

## **Re-Distribution, State Trading Enterprises and ‘Politically Optimal’ Tariffs**

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**Abstract:** State trading enterprises (STEs) are widely used and can be viewed as instruments of trade policy through which the government manipulates market structure by designating exclusive rights and where the objective of the STE reflects the re-distributional aims of the government. We address two aspects of STEs. The first is their potential trade distorting effect and the second is the way in which they modify the case for the ‘politically optimal’ tariff which embeds the possibility that the tariff may be targeted at re-distributing income. We show that though the STE can reduce market access, it can nevertheless reduce the need for an additional tariff when the government aims towards re-distribution; in some circumstances, STEs can act as a perfect substitute. This outcome, therefore, introduces some ambiguity on how we interpret STEs. On the one hand, from a multilateralist perspective, they distort trade and should be dealt with in the same way as other non-tariff barriers; on the other, from a nationalistic perspective, absent other ways of dealing with domestic market power, they can reduce the need for ‘politically optimal’ tariffs aimed at redistribution.

**Key Words:** state trading enterprises; tariffs; policy bias; social welfare

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## Re-Distribution, State Trading Enterprises and 'Politically Optimal' Tariffs

### 1. Introduction

In this paper we analyse the interaction between tariffs and importing state trading enterprises (STEs) when the government has a policy objective function that is more general than the maximisation of social welfare. STEs are intermediaries in international trade, but they vary in form with respect to their exclusive rights, their international market power and their pay-off functions. The extent of these exclusive rights and the definition of their pay-off functions depend upon governments' reasons for using STEs; these may reflect a domestic redistributive welfare objective but there could be several others.<sup>1</sup> With these exclusive rights that typically (but not solely) apply to managing imports, STEs will affect market access, but the extent to which they do so depends also on the nature of their pay-off function.<sup>2</sup> As such, STEs are regarded at the border as non-tariff measures. Recognising this characteristic, STEs have been included in recent attempts to quantify the effects of non-tariff measures that distort trade.<sup>3</sup> Behind the border, STEs may or not be used in conjunction with other instruments to achieve a variety of objectives.<sup>4</sup> In the remainder of the paper, we abstract from these

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<sup>1</sup> For an account of these other objectives and different types of STE, see OECD (2001). Examples of major importing countries that employ state trading enterprises in agricultural commodity markets for a variety of reasons include China, India, Indonesia, Japan, South Korea, Thailand, the Philippines and Turkey. (In Canada, the Canadian Dairy Commission is an example of an importing STE.) Abbott and Young (1999, Table 1) provide a more detailed list of countries that have used STEs in the international wheat market. Although state ownership may be a feature of STEs, the main determining issue is the provision of exclusive rights. This follows from the WTO definition which we work with in the analysis presented here. Specifically, the WTO defines a state trading enterprise as: "Governmental and non-governmental enterprises, including marketing boards, which have been granted exclusive or special rights or privileges, including statutory or constitutional powers, in the exercise of which they influence through their purchases or sales the level or direction of imports or exports." (WTO 1995, p. 25)

<sup>2</sup> Dixit and Josling (1997) created a typology with four categories based upon the extent of the exclusive rights but they ignored the interaction between these rights and the objective function of the STE. Therefore, their typology is incomplete as a measure of the potential trade distortion created by specific STEs.

<sup>3</sup> For example, the current MAST project coordinated by the OECD includes STEs as part of the set of non-tariff measures (see van Tongeren *et al.* (2009)). However, as demonstrated in this paper, their handling in the MAST project is inadequate and misleading.

<sup>4</sup> For an empirical analysis of the interaction between an STE and domestic instruments, see Schmitz (2002).

other objectives in order to concentrate on domestic welfare redistribution, as reflected in the biases in agricultural policies that are typically observed in developed and developing countries.<sup>5</sup>

There are two reasons why the role of tariffs is relevant in the context of STEs. The first arises because of the effect of STEs on market access, which can be measured by its tariff equivalence. The second arises in the context of the redistributive aims of government policy because STEs are a substitute for more traditional trade policy instruments. These two issues give rise to different perspectives on the role of STEs. The former is benchmarked on the principle that open markets are desirable and that impediments to market access should be subject to negotiation under the auspices of the World Trade Organization. The latter takes a more nationalistic perspective. Given that the government may wish to redistribute welfare between constituent groups, a tariff could be used. It is well-known, however, that in the presence of domestic distortions using the tariff alone can be an inefficient policy instrument (Bhagwati and Ramsawami, 1963).<sup>6</sup> But, given that STEs involve the manipulation of market structure, and to the extent that the redistributive aims of government policy may be captured in the STE's pay-off function, the role of the redistributive tariff may be reduced or, as we show, in some cases may become redundant.<sup>7</sup>

These two perspectives lead to a more ambivalent view of STEs. From a multilateral perspective, to the extent that STEs distort trade, their market access effect should be appropriately quantified.<sup>8</sup> As a consequence, they should become part of the negotiating architecture of the WTO. Further, to the

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<sup>5</sup> The recent World Bank project (Anderson, 2009) summarises the bias of government policies towards agriculture across a large number of countries and how these have changed over time.

<sup>6</sup> Using tariffs alone in the presence of domestic distortions suggests that tariffs are an inefficient policy instrument. However, as Rodrik notes: "Of course, trade policy is not the only, or even the most important mechanism of redistribution by governments. But practically all governments use it for that purpose" (Rodrik, 1995). The focus in this paper is therefore premised on two trade policy instruments that the government uses for re-distribution: tariffs and STEs together versus tariffs alone.

<sup>7</sup> Other papers in the trade literature have dealt with the issue of governments using more than one instrument (for example, Bagwell and Staiger (2002), Copeland (1990), Ederington (2001) and Schmitz (2002)).

<sup>8</sup> For the international wheat market Abbott and Young (1999) tested the hypothesis that STEs are associated with higher levels of protection than the tariffs faced by private firms. They concluded that the empirical evidence was inconclusive. However, in their econometric specification, there was no formal model of STEs nor was there any account taken of the domestic instruments that can co-exist with the STE in that specification, a point that they acknowledge.

extent that countries use tariffs and STEs, by focussing negotiations on tariffs alone while leaving STEs unchecked, trade negotiators will not increase market access to the extent that they anticipate even if there is no 'water in the tariff'. From a national perspective, and in the absence of any other means of dealing with domestic distortions, manipulating market structure may reduce or remove the need for the tariff as a redistributive or welfare maximising instrument.<sup>9</sup> We show that this is indeed the case and that in some situations (where there is a specific permutation of exclusive rights that apply to the STE and the government aims to either maximise welfare or it has a bias towards consumer interests), the corresponding role for a tariff is zero. However, other permutations of exclusive rights and/or a bias towards producers may still leave the need for a tariff to be used to meet the government's objectives. Nevertheless, with the STE in place and, predicated on welfare maximisation or redistribution, these tariffs become more marginal and may be relatively low, thereby causing the sector to appear to be more open to trade than it really is.

The paper is organised as follows. In section 2, we outline preliminary issues associated with identifying the tariff equivalent of STEs in importing countries and the role of the tariff as an instrument for redistributing or maximising welfare. In section 3, to highlight the links between the tariff equivalent and the traditional tariff, we focus the analysis on the simplistic case where there is no domestic procurement and all consumption is met from imports. We expand this case in sections 4 and 5 to more detailed market set-ups: first, in section 4, where the STE has joint rights over procurement from domestic producers and over imports and has exclusive rights over distribution (the corollary being that there is no role for private firms); followed in section 5 by the case where the STE has exclusive rights over imports only, with private firms being responsible for domestic procurement for which they directly compete in distribution with imports by the STE. In both cases, expressions for the tariff equivalence of the STE are obtained using the private firm market structure as the benchmark. For each of the three market structures, expressions for the 'politically optimal' tariff are

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<sup>9</sup> Specifically, in the context of the STE, which involves the manipulation of market structure, the domestic distortions that arise here relate to the potential exercise of market power in procurement and distribution. Note, however, that if the benchmark market structure were competitive, there would be one remaining distortion, i.e., the country would not be able to exercise market power with respect to imports and hence correct the terms of trade distortion, thus leaving open the need for an (optimal) tariff to deal with this distortion.

also obtained and a numerical example is used to illustrate the algebraic results.<sup>10</sup> We summarise and conclude in section 6.

## **2. Preliminary Issues**

There are two aspects to analysing the effects of STEs: the first relates to the impact of their presence on market access, which we summarise in the tariff equivalence of STEs;<sup>11</sup> and the second relates to the role of the STE in determining the redistributive or welfare maximising tariff and how the case for it may change in the presence of the STE. These two effects are related since, if the STE gives rise to a tariff equivalent effect, the justification for the additional use of a tariff is that it plays a complementary role and, consequently, the level of the tariff is potentially more marginal (or even different in sign) relative to what would be expected in the presence of private firms only. We deal with each of these in turn.

