

## How does state ownership affect optimal export taxes?

Ngo Long  
*McGill University*

Frank Staehler  
*University of Otago*

### *Abstract*

This note discusses the influence of state ownership on optimal export taxes. We demonstrate an invariance theorem: the degree of state ownership affects neither the level of socially optimal export levels nor welfare nor the level of optimal trade taxes.

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# 1 Introduction

Although a lot of state-owned enterprises have been privatized or partially privatized in the last decades, state ownership still plays an important role in most economies. The OECD (2005) reports that state-owned enterprises make up to 10 % of employment and up to 50 % of market capitalization in some OECD countries. Furthermore, a lot of firms are owned jointly by private agents and the government. We will label these partially state-owned firms as mixed enterprises. These mixed enterprises co-exist with private firms in a lot of industries, and the role of state ownership has been investigated in much detail empirically in a closed economy framework.<sup>1</sup>

The international trade literature, however, has by and large ignored the role of mixed enterprises. The few exceptions have either considered the degree of partial ownership and/or the role of tariffs and production subsidies.<sup>2</sup> None of the papers has considered the case that both mixed enterprises and private firms may export from the same country to another country. In this note, we consider this case of export policies in a model à la Rodrik (1989). We use a standard model for the behavior of mixed enterprises which we borrow from the closed economy literature. This literature assumes that a mixed enterprise maximizes a weighted sum of social welfare and profits, so a completely state-owned firm would maximize social welfare only.<sup>3</sup> Under this assumption, we demonstrate that neither the optimal export tax nor the optimal outputs depend on the degree of state ownership.

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<sup>1</sup>See, for example, Boardman and Vining (1989), Boardman, Laurin and Vining (2002), D'Souza and Megginson (1999), Kole and Mulherin (1997) and Kwoka (2005).

<sup>2</sup>See Chang (2005, 2007), Chao and Yu (2006), Fershtman (1990), Fjell and Pal (1996), Matsumura (1998), Pal and White (1998, 2003).

<sup>3</sup>See Bös (1991), Matsumura (1998), Bárcena-Ruiz and Garzón (2003), and Matsumura and Kanda (2005).

## 2 The model

Two domestic firms, 1 and 2, produce a homogeneous good and export their entire outputs,  $q_1$  and  $q_2$ , to a foreign country that does not produce the good. They have identical marginal cost,  $c$ .<sup>4</sup> Let  $Q = q_1 + q_2$ . The foreign country's import demand function is  $P = P(Q)$ , where  $P(0) > c$  and  $P'(Q) < 0$ . It is well known that the rivalry of the two domestic firms implies that the home country as a whole overproduces and thus fails to exploit its potential monopoly power in the foreign market. If the home country could directly control the outputs of the domestic firms, it will choose  $Q$  to maximize social welfare, which is the export revenue minus the production cost:

$$W = P(Q)Q - cQ. \quad (1)$$

The socially optimal industry output, denoted by  $Q^*$ , must therefore equate the marginal export revenue with the marginal production cost:

$$P'(Q^*)Q^* + P(Q^*) = c. \quad (2)$$

As usual, we assume that the second order condition is satisfied. Let us start with the standard case of two domestic firms which are privately owned. Suppose that direct control is not possible. The home government can choose an export tax  $t$  to influence the quantity exported. Assume the firms behave as Cournot rivals, and that each wants to maximize its profit. Firm  $i$ 's profit function (net of tax) is

$$\tilde{\pi}_i = P(q_i + q_{-i})q_i - cq_i - tq_i. \quad (3)$$

The first-order condition for firm  $i$  is

$$P'(q_i + q_{-i})q_i + P(q_i + q_{-i}) = c + t \text{ for } i = 1, 2. \quad (4)$$

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<sup>4</sup>As long as international markets are segmented and marginal costs are constant, it does not matter whether a domestic demand exists or not because the optimal export tax does not depend on domestic demand. See Rodrik (1989).

