' - s) \left. \frac{\partial x}{\partial t} \right|_{dp^W=0} + x p_t - s \frac{\partial s}{\partial t} \right] \\ &= x[p_t - (n - 1)] - X \frac{\partial s}{\partial t} \end{aligned} \quad (18)$$

$$\left. \frac{\partial T}{\partial t} \right|_{dp^W=0} = X \frac{\partial s}{\partial t} + s \left. \frac{\partial X}{\partial t} \right|_{dp^W=0} + X - D + t \left[\left. \frac{\partial X}{\partial t} \right|_{dp^W=0} - \left(p_X \left. \frac{\partial X}{\partial t} \right|_{dp^W=0} + p_t \right) D' \right], \quad (19)$$

where the first-order condition for utility maximization and profit maximization, and the fact that $p_X (\partial X / \partial t)|_{dp^W=0} + p_t = -1$ have been used. Summing Eqs. (17)-(19) up, the welfare effect is

$$\left. \frac{\partial W}{\partial t} \right|_{dp^W=0} = x(p_t + 1) + tD' - (s + t) \frac{p_t + 1}{p_X}$$

$$\begin{aligned}
&= xp_X D' + tD' - (s + t)D' \\
&= (xp_X - s)D' = -(p - c')D' > 0, \tag{20}
\end{aligned}$$

where we have used $(p_t + 1)/p_X = D'$ from (3) and (4), and the last equation follows from the first-order condition for profit maximization. Eq. (20) establishes:

Proposition 1.

Suppose that entry into the oligopolistic industry is restricted. Then, the world-price-fixing reform of export tax reductions and production tax increases reduces welfare of Home and the world.

(Table 1 around here)

By using the first row of Table 1, let us seek the intuitions behind Proposition 1. As has already been explained in details, over-taxation on domestic production is needed in response to a reduction in export taxes. Not surprisingly, this decreases the output of all firms, which causes the domestic price to rise. As a result, consumer surplus in Home decreases. Moreover, a decrease in the individual firm's output decreases its profit. Although the effect on government revenue is indeterminate, the negative effect on consumer surplus and the firm profits plays a dominant role, thereby involving a

welfare loss. Since both the world price and Foreign's welfare are unchanged with the proposed reform, the world welfare also declines as a result of the reform.

What is worth noting is that the sign of c'' is irrelevant to the validity of Proposition 1. In view of that comparative statics outcomes are quite sensitive to the sign of c'' , this robustness is of great importance in the practical sense because the policy implication of the reform is not influenced by the sign of c'' .⁹

3 Free entry

3.1 Model

This section endogenizes the number of oligopolistic firms to reconsider the validity of Proposition 1. In the present case, the equilibrium conditions consist of the profit maximization condition (6), and the zero profit condition:

$$xp(nx, t) - c(x) - sx = 0. \quad (21)$$

Noting that n as well as x is an endogenous variable, an increment in t and s affects x and n as follows.

$$\begin{aligned} & \begin{bmatrix} (n+1)p_X - c'' & xp_X \\ nxp_X + p - c' - s & x^2p_X \end{bmatrix} \begin{bmatrix} dx \\ dn \end{bmatrix} \\ = & \begin{bmatrix} (n+1)p_X - c'' & xp_X \\ (n-1)xp_X & x^2p_X \end{bmatrix} \begin{bmatrix} dx \\ dn \end{bmatrix} = \begin{bmatrix} -p_t \\ -xp_t \end{bmatrix} dt + \begin{bmatrix} 1 \\ x \end{bmatrix} ds. \quad (22) \end{aligned}$$

Solving this system yields the comparative statics outcomes:

$$\frac{\partial x}{\partial t} = \frac{\partial x}{\partial s} = 0, \quad \frac{\partial n}{\partial t} = -\frac{p_t}{xp_X} \quad \frac{\partial n}{\partial s} = \frac{1}{xp_X}, \quad (23)$$

and

$$\frac{\partial X}{\partial t} = x \frac{\partial n}{\partial t} + n \frac{\partial x}{\partial t} = -\frac{p_t}{p_X}, \quad \frac{\partial X}{\partial s} = x \frac{\partial n}{\partial s} + n \frac{\partial x}{\partial s} = \frac{1}{p_X}. \quad (24)$$

3.2 Reform strategy

Eq. (24) allows us to know the change in the two taxes so as to keep the world price constant. Differentiating the definition of the world price $p^W = p(X, t) + t$ totally and using (24), we have

$$dp^W = \left(p_X \frac{\partial X}{\partial t} + p_t + 1 \right) dt + p_X \frac{\partial X}{\partial s} ds = dt + ds = 0. \quad (25)$$

Eq. (25) suggests that the production tax must be raised in a point-by-point manner in response to export tax reductions. This is because a reduced export tax induces new entry into the oligopolistic industry, and so an increase in production tax is required to prevent such entry. What is worth noting is that the Home government adjusts the two taxes in a one-to-one way under free entry while it must over-tax production under restricted entry.