### ***2.1 Tariff equivalence***

In order to assess the trade distorting effect of state trading, it is necessary to define the benchmark or counter-factual against which to measure the distortion.<sup>12</sup> It is defined here as a private  $n$ -firm Cournot oligopoly/oligopsony where, for present purposes, the number of competing firms is given exogenously.<sup>13</sup> This set-up has two attractive features. First, by varying the number of firms in the benchmark, we capture alternative characterisations of the market: these range from a private firm monopoly/monopsony through to the competitive outcome. Second, given that much of the debate on reforming STEs has revolved around what the counter-factual market structure would be, and the concerns that would arise if the STE were replaced by a private sector monopoly/monopsony, we can be flexible in considering the sensitivity of the trade distorting effect, contingent on different

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<sup>10</sup> We define the ‘politically optimal’ tariff below.

<sup>11</sup> We are grateful to a referee for pointing out that in place of the term ‘tariff equivalence’, we should use the more accurate term ‘STE-import-equivalent tariff’. For brevity, we will continue to use the former term while interpreting it as the latter.

<sup>12</sup> The issue of trade policy equivalence of state trading was initially raised by Lloyd (1982) assuming perfect competition and was initially explored assuming imperfect competition in the context of importing STEs by McCorriston and MacLaren (2005).

<sup>13</sup> While it is possible to set up the model with  $n$  being endogenous, doing so diverts attention away from the essential results in the paper while, at the same time, adding unnecessary complexity.

perceptions of the counter-factual.<sup>14</sup> Note that, in this characterisation, and subsequently, the state trading enterprise that is introduced below, firms do not produce or process commodities but act as intermediaries in procurement and distribution. The role played by middlemen in international trade is one that has been largely ignored (Lahiri and Ono, 1999). Gervais and Larue (2002) also deal with imperfectly competitive firms that procure from the domestic market and from imports. However, the setting in both papers is different from the one presented here. As we outline below, even if the STE has sole rights in procurement and distribution, one should not conjecture that the outcome obtained with a profit maximising firm will be the same as that obtained using a re-distributive STE as an instrument of government policy.

In more detail, as well as designating the segments of the market in which STEs may operate, there is the possibility that the payoff functions of the STE and private firms differ. For the private firm benchmark, we assume as usual that firms maximise profits. However, in the case of the STE, given that it is an instrument of government policy, the payoff function is assumed to reflect the government's objectives towards re-distribution. Given that there are upstream suppliers, the welfare concerns may also relate to this constituent group. We assume that the objective function for the STE can be biased towards either consumers or producers or towards neither, with the profit maximising STE being embedded in this objective function through setting the bias towards consumer and producer surplus set equal to zero.<sup>15</sup> The other case of unbiasedness is where the STE maximises social welfare.<sup>16</sup>

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<sup>14</sup> This is a desirable means of assessing potential differences in the perceptions for the use of STEs. In the early discussions in the Doha Round on STEs, considerable differences emerged among negotiating countries regarding how competitive markets would be in the absence of STEs. As such, we are agnostic as to the size of  $n$ .

<sup>15</sup> Given that STEs are pervasive in agricultural trade, accounting for upstream producers in the government's welfare and STE's pay-off function is an important feature of the set-up. Other models with intermediaries, such as those of Lahiri and Ono (1999) and Larue and Gervais (2002), do not have this feature and, therefore, their analysis cannot readily be applied to this issue. Moreover, these papers are concerned with welfare or revenue maximisation not re-distribution and therefore miss an important rationale for the existence of STEs and the use of government policies in agriculture.

<sup>16</sup> This specification is related to the formal literature on the public firm (see, for example, Cremer *et al.* (1989) and De Fraja and Delbono (1990) for an overview). However, the role of the public firm in an open economy context has received only limited attention. Fjell and Pal (1996) and Pal and White (1998) are examples, although the focus in their papers was how the presence of a state firm affected the argument for rent-shifting export subsidies which is not the focus of the set-up here.

It should be noted that this framework and, by extension, the mechanisms that determine the outcome are different from those in other models that focus on intermediaries (see Lahiri and Ono, and Larue and Gervais). Since the STE is an instrument of government policy, the manipulation of market structure via the exclusive rights of the STE in combination with the re-distributive pay-off function means that the government has two independent instruments available to deal with the domestic distortion (i.e., the potential exercise of market power by private firms) and the terms of trade distortion. As we note below, this has several implications. These include: (a) how we evaluate the use of (politically optimal) tariffs in the presence of the STE; (b) given the range of re-distributive concerns of the government to include consumer and upstream producer welfare, the equilibrium outcomes in the absence of the (politically) optimal tariff differ from the standard private firm profit maximising case; and (c) changes the rationale and outcome when the ‘politically’ optimal tariff is employed. In sum, even though the STE with exclusive rights has the appearance of looking like the outcome with  $n=1$  private firms, this is only superficial given the way that a re-distributive STE changes the rationale and outcome from using a standard trade policy instrument only.

The trade distortion created by the STE is characterised by its tariff equivalence. This equivalence is defined as the implicit specific tariff ( $t^e$ ) that would bring about equality between the level of imports procured by the private sector benchmark and that of the state trading enterprise, i.e.,  $Q_m^{priv}(t^e) = Q_m^{STE}$ , where superscript *priv* (*STE*) represents the private (state trading) outcome and the subscript *m* denotes that the source of procurement is imports. Intuitively, the tariff equivalence measures the tariff that would have to be imposed on the  $n$  private firms to give the same level of imports that would arise when, instead, the state trading enterprise exists. It is positive (negative), if imports by private firms have to be reduced (increased) to make them equal to imports by the STE. It is zero, if imports are already equal. The sign depends on the specific characterisation of the exclusive rights bestowed on the state trading enterprise, the direction of income redistribution sought by government

and the value of  $n$  in the benchmark. If it is found that the tariff equivalence of the STE is not zero, then the case, if any, for a redistributive or welfare maximising tariff will need to be modified.

## ***2.2 The Politically Optimal Tariff***

Traditional trade theory focuses on the optimal tariff as the means whereby countries can correct the terms of trade externality. More recently, research has focussed on the terms of trade equivalent effect of capturing the market access impacts of government policies (Bagwell and Staiger, 2002). These authors also note however that a government need not set out to maximise welfare and, recognising the effect that government policy focussed on redistribution may have on market access, they refer to the ‘politically optimal’ tariff. We adopt this terminology here when the government uses a tariff (without or without the presence of the STE) to achieve these broader objectives. Note that in our characterisation of the government’s objectives, we also have embedded the case of welfare maximisation.<sup>17</sup> In the case of the private firm benchmark, the use of the ‘politically optimal’ (PO) tariff is designed to maximise or redistribute welfare and it is assumed that the government has only this one trade instrument at hand to do so. However, when a state trading enterprise is employed, there is an additional trade policy instrument, namely, the government’s explicit manipulation of market structure through the STE. With two independent instruments, it is probable that the PO tariff will be altered from its value in the situation in which there is only a tariff.

Intuitively, it is straightforward to understand why the existence of an STE could influence the case for the tariff.<sup>18</sup> In the standard private sector case, the government selects the politically optimal tariff knowing that the firms maximise profit. The firms choose quantities subject to the choice of this tariff. When an STE is employed, the government decides on the re-distributive aims of policy which, in turn, define the objective of the STE and the extent of the exclusive rights that it gives to the STE.

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<sup>17</sup> Despite some commentary that the optimal tariff is an intellectual curiosity, recent research has focused on the empirical relevance of terms of trade effects. See, for example, Broda *et al.* (2008) and Bagwell and Staiger (2002, 2011).

<sup>18</sup> Recall that we are dealing with domestic firms that procure from the world market rather than foreign firms that sell in the domestic market. The role of the latter has been dealt with in the trade policy literature where the tariff may be used to extract rent from the foreign firm(s). See, for example, Brander and Spencer (1984) and references therein.

The tariff faced by the STE is contingent on this preceding determination of market structure. The analysis of the politically optimal tariff, therefore, can be considered as a three-stage game. In the first stage, the government decides on market structure: an  $n$ -firm Cournot oligopsony/oligopoly or an STE (and the exclusive rights that will apply to the STE). In the second stage, it decides on the bias towards consumers, producers and profits in its (the government's) welfare function. In the third stage, the firms or the STE, depending upon the government's choice of market structure, maximise their respective objective functions. As is conventional, the model is solved in reverse order, i.e., the firms or the STE solve their optimisation problem given the size of the tariff.

To explore the properties of the tariff equivalence and the related argument with respect to the more conventional PO tariff, we consider three characterisations of the market. These allow us to establish the intuition for the results that we obtain. The first is where there is no domestic production and imports supply all domestic consumption. The second is where there is domestic production and the private firms or the STE determine the level of domestic procurement and imports. The third characterisation is where the STE has exclusive rights to import and private firms have exclusive rights to procure domestically and each is excluded from the other's procurement market. Essentially, the implicit tariff that is calculated provides a summary measure of the market access that occurs under different characterisations of market structure and the asymmetric features of the pay-off functions of private firms and the STE.

