DOMESTIC AND TRADE EQUIVALENCES OF STATE TRADING IMPORTERS

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This version: July, 2010

Abstract: Governments manipulate market structure by using state trading enterprises to achieve a number of different objectives, one of which is the redistribution of the components of domestic social welfare. Such manipulation induces changes in consumption and production and, in an open economy, induces changes in imports (or exports). Thus, an importing STE can be designated as a non-tariff measure and its consumer subsidy, its producer subsidy and its tariff equivalence can be defined. Having explored the properties of these equivalences, we calibrate the theoretical model to an STE employed in Japan and calculate their significance.
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1. INTRODUCTION

Non-tariff measures (NTMs) are an increasingly important feature in international trade. Some of these measures exist to correct market failures, e.g., measures such as standards; others exist for protectionist reasons, e.g., tariff quotas; and others are essentially domestic instruments that have an influence on international trade, e.g., domestic price support. The use of state trading enterprises bridges each of these characterisations of policy instruments since, contingent on their particular form, they may be used to correct for domestic and/or external market failures, to manage trade and/or to influence the distribution of welfare internally.\(^1\) Recently, the United Nations Conference on Trade and Development (UNCTAD) and the World Trade Organization (WTO) have established a Multi-Agency Support Team (MAST) to develop a new classification scheme for NTMs (van Tongeren \textit{et al.}, 2009). The outcome of this development is seen as step forward in providing a consistent international classification of NTMs for the purposes of improving transparency in this category of trade measures. State trading enterprises have been classified by MAST under the heading "Anti-Competitive Measures" (van Tongeren \textit{et al.}, 2009). However, the economic effects of STEs (both domestically and on trade) have been relatively underexplored and having them classified unconditionally as “anti-competitive” may be premature. The objective in this paper is to evaluate, both theoretically and empirically, the nature and extent of the impact of STEs using domestic subsidy and tariff equivalent measures that arise from their so-called “anti-competitive behaviour”, while taking into account the different characteristics of state trading in importing countries.

\(^1\) In the Understanding on the Interpretation of Article XVII of the General Agreement on Tariffs and Trade 1994, the working definition of STEs was agreed to be:

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)
State trading enterprises have a long history and they remain a common feature in international markets, especially those for certain agricultural commodities. They exist in order to achieve a variety of objectives pursued by governments of both developed and developing countries.\(^2\) The government's objective may be to change the market structure (domestic, import or both) with a view to influencing the distribution of domestic welfare by addressing domestic distortions such as the exercise of domestic market power by private firms, external distortions such as maximising terms of trade benefits or acting as a substitute for more conventional policy instruments such as price support. There are two ways in which this change can be effected. First, there is the designation of exclusive rights and the markets in which they apply (i.e., either domestic procurement or import procurement or both) as this allocation explicitly determines market structure and the number of participants that operate in (segments of) the market. Second, the market outcome will also reflect the objective function of the STE which, in turn, reflects the distributional aims of the government. Thus the objective of the STE potentially differs from the profit maximising objective common to commercial firms. Having altered market structure and determined the objective function of the STE, the government has created an entity which affects prices and quantities and, therefore, like some other policy instruments, is equivalent to an import tax/subsidy, to a domestic producer tax/subsidy and to a consumer tax/subsidy. Therefore, the trade and welfare effects of an STE can be expressed in terms of each of these tax/subsidy equivalences.\(^3\)

There are several definitions of instrument-equivalence (Lloyd, 1982). In the most general form, equivalence of two instruments exists when each is capable of generating the same values of all of the endogenous variables. In a narrower definition, two instruments are equivalent if each generates the same values for a subset of the endogenous variables. In Lloyd's terminology, such instruments are "quasi-equivalent". In this paper, we make use of this narrower definition using quantities consumed, produced and imported as the variables used to measure equivalence.

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\(^2\) The objectives of STEs are several and they vary across countries and even within countries across different commodities (see OECD (2001) for details). Moreover, they are often found in conjunction with other forms of government intervention. These include minimum producer prices and maximum consumer prices. In this paper, we ignore the interaction of the STE with these instruments in order to focus attention on the direct effects of the STE.