In what follows, we make a comparative statics analysis associated with

$ds = -dt$. Under this policy reform, the right-hand side of (22) becomes

$$\begin{bmatrix} -p_t \\ -xp_t \end{bmatrix} dt + \begin{bmatrix} 1 \\ x \end{bmatrix} ds = \begin{bmatrix} -p_t \\ -xp_t \end{bmatrix} dt + (-1) \begin{bmatrix} 1 \\ x \end{bmatrix} dt = \begin{bmatrix} -(p_t + 1) \\ -x(p_t + 1) \end{bmatrix} dt. \quad (26)$$

The change in x , n and X thus becomes

$$\left. \frac{\partial x}{\partial t} \right|_{dp^w=0} = 0, \quad \left. \frac{\partial n}{\partial t} \right|_{dp^w=0} = -\frac{p_t + 1}{xp_X}, \quad \left. \frac{\partial X}{\partial t} \right|_{dp^w=0} = -\frac{p_t + 1}{p_X}. \quad (27)$$

3.3 Welfare effect

In the free entry case, Home's welfare consists of consumer surplus and government revenue since all the firms make zero profit. The proposed tax reform affects CS and T as follows.

$$\left. \frac{\partial CS}{\partial t} \right|_{dp^w=0} = - \left(p_X \left. \frac{\partial X}{\partial t} \right|_{dp^w=0} + p_t \right) D = D \quad (28)$$

$$\left. \frac{\partial T}{\partial t} \right|_{dp^w=0} = X \frac{\partial s}{\partial t} + s \left. \frac{\partial X}{\partial t} \right|_{dp^w=0} + X - D + t \left[\left. \frac{\partial X}{\partial t} \right|_{dp^w=0} - \left(p_X \left. \frac{\partial X}{\partial t} \right|_{dp^w=0} + p_t \right) D' \right]. \quad (29)$$

Aggregating (28) and (29), and using (27) and $p_X (\partial X/\partial t)|_{dp^w=0} + p_t = -1$,

we obtain

$$\begin{aligned} \left. \frac{\partial W}{\partial t} \right|_{dp^w=0} &= -(s+t) \frac{p_t + 1}{p_X} + tD' \\ &= -(s+t)D' + tD' = -sD' > 0, \end{aligned} \quad (30)$$

where we have used $(p_t + 1)/p_X = D'$ from (3) and (4). Eq. (30) gives:

Proposition 2.

Suppose that entry into the oligopolistic industry is free. Then, the world-price-fixing reform of export tax reductions and production tax increases reduces welfare of Home and the world.

The second row of Table 1 is used to intuitively interpret this result. As mentioned in the last subsection, the policy reform in the present case involves a point-by-point increase in production taxes and reduction in export taxes. According to the table, this change in two taxes reduces the total output by promoting exit of the firms and preserving the output of each incumbent.

The resultant decrease in the total output leads to a loss in consumer surplus by raising the consumer price. Note here that the firm profits remain unchanged since they are zero both before and after the reform. While the effect on government revenue is ambiguous, the loss in consumer surplus is so dominant that the overall effect on welfare becomes negative.

4 Discussions

In this section, we offer two notes about Propositions 1 and 2. First, we discuss the case of an export subsidy, and then we compare our results with

those in a perfectly competitive model.

4.1 Export subsidy

The foregoing arguments, which rest on the assumption that t is an export tax, can readily be modified to the case of an export subsidy. If t is negative, it represents an export subsidy, and $dt > 0$ expresses a reduction in export subsidies. What deserves attention is that the world-price-fixing policy reform becomes welfare-improving for Home and the world by looking at Eqs. (20) and (30). Furthermore, as stressed in Introduction, no international income transfer is needed to achieve this objective.

4.2 Perfect competition

While our focus is on imperfect competition, it is useful to relate our results to the result under perfect competition. To this end, suppose the following model of perfect competition:¹⁰

$$e(p^W - t, W) = r(p^W - t - s) + sr_p(p^W - t - s) + t[r_p(p^W - t - s) - e_p(p^W - t, W)] \quad (31)$$

$$e^*(p^W, W^*) = r^*(p^W) \quad (32)$$

$$e_p(p^W - t, W) + e_p^*(p^W, W^*) = r_p(p^W - t - s) + r_p^*(p^W), \quad (33)$$