### **3. The Import Only Case**

#### ***3.1 Tariff equivalence***

We start with the simplest characterisation of the market – one with no domestic production and domestic consumption is met entirely from imports. We assume a partial equilibrium set-up where consumer utility is separable and linear in the *numeraire* good. The inverse demand function is given by:

$$p = p(q) \tag{1}$$

where  $p' < 0$ ,  $p'' \leq 0$  and  $q$  is the quantity imported. The inverse import supply function is given as:

$$P_m = P_m(q) \quad (2)$$

where subscript  $m$  denotes imports,  $p'_m > 0$ ,  $p''_m \geq 0$  and  $p(0) > p_m(0)$ . It is assumed that the private firms and the STE have no costs other than the purchase of imports.

As noted above, the STE's pay-off function reflects the government's objectives regarding redistribution. In the import only case, the pay-off function comprises consumer surplus ( $CS$ ) and profits ( $\pi$ ) from importing, with the coefficients reflecting the importance that government attaches to each. Specifically, the biased pay-off function is given by:

$$\begin{aligned} W &= \alpha_1 CS + \alpha_2 \pi^{STE} \\ &= \alpha_c CS + \pi^{STE} \end{aligned} \quad (3)$$

where  $\alpha_c \equiv \alpha_1/\alpha_2$  is the emphasis the government places on consumer surplus relative to that on profits.

Consumer surplus is given by:

$$CS = \int_0^{Q^{STE}} p(z) dz - pQ^{STE}$$

and profit by:

$$\pi^{STE} = (p - p_m)Q^{STE}$$

The first-order condition from the maximisation of (3) with respect to imports gives:

$$p + Q^{STE} p'(1 - \alpha_c) = p_m + Q^{STE} p'_m \quad (4)$$

giving the optimal level of imports as:

$$Q^{STE*} = \frac{(p - p_m)}{p'_m - p'(1 - \alpha_c)} \quad (5)$$

Note that the greater the government's bias towards consumers, the more will be imported by the STE.

In contrast with the STE, private firms are concerned only with their own profits, the representative firm maximising:<sup>19</sup>

$$\pi^{priv} = (p - p_m - t^e)q^{priv} \quad (6)$$

where  $t^e > 0$  ( $< 0$ ) is the implicit, specific tariff (import subsidy) needed to equilibrate total imports by the private firm benchmark with those by the STE. The first-order condition gives:

$$p + q^{priv} p' = p_m + q^{priv} p'_m + t^e \quad (7)$$

Aggregating over  $n$  private firms and re-arranging in terms of  $Q^{priv} (= nq^{priv})$  gives the aggregate optimal level of imports in the private sector benchmark:

$$Q^{priv*} = \frac{n(p - p_m - t^e)}{p'_m - p'} \quad (8)$$

Totally differentiating (7) and rearranging gives:

$$\frac{dq^{priv*}}{dt^e} = \frac{1}{2(p' - p'_m) + q^{priv*}(p'' - p''_m)} < 0$$

Setting aside the tariff equivalence term in (7) for the moment, note the factors that will determine the difference between imports by the STE and imports by the private sector are the redistributive bias of the STE ( $\alpha_c$ ) and the number of private firms in the benchmark ( $n$ ). To determine how these factors matter, we need a general expression for the tariff equivalence of the STE.

The tariff equivalence for the general case is obtained by setting (8) equal to (5) and solving for  $t^e$ .

This gives:

$$t^e = \frac{(p - p_m)[(n-1)(p'_m - p') + np' \alpha_c]}{n[p'_m - p'(1 - \alpha_c)]} \quad (9)$$

Consistent with the intuition above, if  $n = 1$  and  $\alpha_c = 0$  in (9), then the tariff equivalence of the STE is zero: the STE does not distort trade relative to this private monopoly/monopsony benchmark. However, suppose instead that the benchmark were a duopoly and  $\alpha_c = 0$ . Then, the optimal level of procurement and sales will be greater than if  $n = 1$  and the tariff equivalence will be  $(p - p_m)/2$ ,

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<sup>19</sup> We assume throughout that the second-order and stability conditions hold.

which is strictly positive. For the case where  $\alpha_c = 0$ , the expression for the tariff equivalence can be written as  $t^e = (n-1)(p - p_m)/n$ , the limit of which, as  $n$  goes to infinity, is  $(p - p_m)$ , where  $p$  and  $p_m$  remain the values at the equilibrium defined by the STE. Thus, it has been shown: first, that the size of the tariff equivalence of the STE is positively related to the number of firms in the benchmark, ranging from zero with monopoly/monopsony to  $(p - p_m)$  with perfect competition; and second, that this STE (with  $\alpha_c = 0$ ) distorts trade when compared with a benchmark where  $n \geq 2$ .

Suppose instead of there being no policy bias towards consumers, the bias imposed by government on the STE's pay-off function were  $\alpha_c = 1$ . Then, with  $n = 1$ , (9) becomes  $t^e = (p - p_m)(p' / p'_m) < 0$  and the STE acts as an import subsidy. In general,  $t^e |_{\alpha_c=1} = (p - p_m)[(1-1/n) + (p' / p'_m)/n]$  which is positive for  $n > (1 - p' / p'_m) > 1$ . Unlike the first case (where  $\alpha_c = 0$ ), the sign of the tariff equivalence of the STE with  $\alpha_c = 1$  is now ambiguous in general but it is likely to be positive even for 'small'  $n$ .

These observations are summarised in the following proposition.

*Proposition 1: In the case where there is no domestic procurement, the trade distorting impact of the STE is ambiguous in general because the sign of the implicit tariff can be negative, zero or positive. The sign will depend on the combination of the competitiveness of the benchmark and the bias in the government's welfare function. In sum, it is concluded that an STE will distort trade but, a priori, the sign of that distortion is indeterminate.*

### **3.2 Politically optimal tariff**

#### **3.2.1 Private firms**

The government is assumed to maximise a welfare function comprising consumer surplus, profits and tariff revenue through its choice of a specific tariff,  $t$ . In order to allow for an objective of re-distribution, as well as one solely of welfare maximisation in the conventional sense, the welfare function is biased and given by:<sup>20</sup>

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<sup>20</sup> It has been assumed that profits and tariff revenue each has a coefficient of unity. Of course, this need not be the case and tariff revenue, just as with consumer surplus, could have a smaller coefficient and we could explore

$$W_{priv} = \alpha_c CS + \pi + tnq^{priv} = \alpha_c \left[ \int_0^{nq} p(z) dz - p(nq^{priv}) \right] + (p - p_m - t)(nq^{priv}) + t(nq^{priv}) \quad (10)$$

Totally differentiating (10) gives:

$$\begin{aligned} dW_{priv} &= \alpha_c [pndq^{priv} - p'(nq^{priv})dq^{priv} - pndq^{priv}] + (p' - p'_m)(nq^{priv})dq^{priv} + (p - p_m)ndq^{priv} \\ &= ndq^{priv} [p'(1 - \alpha_c)q^{priv} - p'_m q^{priv} + p - p_m] \end{aligned}$$

Dividing through by  $dt$ , making use of the first-order conditions (equation (7)) to substitute out  $(p - p_m - p'_m q^{priv*})$ , and setting  $dW / dt = 0$ , gives:

$$\frac{dW_{priv}}{dt} = n(t - p'q^{priv*} \alpha_c) \frac{dq^{priv*}}{dt} = 0 \quad (11)$$

where  $q^{priv*}$  is the optimal quantity imported. Now, from equation (7),  $dq^{priv*} / dt < 0$  and, with  $n \geq 1$ , the PO tariff is:

$$t_{priv}^o = p'q^{priv*} \alpha_c \quad (12)$$

From (12) with  $\alpha_c > 0$ , the sign of  $t_{priv}^o$  is unambiguously negative, implying that the welfare maximising trade intervention is always an import subsidy irrespective of the value of  $n$ . The size of this subsidy depends upon the size of the policy bias: the greater the size, the larger is the import subsidy. If the policy coefficient is one, then the welfare maximum occurs at  $t_{priv}^o = p'q^{priv*}$ .<sup>21</sup> If the government chooses to be concerned only with profits and tariff revenue and not with consumer surplus, then  $\alpha_c = 0$  and the optimal setting of the tariff is zero. In this case, the private firms are already fully exploiting their market power. Because the government does not 'care' about consumers, it will not pay a subsidy to increase imports and, thereby, consumer surplus. On the other hand, if there is a policy bias towards consumers, the government will want more to be procured than the profit-maximising private firms will import and to encourage them to increase imports, an import subsidy is necessary, the size of which depends upon the size of the policy bias and  $n$ , which influences the size of  $q^{priv*}$ .

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the role of revenue maximizing tariffs. This, however, is not pertinent to the issues explored here and is therefore left aside.

<sup>21</sup> Lahiri and Ono (1999) obtain a similar result for an *ad valorem* tariff in their proposition 1.