\(^3\) For the development of a framework for the analysis of standards, see van Tongeren et al. (2009).
There are several attractive features of these instrument equivalences, the most obvious one being their transparency. In the context of trade policy equivalence, various non-tariff barriers (e.g. quantitative restraints) may be expressed as tariff equivalents, thus providing a common basis on which to assess the trade restrictiveness of a range of different trade policy instruments, as reflected in the motivation for the MAST initiative. In the context of domestic policy equivalents, producer and consumer subsidy equivalents have been used since the mid-1980s to measure intervention in agricultural markets, the aim of which being to absorb in a price-related measure the extent to which a range of government interventions affect domestic producers and consumers (see OECD (2009b) for the most recent application of these measures).

However, despite their widespread use, STEs have been generally ignored analytically until recently mainly because the challenges of measuring their instrument-equivalence are very different from measuring the effects of more conventional policy interventions. This challenge arises because STEs alter market structure. The limited exceptions include Lloyd (1982), and McCorriston and MacLaren (2005, 2007) who address the import tariff/export subsidy-equivalence of importing and exporting STEs. The domestic equivalence of STEs, however, has been largely ignored. This omission is important because the impact of STEs may be primarily on domestic markets rather than on trade, as argued by several participants in the Doha Round negotiations, including Japan. In addition, by appearing to be reducing the use of conventional forms of intervention (e.g. price support) but keeping STEs in place, the overall assessment of government intervention in markets may be unclear, unless the impact of STEs is fully taken into account. Therefore, determining both the trade and domestic effects of STEs by the use of tariff and domestic subsidy equivalent measures offers a means to promote greater transparency of STEs as a non-tariff measure and as an instrument for re-distributing welfare.

The paper is organised as follows. In section 2, we develop the intuition for the equivalences of an STE through an illustrative example. Unlike the measurement of

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4 For an elaboration of the argument put by Japan to the WTO negotiating committee on agriculture, see WTO (2000).
more traditional policy instruments, the equivalences that we derive relate to a counterfactual market structure that is not directly observed. In this section, to highlight the nature of instrument-equivalence, we assume initially that the counterfactual is a pure middleman (i.e., a monopsony/monopoly) in both domestic and import markets and that the STE, operating similarly in both markets, pursues one of three different objectives. These differences highlight the role of the redistributional objectives of the STE in determining the policy equivalences. In section 3, we develop the principle of instrument-equivalence in a formal theoretical framework. This allows us to analyse three features of STEs which emerge as important: first, we consider a more general counterfactual market structure which is an $n$-firm Cournot oligopsony/oligopoly; second, we assess the effects on equivalences where different exclusive rights apply to the STE; and third, we consider a more general representation of the re-distributive bias in the STE’s objective function. In section 4, we calibrate a linear version of the theoretical model to a case study of an STE in Japan. This case study was chosen because Japan is not only a primary user of STEs in (agricultural) markets but, reflecting recent policy reforms, there has been a change in the extent of the exclusive rights designated to the STE. This change allows the measurement of equivalences to have some quantitative significance in assessing the change in policy. Japan has also claimed in the WTO negotiations that the trade effects of the STE were secondary to the domestic impact, a position that was supported by other state trading importers such as South Korea. The contention that STEs have primarily a domestic rather than trade impact, together assessing the levels of support arising from the change in the exclusive rights that apply to the STE highlight the applicability of the theoretical framework outlined. In section 5, we present some conclusions.

2. AN ILLUSTRATIVE MODEL

We begin the analysis of an STE in an importing country through developing a simple model that clarifies the intuition of the more general results that follow in section 3. Consider a marketing firm, or middleman, in an importing country that buys a good from domestic and import sources and sells it to domestic consumers; it does not
manufacture the good. In the absence of government intervention, the market structure is assumed to be a pure middleman. For the moment, this is the benchmark or counterfactual that allows a comparison with the STE. With government intervention through the establishment of an STE that has exclusive rights in both domestic and import markets, as well as a specific objective, the market structure is altered here only through the difference in objectives between the STE and the private firm. The effects of this difference are measured through subsidy and tariff equivalences.