where $e(\cdot)$ and $e^*(\cdot)$ are an expenditure function, $r(\cdot)$ and $r^*(\cdot)$ are a revenue (GDP) function, and the rest of the notations follows the main text. The subscripts p refer to a partial derivative with respect to p . Eq. (31) is an income-expenditure equality of Home, (32) is the counterpart of Foreign, and (33) is a world market-clearing condition. This system determines W, W^* and p given t and s . Then, the final outcome turns out to be¹¹

$$\left. \frac{\partial W}{\partial t} \right|_{dp^W=0} = -\frac{se_{pp}}{e_u - se_{pu}} > 0, \quad (34)$$

under the plausible assumption that $e_p - se_{pu} > 0$.¹² In other words, the welfare-reducing property of the world-price-fixing reform survives perfect competition. The reason is that the reform-induced decline in domestic production raises the domestic consumer price, and the resulting loss in consumer utility plays a central role in the overall welfare effect. This coincidence of results is of great importance from both theoretical and practical viewpoints because it asserts that the welfare-reducing outcomes are valid whether or not the product market is competitive.

This model is also used to identify the effect of the reform for a small open economy.¹³ Just by differentiating (31) and using $ds = -dt$, we have

$$\left. \frac{\partial W}{\partial t} \right|_{ds=-dt} = \frac{te_{pp}}{e_W + te_{pW}} < 0. \quad (35)$$

As a result, the point-by-point replacement of an export tax with a produc-

tion tax necessarily improves welfare of Home. Taking into account that an export tax reduction is decomposed into a production tax reduction and a consumption subsidy reduction, the proposed reform has a net effect of a consumption subsidy reduction. That is, this reform raises welfare by decreasing consumption distorted by an export tax. Therefore, it is a key behind our results whether the reform-implementing government has an ability to affect the world price.¹⁴

5 Concluding remarks

This paper has theoretically considered the effectiveness of a trade and domestic tax reform that makes the trading country's no-worse off by fixing the world price. We have shown that the proposed reform of export tax reductions and production tax increases has a negative welfare effect regardless of freeness of entry. This result may be useful since it is in contrast to the result of Emran (2005) that positively evaluates the combination of export tax reductions and production tax increases.¹⁵

We have admittedly left much unexplored. In particular, it is worth mentioning that our results rest on the assumption that no firm exists in the exporting country. This assumption, which is undoubtedly restrictive, allows us to make a transparent analysis and obtain clear results. It is guessed

that our results may be reversed if international oligopoly between domestic and foreign firms is allowed. Moreover, the slightly different assumption on market structures as well as entry modes is conjectured to alter our results. It is our future research agenda to explore the validity of our results in a variety of market structures, e.g., international oligopoly and monopolistic competition in view of the recent developments of the GATT/WTO theory in oligopolistic and monopolistically competitive models, e.g., Ossa (2011) and Bagwell and Staiger (2012a, 2012b).

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Notes

1. See IMF (2005) for comprehensive evidence.
2. Piermartini (2004) and Solleder (2012) survey the recent literature on the effects of export taxes.
3. See, among others, Hatzipanayotou et al. (1994) and Keen and Ligthart

(2002) both of whom prove that a point-by-point tariff reduction associated with a consumption tax increase improves both welfare and government revenue for a small open economy.

4. Our model is inspired by Ishikawa (2000, 2004), Ishikawa and Kuroda (2007) and Ishikawa and Mukunoki (2008a, 2008b).

5. Markusen and Venables (1988) and Brander (1995) clearly suggest this in a context of strategic trade policies. Haufler et al. (2005) and McCracken and Stahler (2010) also address how free entry into the oligopolistic industry affects the debate over consumption versus production taxation in open economies.

6. All the results in this paper are valid even if inverse demand is defined by the world price p^W rather than the Home consumer price p . The proof is available from the authors upon request.

7. If t is negative, it represents an export subsidy. This case is briefly addressed in Section 4.

8. If c'' is too negative, the foregoing argument may be invalid. However, the main results in this paper are valid regardless of the sign of c'' .

9. See Ishikawa (2000, 2004), Ishikawa and Kuroda (2007) and Ishikawa and Mukunoki (2008a, 2008b) who study how the sign of c'' affects the policy effects.

10. We assume a two-country, two-good model while the existing literature on tariff reforms usually employs a multi-good model.
11. The detailed proof is available from the authors upon request.
12. This inequality is called a Hatta Normality Condition after Hatta (1977a, 1977b).
13. This is exactly what Emran (2005) considers.
14. This point is suggested by an anonymous referee.
15. Note, however, that the reform considered in this paper and Emran (2005) is very different. Our reform aims to fix the world price while Emran's (2005) reform is designed to fix the producer price.

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	x	n	nx	CS	π	T	W	W^*	$W + W^*$
restricted entry	–	(exogenous)	–	–	–	?	–	0	–
free entry	0	–	–	–	0	?	–	0	–

Table 1: The effects of the reform