### 3.2.2 The STE

Suppose now that only an STE operates and, as before, the government is assumed to maximise a weighted welfare function. It is defined here as:

$$W_{STE} = \alpha_c \left[ \int_0^{Q^{STE}} p(z) - p Q^{STE} \right] + (p - p_m - t) Q^{STE} + t Q^{STE} \quad (13)$$

Totally differentiating (13) gives:

$$dW_{STE} = dQ^{STE} [p' Q^{STE} (1 - \alpha_c) - p'_m Q^{STE} + p - p_m],$$

then dividing by  $dt$ , setting  $dW / dt = 0$  and making use of the first-order condition (equation (4))

with the term  $p_m$  replaced with  $p_m + t$  to substitute out  $(p - p_m - p'_m Q^{STE})$  gives:

$$\frac{dW_{STE}}{dt} = \frac{dQ^{STE*}}{dt}(t) = 0 \quad (14)$$

From equation (5), with  $p_m$  replaced with  $p_m + t$ ,  $dQ^{STE*} / dt \neq 0$  and, therefore, the PO tariff faced by the STE is  $t_{STE}^o = 0$ . Thus, if an STE has sole rights to import, then it attains the government's objective on its own because the policy bias is already built into its objective function (equation (3)) and its first-order condition (equation (4)). Therefore, there is no need for the additional policy instrument. As a consequence, the PO tariff is zero, no matter the size of the policy bias towards consumers. These insights are summarised in the following proposition.

*Proposition 2: If the government cares about consumer welfare (i.e.,  $\alpha_c > 0$ ) the PO tariff facing private firms is negative, and it is zero otherwise ( $\alpha_c = 0$ ). In the presence of a state trading enterprise, the PO tariff is zero whatever the bias towards consumers' welfare. The STE is a perfect substitute for the PO tariff.*

### 3.3 A comparison of the PO tariffs

The presence of an STE has been shown to alter the case for a PO tariff. When there is an STE, the PO tariff is always zero no matter the policy bias. Thus, the STE is a perfect substitute for the PO tariff because the government has already built into the objective function of the STE its policy objective. Thus a tariff is redundant. However, if the government allows the market structure to be an  $n$ -firm Cournot oligopsony/oligopoly, then there is a role for a tariff in achieving the government's

policy objective. For  $0 < \alpha_c \leq 1$ , the PO tariff is negative, i.e., it is an import subsidy, while for  $\alpha_c = 0$ , the PO tariff is zero.

#### **4. Domestic Procurement and Imports**

We now consider the more realistic case where there are two sources of supply, namely, imports and procurement from domestic suppliers. We maintain the assumption throughout the remainder of the paper that the domestically produced and imported goods are homogeneous. In the private benchmark, the firms choose how much to procure from these two sources. Note also that with upward sloping inverse supply functions, there is the potential for market power in procurement in both markets, the possibility for third-degree price discrimination in procurement, as well as market power with respect to consumers. By adding domestic procurement to the model, not only does it more appropriately characterise the environment in which STEs operate but it also allows for a more interesting characterisation of exclusive rights.

There are two obvious characterisations of these rights. The first is where the STE has joint exclusive rights, i.e., it is solely responsible for imports and domestic procurement as well as sales of these supplies to domestic consumers. The second is where the STE has sole rights to procure in either the import or the domestic market but not in both, and it competes with private firms only for sales. The analysis immediately below deals with the joint exclusive rights case and, to explore the effects of exclusive rights that arise in only one market, we analyse the case where the STE has exclusive rights over imports but it competes in the distribution of these imports with private firms that procure only from the domestic market (section 5).

##### ***4.1 Tariff equivalence***

There are two amendments to be made to the model outlined above. First, profits are now generated from the sale of domestically procured supplies as well as from profits from the sale of imports. The aggregate profit function for the representative firm is:

$$\pi^{priv} = \pi_h^{priv} + \pi_m^{priv} = (p - p_h)q_h^{priv} + (p - p_m - t^e)q_m^{priv} \quad (15)$$

where the subscript  $m$  ( $h$ ) relates to the import (domestic) market as the source of supply and where  $p_h$  is the inverse supply function for the domestic market with the same properties as those given for  $p_m$  (see equation (2)). The inverse demand function facing private firms is  $p = p(Q^{priv})$ , where  $Q^{priv} = n(q_h^{priv} + q_m^{priv})$ . The tariff equivalence,  $t^e$ , will be used to measure the trade distorting impact of the STE relative to the benchmark, where the benchmark continues to be an  $n$ -firm Cournot oligopsony/oligopoly.

Second, the maximand of the STE now changes. Not only are there two sources of profits, but given that domestic supply is now a feature of the model, the government may also care about redistribution towards producers. To allow for this possibility, producer surplus is added to the pay-off function for the STE which is given by:

$$W = \alpha_c CS + \alpha_p PS + \pi_h^{STE} + \pi_m^{STE} \quad (16)$$

where  $\alpha_c$  is the coefficient on consumer surplus relative to that on profits (as before) and  $\alpha_p$  is the coefficient on producer surplus relative to that on profits. Reflecting the re-distributional aims of trade policy in developing (developed) countries, the relative bias towards consumers (producers) will exceed that towards producers (consumers). A profit maximising STE would be characterised as one with  $\alpha_c = \alpha_p = 0$ .

In the benchmark, the representative private firm chooses  $q_h^{priv}$  and  $q_m^{priv}$  to maximise (15), the first-order conditions being given by:

$$\begin{aligned} p + (q_{h,i}^{priv} + q_{m,i}^{priv})p' - p_h - q_{h,i}^{priv}p'_h &= 0 \\ p + (q_{h,i}^{priv} + q_{m,i}^{priv})p' - p_m - q_{m,i}^{priv}p'_m - t^e &= 0 \end{aligned} \quad (17)$$

The representative firm, as before, exploits its buying and selling power by equating its marginal revenue with the its marginal procurement cost in each market. Aggregating over the  $n$  firms and rearranging gives:

$$\begin{bmatrix} Q_h^{priv*} \\ Q_m^{priv*} \end{bmatrix} = \frac{n}{\Delta_B} \begin{bmatrix} p'_m - p' & p' \\ p' & p'_h - p' \end{bmatrix} \begin{bmatrix} p - p_h \\ p - p_m - t^e \end{bmatrix} \quad (18)$$

where  $Q_h^{priv*} = nq_h^{priv*}$ ,  $Q_m^{priv*} = nq_m^{priv*}$  and  $\Delta_B = (p'_h - p')(p'_m - p') - (p')^2 > 0$ . Again, we assume that the second-order and stability conditions hold.

The STE chooses  $Q_h^{STE}$  and  $Q_m^{STE}$  to maximise (16), the first-order conditions being given by:

$$\begin{aligned} p + (Q_h^{STE} + Q_m^{STE})(1 - \alpha_c)p' - p_h - Q_h^{STE}(1 - \alpha_p)p'_h &= 0 \\ p + (Q_h^{STE} + Q_m^{STE})(1 - \alpha_c)p' - p_m - Q_m^{STE}p'_m &= 0 \end{aligned} \quad (19)$$

Note that if  $\alpha_c = \alpha_p = 1$ , then (19) can be re-written for the welfare-maximising STE as:

$$\begin{aligned} p - p_h &= 0 \\ p - p_m - p'_m Q_m^{STE} &= 0 \end{aligned} \quad (19')$$

i.e., the STE will remove any domestic distortion (the domestic procurement price and the selling price being made equal) but it will take account of the terms of trade distortion in relation to imports (the selling price equalling marginal expenditure on imports) and this is its only source of its profits.

Re-arranging (19) gives:

$$\begin{bmatrix} Q_h^{STE*} \\ Q_m^{STE*} \end{bmatrix} = \frac{1}{\Delta_s} \begin{bmatrix} p'_m - (1 - \alpha_c)p' & (1 - \alpha_c)p' \\ (1 - \alpha_c)p' & (1 - \alpha_p)p'_h - (1 - \alpha_c)p' \end{bmatrix} \begin{bmatrix} p - p_h \\ p - p_m \end{bmatrix} \quad (20)$$

where  $\Delta_s = [(1 - \alpha_p)p'_h - (1 - \alpha_c)p'] [p'_m - (1 - \alpha_c)p'] - [(1 - \alpha_c)p']^2 > 0$ .<sup>22</sup>

To derive the implicit tariff measure, set  $Q_m^{priv*}$  from (18) equal to  $Q_m^{STE*}$  from (20) and solve out for  $t^e$ . The result is given by:

$$t^e = \frac{(p - p_h)}{(p'_h - p')} \left\{ p' - \frac{\Delta_B}{n\Delta_s} [(1 - \alpha_c)p'] \right\} + \frac{(p - p_m)}{(p'_h - p')} \left\{ (p'_h - p') - \frac{\Delta_B}{n\Delta_s} [p'_h(1 - \alpha_p) - p'(1 - \alpha_c)] \right\} \quad (21)$$

<sup>22</sup> It is shown below (equation (37)), that a change to the nature of the exclusive rights alters the relationships between the bias of government policy and the expressions for the optimal quantities by altering the structure of the matrix.