As illustrative of the intuition, consider Figure 1 where, for clarity of the geometry, the domestic and import inverse supply functions are assumed to be identical. In the domestic market there is a single, profit-maximising marketing firm that procures an amount of the good from domestic producers and from imports, and that sells it to domestic consumers. This is the structure that is defined as the benchmark. The good is homogeneous and is supplied under perfect competition at increasing marginal cost, thus allowing: first, for terms of trade effects with respect to import procurement; and second, for interdependence between the two procurement markets. The firm's only costs are those of procurement. From the standard first-order conditions, \( ME_h(q_h) = ME_m(q_m) = MR(Q) \), and \( Q = q_h + q_m \), the quantities that it procures are \( q_{h}^{\text{priv}} = q_{m}^{\text{priv}} = q_{i}^{\text{priv}} \) at a price \( p_{i}^{\text{priv}} \) \( (i = h, m) \) and it sells the amount \( Q_{\text{priv}} = q_{h}^{\text{priv}} + q_{m}^{\text{priv}} \) at the consumer price of \( p_{\text{priv}} \). With the domestic and import supply functions assumed to be identical, there is no opportunity for the firm to practise third-degree price discrimination across different sources of procurement.

The alternative market structure is one in which there is an STE with exclusive rights in both procurement markets. The STE maximises a weighted objective function comprising consumer surplus, domestic producer surplus and profits, where the weights are chosen by government. Assume first of all that the objective function is biased towards consumers and no weight is placed on the welfare of domestic suppliers. Then the weights on consumer surplus and the STE's profits are each unity. The first-order conditions, \( ME_h(q_h) = ME_m(q_m) = p(Q) \), give rise to the procurement

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5 Lahiri and Ono (1999) have claimed this form of market structure has been largely ignored in the international trade literature.
of quantities $q^S_{h,c} = q^S_{m,c} = q^S_{i,c}$ at a price $p^S_{i,c}$ ($i = h, m$), and sales to consumers of $Q^S = q^S_{h,c} + q^S_{m,c}$ at the price $p^S$. 

On the other hand, if the STE is biased towards producers and it places no weight on consumers' welfare, then the weights on producer surplus and the STE's profits are each unity. The first-order conditions, $p_h(q_h) = ME_m(q_m) = MR(Q)$, give rise to domestic procurement of $q^S_{h,c}$ at a price of $p^S_{h,c}$, to imports of $q^S_{m,c}$ at a price of $p^S_{m,c}$, and to sales to consumers of $Q^S = q^S_{h,c} + q^S_{m,c}$ at a price of $p^S$. 

The third alternative specification of the STE is one where it is required to maximise social welfare, which is composed of equally-weighted consumer surplus, producer surplus and its profits, where the weights are each unity. The first-order conditions, $p_h(q_h) = ME_m(q_m) = p(Q)$, bring about equality of the domestic procurement price and the consumer price ($p^{S,w} = p^{S,w}_h$) but the STE continues to exploit exporters through maximising the gains from improving the terms of trade ($p^{S,w}_m < ME^{S,w}_m$). The quantity procured domestically is $q^{S,w}_h = Q^{S,p}$, imports are $q^{S,w}_m$ and sales to consumers are $Q^{S,w}$ at the price $p^{S,w}$.

**FIGURE 1 HERE**

With the number of private firms in the benchmark fixed at one, the differences in the quantities procured and sold, the procurement prices and the selling prices, depend solely on the differences in the objective function of the firm and the STE. Given these differences in outcomes, the consumer tax/subsidy equivalent, the producer tax/subsidy equivalent and the tariff/import subsidy equivalent of the STE can be determined by comparing its choices of procurement and sales with those of the monopsony/monopoly. Consumers and producers would prefer the STE to the pure middleman as measured by increases in consumer and producer surplus, respectively. Foreign suppliers would also prefer the STE, except if its objective is producer-biased, because of the greater market access. Consumers would also prefer the STE

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6 If the STE were required to maximise profits (i.e., placing no weight on consumer or producer welfare), then it would behave exactly as the pure middleman and the equilibrium values for all variables would be identical with those in the benchmark.
to be welfare maximising \((Q_{w}^{S} > Q_{c}^{S} > Q_{p}^{S})\); producers would prefer the STE to be welfare maximising \((q_{h}^{S} > q_{h}^{S} > q_{h}^{S})\); and exporters would prefer the STE to be consumer surplus maximising \((q_{m}^{S} > q_{m}^{S} > q_{m}^{S})\). From these results, it is not obvious in what sense an STE is "anticompetitive", if a pure middleman is the benchmark. With the three chosen objectives for the STE, it is in each case "pro-competitive" because it procures more and sells more than the middleman.