Assume that the second-order condition is satisfied, *i.e.*, for all  $q_i \in [0, Q]$  and for all  $Q > 0$ ,  $P''(Q)q_i + 2P'(Q) < 0$ . The Cournot equilibrium outputs are denoted by  $q_i^C(t)$ . Let

$$Q^C(t) = \sum_{i=1}^2 q_i^C(t).$$

Then, adding the two equations (4) for  $i = 1, 2$ , we get

$$P'(Q^C(t))Q^C(t) + 2P(Q^C(t)) = 2(c + t)$$

To ensure that  $Q^C(t)$  coincides with the socially optimal output  $Q^*$ , the government must set the export tax rate at

$$t^* = -(Q^*/2)P'(Q^*) > 0. \quad (5)$$

because this tax rate makes each firm  $i$  produce the quantity  $q_i = Q^*/2$ : Firm  $i$  takes as given the tax rate  $t^*$  and the output of the other firm, which is  $q_{-i} = Q^*/2$ . So its first-order condition is

$$P'(q_i + \frac{Q^*}{2})q_i + P(q_i + \frac{Q^*}{2}) = c + t^* \equiv c - (Q^*/2)P'(Q^*). \quad (6)$$

Clearly, by choosing  $q_i = Q^*/2$ , the firm satisfies this condition. This argument also applies to the other firm. It follows that, in a Cournot equilibrium with the export tax rate  $t^*$ , the equilibrium industry output is identical to the socially optimal output.<sup>5</sup>

### 3 Mixed duopoly

Consider now the case where one firm is a mixed enterprise and has the objective function of maximizing a weighted average of its own profit  $\tilde{\pi}_1$ , as given by (3), and the home country's welfare  $W$ , as given by (1), with weights  $1 - \theta$  and  $\theta$ , respectively. In this context, we ask the following questions:

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<sup>5</sup>Eq. (5) coincides with Rodrik's (1989) optimal export tax for the case of only two firms.

should the export tax rates be different for the two firms, and should they depend on  $\theta$ ? Our answer for each of these questions is “no”. We now proceed to prove this “invariance theorem”. Since the good is not consumed in the home country, social welfare is just the export revenue minus production cost. Thus firm 1’s problem is:

$$\max_{q_1} (1 - \theta) [P(q_1 + q_2)q_1 - cq_1 - tq_1] + \theta [P(q_1 + q_2)(q_1 + q_2) - c(q_1 + q_2)].$$

We assume that firm 1 takes  $t$  and  $q_2$  as given and may derive the following invariance result:

**Proposition 1** *The social optimum can be achieved as a Nash equilibrium by applying the optimal export tax (5). The optimal export tax is independent of the parameter  $\theta$  that represents the degree of public ownership. The socially optimal output of each firm is independent of  $\theta$ .*

Proof: Suppose that the government sets the same  $t^*$  as in the standard duopoly case (see eq. (5)), and suppose that firm 2 chooses  $q_2 = Q^*/2$  as before. Then the first-order condition for firm 1 is

$$(1 - \theta) \underbrace{\left[ P'(q_1 + \frac{Q^*}{2})q_1 + P(q_1 + \frac{Q^*}{2}) - c - t^* \right]}_{(I)} + \theta \underbrace{\left[ P'(q_1 + \frac{Q^*}{2})(q_1 + \frac{Q^*}{2}) + P(q_1 + \frac{Q^*}{2}) - c \right]}_{(II)} = 0.$$

Now, clearly, if firm 1 chooses  $q_1 = Q^*/2$ , then expression (I) is zero, because  $t^*$  satisfies (5), and expression (II) is also zero, because  $Q^*$  satisfies (2). Therefore the first-order condition for firm 1 is satisfied at  $q_1 = Q^*/2$ . The second-order condition is

$$(1 - \theta) [q_1 P'' + 2P'] + \theta \{QP'' + 2P'\} < 0$$

which is also satisfied. It remains to check that firm 2, by choosing  $q_2 = Q^*/2$ , also satisfies its own first- and second-order condition. This follows immediately from (6).  $\square$

Proposition 1 is a surprising and important result. Its intuition can be best explained by considering the case of a completely state-owned firm. This firm would maximize welfare, and any tax, including the optimal export tax, would not influence its behavior because government tax revenues and the firm's tax bills cancel out for welfare. Hence, given that the privately owned firm produces half of the socially optimal output, a completely state-owned firms would also produce half of the socially optimal output. Proposition 1 demonstrates that the optimal tax guarantees also that any partially state-owned firm will keep this level as it has no incentive to produce less or more. Obviously, Proposition 1 can be generalized to the case of  $n$  domestic firms that are Cournot rivals, of which  $m < n$  firms are mixed enterprises.

## 4 Concluding remark

This note has shown that state ownership does not change optimal export taxes. Furthermore, we have shown that the degree of state ownership affects neither the level of socially optimal exports nor the export and the import country's welfare levels themselves. Hence, state ownership does neither help nor hinder export policies.

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