It is difficult to sign (21) in its most complete form but, in principle, the trade effect of the STE will depend upon the re-distributive bias in the STE's objective function and the competitiveness of the underlying benchmark against which the STE is compared. To explore the intuition, it is useful to assume first, that there is no re-distributive bias, then second, to assume a complete bias in favour of producers' welfare while at the same time having a zero bias towards consumers' welfare, then third, to reverse these biases and fourth, to assume welfare maximisation.

First, compare a profit maximising STE with the private benchmark. The only determinant of the tariff equivalence of the STE will be the number of competing firms in the benchmark. To see this, return to (21), set  $\alpha_c = \alpha_p = 0$  and re-write it as:

$$t_\pi^e = \frac{1}{(p'_h - p')} [p'(p_m - p_h) + p'_h(p - p_m)] \left(1 - \frac{1}{n}\right) \quad (26)$$

with the subscript  $\pi$  denoting the profit maximising case. From equation (20),  $Q_{m,\pi}^{STE*} = \Delta_S^{-1} p'(p_m - p_h) > 0$  if and only if  $(p_m - p_h) < 0$ , which is sufficient for the tariff equivalence of the STE to be unambiguously positive for  $n > 1$  and for the STE unambiguously to restrict trade relative to the benchmark. This outcome follows directly from the fact that in Cournot competition, industry output increases with the number of firms and because the profit-maximising STE is equivalent to a monopsony/monopoly. Thus, as  $n$  increases, so too does the difference between the increasing output of the  $n$ -firm benchmark and the unchanged output of the STE. Therefore, the implicit tariff has to increase to equate imports. If  $n = 1$ , then the tariff equivalence is zero. In this case, the two market structures are of course identical and there is no distortion of imports by the STE relative to those by the monopsony/monopoly benchmark.

Second, assume that the government re-distributes income to producers and it does not care about consumers, then  $\alpha_c = 0, \alpha_p = 1$ . From (20) this would give a level of imports equal to  $Q_{m,ps}^{STE*} = -(p_m - p_h) / p'_m$ , where the subscript  $ps$  denotes the producer surplus maximising case of the

STE. Then  $Q_{m,ps}^{STE*} > 0$  if and only if  $(p_m - p_h) < 0$  and  $Q_{m,ps}^{STE*} = 0$  otherwise. Set  $\alpha_c = 0$  and  $\alpha_p = 1$  in (21) and simplify to give the implicit tariff equivalence as:

$$t_p^e = \frac{1}{(p'_h - p')} \left\{ p'(p_m - p_h) \left[ 1 - \frac{p'_h(p'_m - p') - p'_m p'}{-p'_m p'_m n} \right] + p'_h(p - p_m) \right\} \quad (23)$$

A sufficient condition for the tariff equivalence to be positive is that  $[\cdot] > 0$ . With the denominator being positive, the sign of  $[\cdot]$  depends on the sign of  $-p'_m[p'_h + (n-1)p'] + p'_h p'_m$ , obtained after re-arranging terms. If  $n = 1$ , then  $t_{ps}^e < 0$ . However, for  $n > (1 - p'_h / p' + p'_h / p'_m)$ ,  $[\cdot] > 0$ , to give  $t_{ps}^e > 0$ . Therefore, while some ambiguity remains about the sign of the tariff equivalence, it is likely that the STE will act as a tariff when it has a bias towards producers even for 'small'  $n$ . Furthermore, the more competitive the benchmark, the more the tariff equivalence increases and the more trade distorting is this STE.

Third, consider now the case where the bias is towards consumers and the government has no bias towards producers. From (20), the level of imports is given by  $Q_{m,cs}^{STE*} = (p - p_m) / p'_m > 0$ , where the subscript  $cs$  denotes the bias towards consumers. With the government's bias in favour of consumers, imports are always positive. Following the same procedure as above, set  $\alpha_c = 1$  and  $\alpha_p = 0$  in (21) and simplify, to give:

$$t_c^e = \frac{1}{(p'_h - p')} \left\{ p'(p_m - p_h) + (p - p_m) \left[ p'_h - \frac{\Delta_B}{n p'_m} \right] \right\} \quad (25)$$

The first term in the braces is positive. The second term can be re-arranged to give  $[\cdot] = p'_h(1 - 1/n) + (p'/n)(1 + p'_h / p'_m)$  which is positive for  $n > [1 - p'(1 + p'_h / p'_m) / p'_h]$ . Thus, it is likely that the tariff equivalence will be positive and that the STE will restrict imports relative to this  $n$ -firm Cournot benchmark even for 'small'  $n$ .

Fourth, assume that the government maximises welfare. Then with  $\alpha_c = \alpha_p = 1$ , equation (21) becomes

$$t_{sw}^e = \frac{p'_h(p - p_m)}{(p'_h - p')} > 0 \quad (26)$$

Therefore, if the government maximises social welfare through the STE, then its tariff equivalence is always positive and it restricts imports compared with the  $n$ -firm Cournot industry regardless of  $n$ .

These observations are summarised below.

*Proposition 3: In the case of an STE with joint exclusive rights, the tariff equivalence can be positive, negative or zero. However, in most instances the tariff equivalence will be positive and the STE will restrict imports when compared with the  $n$ -firm benchmark regardless of the policy bias.*

## 4.2 PO Tariffs

### 4.2.1 Private firms

In contrast with the conventional literature on PO tariffs with oligopoly, there is no rent-shifting between domestic and foreign firms in this benchmark because the domestic firms are responsible for both domestic procurement and imports. We define the welfare function that the government maximises to allow for the possibility that it may want to set the tariff to re-distribute income between consumers, producers and profits rather than, as is conventional, maximising welfare through setting  $\alpha_c = \alpha_p = 1$ .

Let the welfare function in the benchmark be:

$$W_{priv} = \alpha_c \left[ \int_0^{nq_h^{priv} + nq_m^{priv}} p(z)d(z) - pnq_h^{priv} - pnq_m^{priv} \right] + \alpha_p \left[ p_h nq_h^{priv} - \int_0^{nq_h^{priv}} p_h(v)d(v) \right] \quad (27)$$

$$+ (p - p_h)nq_h^{priv} + (p - p_m - t)nq_m^{priv} + tnq_m^{priv}$$

Totally differentiating (27) gives:

$$dW_{priv} = ndq_h^{priv} [p'_h q_h^{priv} (1 - \alpha_c) - p'_h q_h^{priv} (1 - \alpha_p) + (p - p_h)]$$

$$+ ndq_m^{priv} [p'_m q_m^{priv} (1 - \alpha_c) + (p - p_m - p'_m q_m^{priv})]$$

Dividing through by  $dt$ , making use of the first-order conditions in (17) to substitute out  $(p - p_h)$  and  $(p - p_m - p'_m q_m^{priv})$ , and equating  $dW / dt$  to zero, allows the PO tariff to be expressed as:

$$t_{priv}^o = p'(q_h^{priv*} + \alpha_c q_m^{priv*}) + [q_h^{priv*} (\alpha_c p' - \alpha_p p'_h) + p' q_m^{priv*}] \left( \frac{dq_h^{priv*} / dt}{dq_m^{priv*} / dt} \right)$$

To evaluate the sign of  $\left( \frac{dq_h^{priv*} / dt}{dq_m^{priv*} / dt} \right)$ , totally differentiate the first-order conditions (17). To keep the

insights tractable, assume that  $p'' = p''_h = p''_m = 0$  (i.e., linearity). After re-arranging, we get:

$$\begin{bmatrix} dq_h^{priv*} / dt \\ dq_m^{priv*} / dt \end{bmatrix} = \frac{1}{\Delta_B} \begin{bmatrix} p'_m - p' & p' \\ p' & (p'_h - p') \end{bmatrix} \begin{bmatrix} 0 \\ -1 \end{bmatrix} \quad (28)$$

Then:

$$\theta \equiv \left( \frac{dq_h^{priv*} / dt}{dq_m^{priv*} / dt} \right) = \frac{-p'}{p' - p'_h}, \text{ with } -1 < \theta < 0$$

and

$$t_{priv}^o = p'(q_h^{priv*} + \alpha_c q_m^{priv*}) + [q_h^{priv*} (\alpha_c p' - \alpha_p p'_h) + p' q_m^{priv*}] \theta \quad (29)$$

The sign of the politically optimal tariff in (29) is ambiguous, the first term being negative but the term,  $[.] \theta$ , being positive.