**Tariff equivalence:**

In general, the tariff equivalence of the STE is the implicit import tax/subsidy that is required to be imposed on the private firms to bring about equality of their imports with those of the STE. Therefore, the tariff equivalence of the consumer-biased (welfare maximising) STE is the implicit import subsidy that would increase import procurement from \(q_{m}^{priv}\) to \(q_{m}^{S} (d_{m}^{S})\) (Figure 1). The tariff equivalence of the producer-biased STE is the implicit tariff that would decrease import procurement from \(q_{m}^{priv}\) to \(q_{m}^{S} \). The important point to note is that the size and the sign of the trade-distorting effect of the STE depends upon its objective function, *ceteris paribus.*

**Consumer subsidy equivalence:**

In general, the consumer subsidy equivalence of the STE is the implicit consumption tax/subsidy that is required to bring about equality of the quantities consumed with private firms and with the STE. The consumer subsidy equivalence of the consumer-biased (producer-biased, welfare maximising) STE is the implicit consumer subsidy that would need to be given to the monopsony/monopoly to increase its total procurement from \(Q^{priv}\) to \(Q^{S} (Q_{c}^{S}, Q_{w}^{S})\).

**Producer subsidy equivalence:**

In general, the producer subsidy equivalence of the STE is the implicit production tax/subsidy that is required to bring about equality of the quantities procured domestically by private firms and by the STE. The producer subsidy equivalence of

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7 In all cases of the policy equivalents, the implicit measures can be expressed in specific or *ad valorem* forms, which may differ given the imperfectly competitive set-up employed in this paper.
the consumer-biased (producer-biased, welfare maximising) STE is the implicit production subsidy that would need to be given to the monopsony/monopoly to increase its domestic procurement from $q_{h}^{priv}$ to $q_{h}^{S,c}$ ($q_{h}^{S,p}$, $q_{h}^{S,w}$).

**Discussion**

Using these definitions of equivalences, it is possible to sign the subsidy equivalence for these three examples of an STE when compared with a pure middleman. First, the consumer-biased STE acts as an import subsidy ($Q_{m}^{S,c} > q_{m}^{priv}$), a consumer subsidy ($Q_{h}^{S,c} > q_{h}^{priv}$) and a domestic producer subsidy ($q_{h}^{S,c} > q_{h}^{priv}$) (Figure 1). Second, the producer-biased STE acts as an import tariff ($q_{m}^{S,p} < q_{m}^{priv}$), a consumer subsidy ($Q_{h}^{S,p} > q_{h}^{priv}$) and a producer subsidy ($q_{h}^{S,p} > q_{h}^{priv}$). Third, the social welfare maximizing STE acts as import subsidy ($q_{m}^{S,w} > q_{m}^{priv}$), a consumer subsidy ($Q_{h}^{S,w} > q_{h}^{priv}$) and a producer subsidy ($q_{h}^{S,w} > q_{h}^{priv}$). Note that in the case of the social welfare maximising STE, it corrects the domestic market failure caused by the pure middleman but it also continues to exploit the country’s terms of trade, even though it imports more than the pure middleman.

**Extensions**

Thus far the counterfactual has been a pure middleman. It is possible to use Figure 1 to illustrate what would happen if the benchmark were an $n$-firm Cournot oligopsony/oligopoly ($n > 1$) instead of a monopsony/monopoly. This extension introduces ambiguity into the results just obtained. In the case of an oligopsony/oligopoly, the perceived marginal expenditure functions and the perceived marginal revenue function would rotate rightwards as $n$ increases (not shown). As they do so, relative to the values for the pure middleman, the optimal procurement quantities and prices will increase. Together, these increased quantities procured and sold will lower the consumer price. In turn, they change the benchmark against which the policy equivalences will be measured.

Specifically, the effect of $n$ on the consumer subsidy equivalence of the STE is to cause the size to decrease as $Q^{priv}$ increases. As the latter passes each $Q^{S,j}$, $j = p, c$, the subsidy equivalence changes sign to an increasing tax equivalence (Figure 1).
The effect of $n$ on the producer subsidy equivalence is to cause the size to decrease and to change sign as $q_{h}^{priv}$ passes $q_{h}^{S-j}$, $j = w, c$ to an increasing producer tax equivalence. Therefore, the consumer and producer equivalences are each an increasing function of $n$. The effect of $n$ on imports follows a similar pattern. As $q_{m}^{priv}$ increases with $n$, the tariff equivalence relative to $q_{m}^{S-p}$ increases while the import subsidy relative to $q_{m}^{S-j}$, $j = w, c$ declines and becomes an increasingly large tariff.