To provide insights into the role played by each of the policy coefficients, we begin where these weights are zero. At  $(\alpha_c, \alpha_p) = (0, 0)$ , the PO tariff, from (29), is:

$$t_{priv}^o = p'(q_h^{priv*} + \theta q_m^{priv*})$$

With the government assuming that firms will maximise profits from the two sources of procurement, the tariff will be set to equalise marginal expenditure on domestically procured input and on imports:

$$t = p_h + q_h^{priv*} p'_h - p_m - q_m^{priv*} p'_m$$

Therefore, the sign of the politically optimal tariff will be given by the relationship between these two marginal expenditure functions. Then,  $sign t_{priv}^o(0, 0) = sign p'(q_h^{priv*} + \theta q_m^{priv*})$ , which implies, since  $p' < 0$ , that  $sign t_{priv}^o(0, 0) = -sign (q_h^{priv*} + \theta q_m^{priv*})$ . Therefore,

$$t_{priv}^o(0, 0) \begin{cases} > 0 \text{ if } (q_h^{priv*} + \theta q_m^{priv*}) < 0 \\ < 0 \text{ if } (q_h^{priv*} + \theta q_m^{priv*}) > 0 \end{cases} \Rightarrow q_m^{priv*} / q_h^{priv*} \begin{cases} > -1 / \theta \\ < -1 / \theta \end{cases} \quad (30)$$

With the ratio of imports to domestically procured input above (below) this critical value  $(-1/\theta)$ , an import tax (subsidy) would be the optimal policy for a government that is not at all concerned about the welfare of consumers and producers. Thus, where import penetration is high, an import tax is required; whereas if import penetration is low, an import subsidy is required.

We now want to investigate the direction of change in the optimal tariff when the policy coefficients individually increase from zero. These directions are given by:

$$\frac{\partial t_{priv}^o}{\partial \alpha_c} = p'(\theta q_h^{priv*} + q_m^{priv*}); \text{ and } \frac{\partial t_{priv}^o}{\partial \alpha_p} = -p'_h \theta q_h^{priv*} > 0 \quad (31)$$

With the second-order partial derivatives both equal to zero, the tariff surface is a plane. The second expression in equation (31) means that as the policy bias towards producers increases, so too does the tariff. This is an intuitive result. The sign of the first expression can be shown to be negative. Set the policy parameters in equation (29) to zero to get  $t_{priv}^o(0, 0) = p'(q_h^{priv*} + \theta q_m^{priv*})$ . Making use of equation (17) and the definition of  $\theta$ , it can be confirmed that the sign of the optimal intervention,  $t_{priv}^o(0, 0)$ , is ambiguous. Assume that it is positive. Then it follows from equation (30) that  $q_h^{priv*} + \theta q_m^{priv*} < 0 \Rightarrow q_m^{priv*} > -q_h^{priv*} / \theta$  and that  $\theta q_h^{priv*} + q_m^{priv*} > \theta q_h^{priv*} - q_h^{priv*} / \theta = -q_h^{priv*} (1 - \theta^2) / \theta > 0$ . Therefore,  $p'(q_h^{priv*} + \theta q_m^{priv*}) < 0$ . Because the tariff surface is a plane, it can be concluded that  $\partial t_{priv}^o(0, 0) / \partial \alpha_c < 0$  whether the optimal intervention is an import tax or a subsidy.

Consider second the bias towards domestic producers. At  $(\alpha_c, \alpha_p) = (0, 1)$ , from (29), the PO tariff is:

$$t_{priv}^o(0, 1) = p'(q_h^{priv*} + \theta q_m^{priv*}) - p'_h q_h^{priv*} \theta = t_{priv}^o(0, 0) - p'_h q_h^{priv*} \theta \quad (32)$$

Thus, the PO tariff remains positive if it is positive at  $(0, 0)$  but it may be of either sign if  $t_{priv}^o(0, 0) < 0$ .

Suppose third, there is a bias towards consumers. Evaluating the PO tariff at  $(\alpha_c, \alpha_p) = (1, 0)$ , from

(29):

$$t_{priv}^o(1, 0) = p'(1 + \theta)(q_h^{priv*} + q_m^{priv*}) < 0 \quad (33)$$

The PO tariff remains negative if it is negative at  $(0, 0)$  and it becomes negative at some value of  $0 < \alpha_c \leq 1$  if  $t_{priv}^o(0, 0) > 0$ .

Finally, consider the welfare maximising outcome. Evaluating the PO tariff at  $(\alpha_c, \alpha_p) = (1, 1)$ , from

(29):

$$t_{priv}^o(1, 1) = q_h^{priv*}[\theta(p' - p'_h) + p'] + p'q_m^{priv*}(1 + \theta)$$

Making use of the definition of  $\theta$ , the first term is zero, so that:

$$t_{priv}^o(1, 1) = p'(1 + \theta)q_m^{priv*} < 0 \quad (34)$$

If the PO tariff is negative at  $(0, 0)$ , it remains so at  $(1, 1)$  whereas if it is positive at  $(0, 0)$ , it changes sign to become an import subsidy.<sup>23</sup>

These outcomes are summarised in the following proposition:

*Proposition 4: In the case of private firms with two sources of procurement, the PO tariff can be negative, zero or positive, the sign depending on the government's relative bias towards/against producer and consumer welfare and the associated ratio of imports to domestic procurement. The greater (smaller) is the bias towards consumers and the smaller (greater) the bias towards producers, the more likely it is that the sign will be negative.*

#### 4.2.2 STE with Joint Exclusive Rights

Let the government choose the tariff to maximise weighted welfare, as given by:

$$W_{STE, JR} = \alpha_c \left[ \int_0^{Q_h^{STE} + Q_m^{STE}} p(z) dz - pQ_h^{STE} - pQ_m^{STE} \right] + \alpha_p \left[ p_h Q_h^{STE} - \int_0^{Q_h^{STE}} p_h(v) dv \right] \\ + (p - p_h)Q_h^{STE} + (p - p_m - t)Q_m^{STE} + tQ_m^{STE} \quad (33)$$

<sup>23</sup> This result is consistent with proposition 3 of Lahiri and Ono where  $n=1$  and it is a more precise result than that obtained in proposition 4 of Larue and Gervais in which they found the sign of the *ad valorem* tariff to be ambiguous. It is clear from equations (30) and (32)-(34) that our results are more general because we allow more a greater variety of objective functions.

Totally differentiating, dividing through by  $dt$ , making use of (19), with  $p_m$  replaced with  $p_m + t$ , to substitute out  $(p - p_h)$  and  $(p - p_m - p'_m Q_m^{STE})$ , and simplifying, gives:

$$t_{STE, JR}^o = p'(1 - \alpha_c)[Q_h^{STE*} + Q_m^{STE*} \left( \frac{dQ_h^{STE*}/dt}{dQ_m^{STE*}/dt} \right)]$$

The first-order conditions for the STE were given by equation (19), as now modified by replacing  $p_m$  with  $p_m + t$ . Totally differentiating these expressions, setting  $p'' = p_h'' = p_m'' = 0$  and inverting, gives:

$$\begin{bmatrix} dQ_h^{STE*}/dt \\ dQ_m^{STE*}/dt \end{bmatrix} = \frac{1}{\Delta_1} \begin{bmatrix} 2p'_m - (2 - \alpha_c)p' & (2 - \alpha_c)p' \\ (2 - \alpha_c)p' & (2 - \alpha_p)p'_h - (2 - \alpha_c)p' \end{bmatrix} \begin{bmatrix} 0 \\ -1 \end{bmatrix} \quad (34)$$

from which  $\phi \equiv \left( \frac{dQ_h^{STE*}/dt}{dQ_m^{STE*}/dt} \right) = \frac{-(2 - \alpha_c)p'}{(2 - \alpha_c)p' - (2 - \alpha_p)p'_h}$ , with  $-1 < \phi < 0$ .

Making this substitution gives the PO tariff as:

$$t_{STE, JR}^o = p'(1 - \alpha_c)[Q_h^{STE*} + \phi Q_m^{STE*}] \quad (35)$$

The most obvious outcome from equation (35) is that if the STE is completely biased towards consumers ( $\alpha_c = 1$ ), the PO tariff will be zero regardless of its producer bias. The STE is a perfect substitute for a PO tariff. More generally, consider the relationship between the PO tariff and the policy bias. Using a parallel development to that for equations (30) and (32)-(34), similar results are obtained, the principal difference being that, unlike  $\theta$ , which is a constant,  $\phi$  is a function of the policy parameters. Therefore, the critical value of the ratio of imports to domestic procurement changes with the change in the policy parameters.

*Proposition 5: In the presence of a state trading enterprise with joint exclusive rights, the PO tariff may be negative, zero or positive. For a consumer-welfare maximising STE ( $\alpha_c = 1$ ), the PO tariff is zero. When there is some bias towards either consumers' or producers' welfare, the sign of the PO tariff is ambiguous.*

### 4.3 The difference in the PO tariffs

In section 3, it was concluded that if the government chooses an STE as the market structure in preference to an  $n$ -firm Cournot oligopsony/oligopoly, then there is no need for a tariff to achieve the maximum of the government's objective function. This unambiguous conclusion no longer holds in

the joint rights case. To see this, compare the expression for the politically optimal tariff for the benchmark (equation (29)) and that for the STE (equation (35)).

It can be shown that the politically optimal tariff as a function of the policy bias towards consumers is smaller with the STE than it is with private firms. Over a wide range of values of  $\alpha_c$ , the optimal tariff is an import subsidy for the benchmark, whereas with the STE, it remains an import tax. The same conclusion emerges with respect to the bias towards producers: the optimal tariff for the STE is smaller than that for the benchmark, although in this policy direction, it remains an import tax. In other words, the STE marginalises the usefulness of the tariff as a policy instrument to achieve policy optimisation. This marginalisation occurs because when the government chooses the STE as the market structure, it imposes its policy biases directly on the behaviour of the STE through its objective function. In effect, if the government chooses the STE as the market structure, it is employing two policy instruments to achieve its objective of re-distribution, whereas it has only one instrument with private firms. Intuitively, as above (section 3.2), the objectives of the government are already captured in the STE's first-order conditions which, therefore, require the politically optimal tariff to play a more marginalised role. Thus there is less for the tariff to do to achieve re-distribution with the STE market structure.

It is important to recognise that even though the STE acts as a sole intermediary, the outcome of policy with the STE cannot be conjectured from the  $n=1$  private intermediary cases, for example, as in Lahiri and Ono and in Larue and Gervais. To highlight this difference, take an example. Since most STEs are involved in agricultural trade with government policies targeted towards re-distribution, the government's welfare function should include the welfare of upstream suppliers, i.e., farmers' producer surplus. With the STE employed as an instrument of government policy, it will also include a potential bias towards producer and consumer welfare. Suppose, to push the example further, the STE is concerned about producer welfare. Then, even though it is the sole procurer in the domestic and import markets, it will not exploit its upstream market power in contrast to a profit maximising

monopsony intermediary. Since a single intermediary has the potential to act as a discriminating monopsonist, with the STE not exploiting its market power in domestic procurement, the level of equilibrium domestic procurement and imports now changes relative to that in the private firm case.

What the above analysis clearly shows is that if we now think of a politically optimal tariff in this context, with the STE the PO tariff is now redundant because the manipulation of the market and the nature of the STE's pay-off function *prior* to the setting of the politically optimal tariff. This mechanism and resulting outcome cannot be conjectured from previous research that is based on the case of a profit maximising single intermediary. These issues carry over to other configurations of policy where the PO tariff (even if not zero) plays a more marginal role in the presence of the STE. Since the STE reflects government policies towards re-distribution, not only is the government's welfare function different from the welfare maximising case (as well as in the constituents of the welfare function) but the government is employing two instruments. Since one of these instruments is the STE that involves the manipulation of market structure and the designation of the pay-off function prior to the setting of the tariff, the equilibrium levels of domestic procurement and imports reflect the presence and pay-off function of the STE. When the government then aims to use the tariff to affect (the redistribution of) welfare, the case for the use of this additional instrument is now more marginal.

## **5. STE with Import Rights Only/Domestic Market with Private Firms**

### ***5.1 Tariff equivalence***

In the previous section, the effects of the government's policy bias and the number of firms in the counter-factual on the tariff equivalence, have been investigated. The third factor that influences the tariff equivalence of an STE is the designation of its exclusive rights. As noted in the Introduction, differences in the exclusive rights that are designated to STEs are one of the main distinguishing features of STEs across countries. Therefore, we now change the nature of exclusive rights that apply to the STE. The market still comprises a domestically-sourced good that competes with imports in the consumer market but the state trading enterprise now has exclusive rights to import only and it is not

permitted to procure in the domestic market. The STE competes with  $n_d$  private firms for sales but these firms cannot purchase imports and are confined to procuring only from domestic producers.

Employing (15), but noting that the representative private firm can now only choose  $q_h^{priv}$  to maximise profits from domestically-procured supplies and employing (19) for the STE, which can now choose only  $Q_m^{STE}$  to maximise its payoff function from imported supplies, the first-order conditions are given by:

$$\begin{aligned} p - p_h - (p'_h - p')q_{h,i}^{priv} &= 0 \\ p - p_m - [p'_m - (1 - \alpha_c)p']Q_m^{STE} &= 0 \end{aligned} \quad (36)$$

Aggregating over the  $n_d$  private firms and re-arranging, (36) can be re-written as:

$$\begin{bmatrix} Q_h^{priv*} \\ Q_m^{STE*} \end{bmatrix} = \frac{1}{\Delta_M} \begin{bmatrix} [p'_m - (1 - \alpha_c)p'] & 0 \\ 0 & p'_h - p' \end{bmatrix} \begin{bmatrix} n_d(p - p_h) \\ p - p_m \end{bmatrix} \quad (37)$$

where  $\Delta_{MO} = (p'_h - p')[p'_m - (1 - \alpha_c)p'] > 0$ . Note now that the STE cannot directly influence producer surplus because of the absence of that component from its objective function.

Following the same procedure as above, set  $Q_m^{STE*}$  from (37) equal to  $Q_m^{priv*}$  from (18) and solve out for  $t^e$ . The implicit tariff equivalence in this case is given by:

$$t_{MO}^e = \frac{p'(p - p_h)}{p'_h - p'} + (p - p_m) \left[ 1 - \frac{\Delta_B}{n\Delta_{MO}} \right] \quad (38)$$

where the subscript  $MO$  denotes the case of exclusive rights over imports only. The sign of the first term is negative and that of the second is positive. The numerator of the term in square brackets can be re-written using the definition of  $\Delta_{MO}$  as:

$$\frac{(p'_h - p')[(n-1)(p'_m - p') - \alpha_c p'] + (p')^2}{n\Delta_{MO}}$$

which is positive  $n = 1$  and  $\alpha_c = 0$ . However, it is not obvious what the sign of  $t_{MO}^e$  will be as  $\alpha_c > 0$  and  $n$  vary.

In general, this STE acts as a tariff compared with a  $n$ -firm counterfactual, unless the policy weight on consumers is 'low' and  $n$  is 'small', in which instance it acts as an import subsidy. These observations are summarised in the following proposition.

*Proposition 6: In the case where the STE has exclusive rights over imports only and it competes with private firms that procure only from domestic suppliers, the tariff equivalence can be positive, zero or negative. The smaller the bias towards consumer welfare and the more competitive the underlying counter-factual benchmark, the greater is the tariff equivalence and the higher the import-restricting effect of the STE.*

## 5.2 PO Tariffs

As above, the government chooses the PO tariff to maximise weighted welfare, the objective function being given by:

$$W_{STE,MO} = \alpha_c \left[ \int_0^{mq_h + Q_m^{STE,MO}} p(z) dz - p(mq_h) - p(Q_m^{STE,MO}) \right] + \alpha_p \left[ p_h(mq_h) - \int_0^{mq_h} p_h(v) dv \right] \quad (39)$$

$$+ (p - p_h)mq_h + (p - p_m - t)Q_m^{STE,MO} + tQ_m^{STE,MO}$$

Totally differentiating, dividing through by  $dt$  and using equations (36), with  $p_m$  replaced with  $p_m + t$ , to substitute out  $(p - p_h)$  and  $p - p_m - p'_m Q_m^{STE,MO}$  gives:

$$t_{MO}^o = n_d q_h^{priv*} (\alpha_c p' - \alpha_p p'_h) \left( \frac{dq_h^{priv*} / dt}{dQ_m^{STE,MO*} / dt} \right) \quad (40)$$

The last term in parentheses can be evaluated from totally differentiating the first-order conditions (36), setting  $p'' = p_h'' = p_m'' = 0$  and inverting, to get:

$$\left[ \frac{dq_h^{priv*} / dt}{dQ_m^{STE,MO*} / dt} \right] = \frac{1}{\Delta_2} \begin{bmatrix} p'(2 - \alpha_c) - 2p'_m & -p' \\ -mp' & (m+1)(p' - p'_h) \end{bmatrix} \begin{bmatrix} 0 \\ 1 \end{bmatrix} \quad (41)$$

where  $\Delta_2 = [(n_d + 1)(p' - p'_h)][(2 - \alpha_c)p' - 2p'_m] - n_d(p')^2 > 0$ .

Then,  $\left( \frac{dq_h^{priv*} / dt}{dQ_m^{STE,MO*} / dt} \right) = \frac{-p'}{(n_d + 1)(p' - p'_h)}$ , where  $-1 < \left( \frac{dq_h^{priv*} / dt}{dQ_m^{STE,MO*} / dt} \right) < 0$ .

Equation (40) is unambiguously positive.<sup>24</sup> The size of the PO tariff depends upon the number of private firms in the domestic market,  $n_d$ , and the values taken by the policy coefficients. In section 4 above, the private firms and the STE were able to price discriminate between imports and domestic procurement since it was the same entity that could gain access to both sources of supply. This discrimination introduced an ambiguity about the sign of the PO trade intervention, i.e., an import subsidy or a tariff. In this section, where the domestic firms and the STE co-exist but where each entity is confined to procuring from a single source, the segmented market structure prevents such discrimination (see equation (37)) and, in doing so, removes the ambiguity. The PO intervention is a tariff imposed on the STE, the size of which depends in part on the level of domestic procurement by the private firms,  $n_d q_h^{priv}$ .