The equilibrium condition for each of the STEs in Figure 1 reflects policy weights of either zero or unity. However, these extremes need not hold in practice. Begin with equal weights of zero on the welfare of consumers and producers and then increase the weight on consumers (producers). The effect is rotate the marginal revenue (marginal expenditure) function to the right and to cause the equilibrium to move along the function labelled $ME_{n}(q_{h}) + ME_{m}(q_{m})$ ([MR(Q)]). Thus the effects of the policy weights individually are different from a change in the number of firms: the first rotates only one of the marginal functions; the second rotates both.

There are other modifications of the benchmark that could be illustrated with the aid of Figure 1. For example, it could be the case instead that the STE has only exclusive rights over imports (domestic procurement) and it has to compete with $n$ profit-maximising firms for domestic procurement (imports). On the other hand, it could also be the case that the STE has exclusive rights to import (procure domestically) but it is excluded altogether from domestic procurement (imports). Another modification is one where the inverse supply function of imports differs from the domestic inverse supply function in either slope or intercept or both. These issues are analysed in the theoretical framework outlined below.

3. A GENERAL MODEL

We assume a partial equilibrium set-up where consumer utility is separable and linear in the numeraire good. The inverse demand function derived from the constrained maximisation of utility is given by:

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8 In all of these cases, there is a form of mixed oligopoly. See De Fraja and Delbono (1990) for an early survey of this literature.
where \( p' < 0, \ p^* \leq 0 \) and \( Q \) is the quantity consumed, which is the sum of the quantity procured domestically and the quantity imported. The domestic inverse supply function is given as:

\[
(2) \quad p_h = p_h(Q_h)
\]

where subscript \( h \) denotes the domestically-procured commodity, \( p'_h > 0, \ p^*_h \geq 0 \). Similarly, the inverse import supply function is given by:

\[
(3) \quad p_m = p_m(Q_m)
\]

where subscript \( m \) denotes procurement from imports with \( p'_m > 0, \ p^*_m \geq 0 \).

There are two sources of profits for the private firms: profits from the domestically-procured commodity (\( \pi_h \)) and profits from the imported commodity (\( \pi_m \)), giving the profit function for a representative firm as:

\[
(4) \quad \pi^\text{priv} = \pi_h + \pi_m = (p - p_h)q^\text{priv}_h + (p - p_m)q^\text{priv}_m
\]

where the superscript \( \text{priv} \) denotes the private firm case. Since we are measuring the effect of the STE against the counterfactual, we amend (4) to account for the implicit policy instruments, specifically, the implicit consumer subsidy equivalent, the implicit producer subsidy equivalent and the implicit tariff equivalent. Taking account of these implicit measures, we can re-write the profit function for a representative firm, assuming specific taxes/subsidies, as:

\[
(4') \quad \pi^\text{priv} = \pi_h + \pi_m = [(p + s^c) - (p_h - s^p)]q^\text{priv}_h + [(p + s^c) - (p_m + t^c)]q^\text{priv}_m
\]

where \( s^c > (<) 0 \) implies consumer subsidy (tax), \( s^p > (<) 0 \) implies a producer subsidy (tax), and \( t^c > (<) 0 \) implies an import tax (subsidy).

There are two aspects of the STE that we need to consider. One is the characterisation of exclusive rights that designate the market(s) in which the STE can operate. The second is the objective function of the STE. As noted above, the STE is an instrument of government policy reflecting its distributional aims., and are widely used in agricultural markets. With this in mind, note that in many developed countries, agricultural policy distributes income to producers at the expense of consumers (and
taxpayers), while in many developing commodity importing countries, policy is often biased in favour of consumers (and taxpayers).9

With these biases in mind, we can characterise the objective function of the STE as:

\[ W = \alpha_1 CS + \alpha_2 PS + \alpha_3 (\pi_h + \pi_m) \]

where \( CS \) is consumer surplus, \( PS \) is producer surplus of domestic suppliers, and \( \pi_h \) and \( \pi_m \) are the profits from the two sources of supply. Normalising on \( \alpha_3 \), we can re-write (5) as:

\[ (5') \quad W = \alpha_c CS + \alpha_p PS + \pi_h + \pi_m \]

where \( \alpha_c \) is the weight on consumer surplus relative to profits and \( \alpha_p \) is the weight on producer surplus relative to profits.10

3.1 An STE with Joint Exclusive Rights

We start with the case where the STE has sole rights over both domestic procurement and imports and we label this the ‘joint rights’ case, superscripted by \( SJ \). Note that, although the government has designated monopsony rights over both sources of supply and monopoly rights with respect to consumers, the extent to which these rights will result in the standard monopoly/monopsony outcomes depends on the weights in the STE’s objective function.