As noted, in the case where either the STE had joint rights over domestic procurement and imports, or where private firms could act as price discriminating oligopsonists, the number of firms played no role in determining the PO tariff. This is not the case when the STE co-exists with the  $n_d$  private firms though each operates in different segments of the procurement market. To see the role of  $n_d$  firms on the welfare maximising trade intervention, differentiate (40) partially with respect to the number of  $n_d$  firms which gives:

$$\frac{\partial t_{MO}^o}{\partial n_d} = \frac{-p' q_h (p' \alpha_c - p'_h \alpha_p)}{(n_d + 1)^2 (p' - p'_h)} > 0$$

Therefore, an increase in the policy bias (from equation (40)) or in the number of domestic firms increases the size of the politically optimal tariff.<sup>25</sup> These effects are summarised below.

*Proposition 7: When the state trading enterprise has exclusive rights over imports only and is excluded from domestic procurement, the PO tariff is always positive, no matter the size of  $n_d$  or the relative bias towards consumer welfare.*

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<sup>24</sup> This result contrasts with the result in Proposition 4 in Lahiri and Ono (1999) and in Proposition 6 in Larue and Gervais (2002) in both of which the sign of the welfare maximising tariff is ambiguous. It is positive (negative) if domestic procurement is 'high' ('low') relative to imports. In these papers, profit shifting occurs, whereas it does not do so in the derivation of equation (40).

<sup>25</sup> Again, the case with the STE changes the outcome due to the arguments in the government's welfare function, the potential concerns for re-distribution and nature of the pay-off function for the STE. Additionally in this case, the co-existence of the private firms with an STE with concerns of redistribution means that we have a mixed oligopoly in the baseline scenario with the implication that it changes the underlying configuration of the market against which to evaluate the use of the politically optimal tariff.

### ***5.3 Difference in the PO tariffs***

It was shown in section 4.3 that the effect of the STE with joint exclusive rights was to marginalise the role of the PO tariff in achieving the government's objective. It has now been shown in section 5.2 that the change in exclusive rights alters in a fundamental way to role of the tariff. As the policy bias towards consumers increases, rather than the PO tariff rate going to zero, as in the joint rights case, the PO tariff rate increases and remains positive. Intuitively, in the case where the STE had joint rights over domestic procurement and imports, it was more effective in substituting for the PO tariff as the bias in government policy was already fully reflected in the objectives of the STE (and hence captured in the first-order conditions). Thus, the STE with joint rights is a 'closer' substitute for the PO tariff. However, for an STE with import rights only, the first-order conditions capture only the potential bias towards consumers; the STE is less able to capture the redistributive aims of government and, as a consequence, acts as a less good substitute for the PO tariff, especially where the redistribution is biased towards producers.

### ***5.4 Numerical Illustration***

To see these comparisons more clearly, we provide a simple numerical example. Let the inverse demand function be  $p = 3000 - 0.2(Q_h + Q_m)$ ; the inverse domestic supply function be  $p_h = 500 + 0.1Q_h$ ; and the inverse import supply function be  $p_m = 50 + 0.1Q_m$ . Then the market access implications as a function of the policy biases can be derived and are shown in Table 1 for a counter-factual with  $n = 3$ . We also show the corresponding politically optimal tariffs for each case. For the policy biases, we highlight three cases: one where the government has an unbiased objective function, the conventional social welfare maximising case with  $\alpha_c = \alpha_p = 1$ ; one where it redistributes towards consumers  $\alpha_c = 1, \alpha_p = 0$ ; and one where producer welfare matters but consumer surplus does not  $\alpha_c = 0, \alpha_p = 1$ .

First of all, in considering the market access effects, the tariff equivalents would be positive in all cases where the STE had joint exclusive rights. In the case where the STE had import rights only and co-existed with private firms that procured from the domestic market, the implied tariff equivalent would be negative with a bias towards consumers but positive when the government favoured redistribution towards producers.<sup>26</sup> Taken on its own, the obvious inference would be that the joint rights STE would be a significant non-tariff barrier to trade and therefore should be appropriately measured as a non-tariff instrument and subject to negotiation in improving market access. With the STE with import rights only, there is also a significant negative market access impact with redistribution aimed towards producers.

However, from a nationalistic perspective, a different view of STEs may arise. The second column of Table 1 reports the level of market access which is contingent on (a) the underlying market structure and (b) the redistributive aims of government policy. In the third column, we report the value of the PO tariff that would be necessary to achieve the politically optimal level of market access. In the case with private firms only, the politically optimal tariff is negative when the government ‘cares’ about consumers (i.e. an import subsidy) but positive when it cares only about producers. Moreover, since the tariff is the only available instrument but with market power in the domestic market, to meet these redistributive objectives, the corresponding level of the tariff is relatively ‘high’.

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<sup>26</sup> The direction of the tariff equivalent is fairly obvious from looking at the market access effects and to limit the information reported in the table, we omit the specific values associated with the tariff equivalent effects.

**Table 1: Market Structure, Market Access and the Politically Optimal Tariff**

Market Structure	Quantity Imported	Politically Optimal Market Access Levels	Politically Optimal Tariff (%)
Private Firms ( $n = 3$ )			
$(\alpha_c, \alpha_p)$			
(1, 1)	5775	7507	-61
(1, 0)	5775	8227	-87
(0, 1)	5775	3750	72
STE, Joint Rights			
$(\alpha_c, \alpha_p)$			
(1, 1)	4812	4812	0
(1, 0)	5667	5667	0
(0, 1)	3393	3087	22
STE, Import Only ( $n_d = 2$ ) <sup>a</sup>			
$(\alpha_c, \alpha_p)$			
(1, 1)	7353	6995	19
(1, 0)	7353	7122	12
(0, 1)	3598	3426	21

Note: <sup>a</sup> The number of private firms is set to 2 to maintain the same total number of intermediaries as in the private firm only case.

In each of the STE cases, there are two principal results to note. First, as is apparent from column 2, the politically optimal level of market access is contingent on the characterisation of market structure and the pay-off function of the STE. When the objectives of the STE are biased towards consumer (producers), the desirable level of market access is high (low) respectively. The second feature of the STE is how close it gets on its own towards this level of market access or, to focus the issue differently, to note the level of the corresponding PO tariff. As we noted in Proposition 5, the PO tariff will be zero when the STE has joint rights and biased towards consumers, i.e., the STE in this case is a perfect substitute for the politically optimal tariff. However, in the case where the STE has joint rights and is biased towards producers or where it has import rights only, there is a case for a positive PO tariff. In these cases, however, the PO tariff is relatively low. In other words, the STE plays some role in meeting the objectives of government policy but it does so imperfectly, thus

leaving open the need for the PO tariff to play a marginal role in ensuring the government's redistributive objectives are fully met.<sup>27</sup>

## 6. Summary and Conclusions

State trading enterprises are widely used and are common across a wide range of countries, including some of the main agricultural importing (and exporting) countries such as China, India, Japan, South Korea among others. Despite their widespread use and importance, relatively little attention has been paid in the research literature to their potential to distort trade and, in turn, the implications for redistributional/welfare maximising trade policies following the state's manipulation of market structure. This paper has focussed on STEs used by importing countries and has analysed two related aspects of their economic effects: the trade distorting effect that can arise, and the case for the corresponding tariff aimed either towards redistribution or welfare maximisation. We have considered these issues for different permutations of STEs and private firms that reflect the use of STEs across many countries, as well as the government's re-distributive objectives that the use of the STE (and tariffs) may aim to achieve. We have analysed how these characteristics of STEs (i.e., the differences in the objective function and the designation of exclusive rights) interact to determine the properties of the trade distorting effect and the case for, and the magnitude of, the use of a politically optimal tariff aimed towards redistribution or welfare maximisation.

The overall policy insights that arise from this paper are two-fold. First, from a nationalist perspective, the use of the STE is an additional instrument in the trade policy armoury of governments that can be used to meet re-distributional objectives. Depending on the re-distributional aims, it may be a perfect substitute for a tariff; in some cases, however, it may be an inadequate instrument (insofar as the effect on market access may be 'too high' or 'too low') requiring the complementary role of a tariff to meet the government's redistributive objectives. But even in the latter cases, the use of an STE, may reduce the need for a politically optimal tariff and, given the inadequacy with which STEs

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<sup>27</sup> If the number of firms is increased, then in the case of private firms, the PO tariff increases marginally in absolute value while in the STE<sub>MO</sub> cases, the tariff decreases.

are currently dealt with in the WTO, manipulating market structure may be a means of dealing with the redistributive issues without the appearance of using a tariff at all or at least one set at relatively high levels. Second, from a multilateral perspective, focussing on conventional trade policy instruments and ignoring the role of state trading enterprises, trade negotiators appear oblivious to the interaction and to the consequences for market access of these STEs.

In the presence of an STE, a reduction in a tariff may not necessarily result in an increase (or as much of an increase) in market access as trade negotiators would expect because of the implicit tariff effect of the STE. As such, it is desirable that state trading enterprises should be subject to stricter WTO disciplines and accepted as non-tariff barriers in those situations in which they restrict imports. In this context, current attempts to quantify non-tariff measures, such as those instigated by the OECD and UNCTAD, deal inadequately with the STE issue.

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