Let the STE choose \( Q_{SJ}^h \) and \( Q_{SJ}^m \) to maximise (5'). The first-order conditions are given by:11

\[ p + (Q_{SJ}^h + Q_{SJ}^m)(1-\alpha_c)p' - p_h - Q_{SJ}^h (1-\alpha_p)p_h = 0 \]

\[ p + (Q_{SJ}^h + Q_{SJ}^m)(1-\alpha_c)p' - p_m - Q_{SJ}^m p_m' = 0 \]

which, after re-arranging give:

\[ \begin{bmatrix} Q_{SJ}^h \\ Q_{SJ}^m \end{bmatrix} = \frac{1}{\Delta_S'} \begin{bmatrix} p'_m - (1-\alpha_c)p' \\ (1-\alpha_c)p' \end{bmatrix} \begin{bmatrix} (1-\alpha_c)p' \\ (1-\alpha_p)p_h' - (1-\alpha_c)p' \end{bmatrix} \begin{bmatrix} p - p_h \\ p - p_m \end{bmatrix} \]

where \( \Delta_S' = [(1-\alpha_p)p_h' - (1-\alpha_c)p'][(p'_m - (1-\alpha_c)p') - (1-\alpha_c)^2(p')^2] > 0 \).

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9 These biases are confirmed by the recent World Bank study (Anderson et al., 2008).
10 Reflecting the re-distributional aims of agricultural policy in developed (developing) countries, we would have \( \alpha_p > \alpha_c \) (\( \alpha_p < \alpha_c \)).
11 We assume second-order and stability conditions hold in all cases.
It is useful for later intuition and analysis to note the effect of the relative weights, \( \alpha_c, \alpha_p \), on the quantities procured. Totally differentiate equation (6) and re-arrange to get:

\[
\begin{bmatrix}
(p' - p'_h)(2 - \alpha_c) & p'(2 - \alpha_c) \\
p'(2 - \alpha_c) & p'(2 - \alpha_c) - 2 p'_m
\end{bmatrix}
\begin{bmatrix}
\frac{dQ^S}{d\alpha_c} \\
\frac{dQ^S}{d\alpha_p}
\end{bmatrix} = \begin{bmatrix}
p'(Q^S_h + Q^S_m)d\alpha_c - p'_h Q^S_h d\alpha_p \\
p'(Q^S_h + Q^S_m)d\alpha_c
\end{bmatrix}
\]

where it has been assumed here that the inverse demand and inverse supply functions are linear (\( p^* = p^*_h = p^*_m = 0 \)). Then, using Cramer’s rule, the total derivatives for the effects of changes in the producer bias are:

\[
\frac{dQ^S}{d\alpha_p} \bigg|_{d\alpha_c = 0} = -(\Delta^I)\frac{1}{\alpha_p} p'_h Q^S_h [p'(2 - \alpha_c) - 2 p'_m] > 0, \quad \text{for} \quad 0 \leq \alpha_c \leq 2
\]

and for the effects of changes in the consumer bias are:

\[
\frac{dQ^S}{d\alpha_c} \bigg|_{d\alpha_p = 0} = (\Delta^I)\frac{1}{\alpha_c} p'(2 - \alpha_c) p'_h Q^S_h \leq 0, \quad \text{for} \quad 0 \leq \alpha_c \leq 2
\]

These effects can be summarised in the following Lemma:

**Lemma 1:** In the STE case with joint exclusive rights over domestic procurement and imports, as the weight on producer surplus increases, domestic procurement rises and imports fall. As the weight on consumer surplus increases, both domestic procurement and imports rise.

To gauge the domestic and trade effects following from this characterisation of the STE, the quantities in (7) have to be compared with the quantities in the \( n \) private firm benchmark which are derived from maximising (4‘)\(^12\). The first-order conditions in the counter-factual private firm case are given by:

\[
\begin{align*}
p + s^c &+ (q^p_{priv} + q^m_{priv}) p' - p_h + s^p - q^m_{priv} p'_h = 0 \\
p + s^c &+ (q^p_{priv} + q^m_{priv}) p' - p_m - t^c - q^m_{priv} p'_m = 0
\end{align*}
\]

Aggregated and re-arranged, they give:

\(^12\)In this paper we are not directly interested in the market structure that would arise in the absence of the STE; rather the focus is on the properties of the implied domestic subsidy/tax and tariff equivalents that arise due to the STE given a more or less competitive benchmark.
where $\Delta_B = (p_h' - p')(p_m' - p') - (p')^2 > 0$.

To derive each of these implicit policy equivalent effects individually, we compare the quantities that would arise in the private sector benchmark (11), with the corresponding quantities that arise in the STE outcome (7). Since each of the implicit policy effects are summary measures focussed on a specific group (i.e., producers or consumers or exporters seeking market access), set two of the implicit subsidy/tax measures not of immediate interest equal to zero and derive the other.

(a) Implicit Producer Subsidy Equivalent

To gauge the effect of the STE on domestic producers, we are looking for the implicit subsidy that would have to be paid to the $n$ private firms to equalise the level of domestic output arising in (11) with the level of domestic procurement arising in (7), i.e., the implicit value of $s^p$ that equalises $Q_h^{priv}(s^p) = Q_h^{SJ}$. Re-arranging in terms of $s^p$ gives the implicit producer subsidy equivalent as:

$$s_p = \frac{(p - p_h)}{(p_m' - p')} \left\{ \frac{p_m' - p'}{n\Delta_S^p} \frac{\Delta_B}{n\Delta_S^p} - (p_m' - p') \right\} + \left\{ \frac{p - p_m}{p_m' - p'} \right\} \left\{ (1 - \alpha_c) p' \frac{\Delta_B}{n\Delta_S^p} - p' \right\}$$

where $\Delta_B$ and $\Delta_S$ are given in (7) and (11), respectively.

(b) Implicit Consumer Subsidy Equivalent

The effect of the STE on consumers is given as the implicit consumer subsidy that would be required for the private firms to replicate the same total quantities sold by the STE. This implicit subsidy is found by equating total quantities $[Q_h^{priv}(s^c) + Q_m^{priv}(s^c)]$ in (11) with total quantities $(Q_h^{SJ} + Q_m^{SJ})$ in (7) and solving for $s^c$:

$$s^c = \frac{(p - p_h)}{(p_m' + p_h)} \left\{ p_m' \frac{\Delta_B}{n\Delta_S^c} + \frac{(p - p_m)}{(p_m' + p_h)} \left\{ (1 - \alpha_p) p' \frac{\Delta_B}{n\Delta_S^c} - p' \right\}$$

(c) Implicit Tariff Equivalent

The effect on trade is given by the implicit tariff that would have to be imposed on the \( n \) private firms such that the level of imports in both the private and STE cases are equal. Using (7) and (11), the implicit tariff is given by:

\[
I^{cl} = \frac{(p - p_n)}{(p'_n - p')} \left[ p' - (1 - \alpha_c) \frac{\Delta_t}{n\Delta_s} \right] + \frac{(p - p_m)}{(p'_m - p')} \left[ (p'_h - p') - [(1 - \alpha_p) p'_h - (1 - \alpha_c) p'] \frac{\Delta_t}{n\Delta_s} \right]
\]

(d) Discussion

Inspection of the implicit measures reported in (12)–(14) shows that the sign and magnitude of them will be determined by the competitiveness of the benchmark \( n \), the relative competitiveness of imports \( p_m \leq p_n \) and the relative weights in the STE’s objective function \( \alpha_c, \alpha_p \). To explore further, it is useful to consider each of these determinants separately.

Assume, first of all that the STE, as with the private firms, maximises joint profits \( \alpha_p = \alpha_c = 0 \). Then each of the implicit measures can now be written as:

\[
S^{pj}_{\alpha_c = \alpha_p = 0} = \frac{(p - p_n)}{(p'_m - p')} \left[ (p'_m - p') \left( \frac{1}{n} - 1 \right) \right] + \frac{(p - p_m)}{(p'_m - p')} \left[ p' \left( \frac{1}{n} - 1 \right) \right]
\]

\[
S^{cj}_{\alpha_c = \alpha_p = 0} = \frac{(p - p_n)}{(p'_m + p'_h)} \left[ p'_m \left( \frac{1}{n} - 1 \right) \right] + \frac{(p - p_m)}{(p'_m + p'_h)} \left[ p'_h \left( \frac{1}{n} - 1 \right) \right]
\]

\[
I^{cl}_{\alpha_c = \alpha_p = 0} = \frac{(p - p_n)}{(p'_h - p')} \left[ p' (1 - \frac{1}{n}) \right] + \frac{(p - p_m)}{(p'_h - p')} \left[ (p'_h - p') (1 - \frac{1}{n}) \right]
\]

The most obvious observation to make from (12′)–(14′) is that, if \( n = 1 \), then all of these implicit policy measures will equal zero. The intuition here is that a profit maximising STE and a private monopoly/monopsony are identical and, therefore, there cannot be any difference between them for consumers, producers or market access. This does not imply that distortions do not exist, only that the STE does not do a better job of dealing with them than the private firm. In this case then there is no
effect arising from the existence of the STE and the implicit policy effects are all zero.\footnote{This is easily seen with reference to Figure 1. With a profit maximising STE with joint exclusive rights, the prices and quantities are identical with the case with a monopoly/monopsony private middleman. As a consequence, with no difference between these two cases, the policy equivalents arising from the use of the STE are zero.}

However, when \( n > 1 \), the STE does have an effect because the comparison now being made is effectively that between an \( n \)-firm Cournot oligopsony/oligopoly and a monopsony/monopoly (the STE) and it is known that quantities procured and sold are increasing functions of \( n \). With respect to the impact on producers, a profit maximising STE would be equivalent to a tax. To see this, re-arrange (12′) to get:

\[
S^{\rho} = \left. \frac{(1/n-1)}{(p'_m - p')} \right|_{\alpha_2 = \alpha_3 = 0} [p'_o(p_h - p_m) + p'_m(p - p_h)]
\]

Then, if domestic production and imports are equally competitive, \( p_h = p_m \), the producer subsidy equivalence is a tax, \( S^{\rho} = (1/n-1)(p'_m - p')^{-1} p'_m(p - p_h) < 0 \), which diminishes when \( p_h \) exceeds \( p_m \), i.e., where the domestic inverse supply function lies above the inverse import supply function. There are, therefore, two offsetting influences (the terms in the square brackets are of opposite sign if \( p_h > p_m \)) but, in general, the greater the competitiveness of the underlying benchmark, and as long as the gap between \( p_h \) and \( p_m \) is not ‘too wide’, a profit maximising STE will be equivalent to a tax on producers.

With respect to consumers (equation (13′)), the effect of a larger number of private firms is more clear cut. Specifically, for \( n > 1 \), the profit maximising STE is equivalent to a tax on consumers since less is procured by it both domestically and through imports and so total output available to consumers is smaller. Re-arranging (13′) gives:

\[
S^{\rho} = \left. \frac{(1/n-1)}{(p'_m + p'_o)} \right|_{\alpha_2 = \alpha_3 = 0} [p'_o(p - p_h) + p'_m(p - p_m)] \leq 0 \text{ if } n \geq 1
\]

The tax equivalence increases with \( n \) and decreases as \( p_h \) increases relative to \( p_m \).
Finally, with respect to the implicit trade distorting effect, (14'), the competitiveness of the benchmark and of domestic production relative to imports again determine the size of the import tariff equivalent. Re-arranging (14') gives:

\[
\tau^{cl}\bigg|_{\alpha_c=0, \alpha_p=0} = \frac{1-1/n}{p'_h - p'} \left\{ -p'(p_h - p_m) + p'_h (p - p_m) \right\} \leq 0 \text{ if } n \geq 1
\]

The trade equivalence is an import tax that increases in \( n \), the size of which also increases as \( p_h - p_m \) increases.

The above three cases consider the effect of manipulating market structure from an \( n \)-firm private profit-maximising industry to an STE that also maximises profit. However, as noted above, there is likely to be a difference in the objective functions of these entities because the STE’s pay-off function will reflect the re-distributional concerns of government policies in the sector in which the STE exists. The effect of this bias of government policies is reflected in the weights in the pay-off function as given by (5').

Consider then the effects of this government bias on the equivalences of the implicit policy measures outlined above. Again, it is easier to consider the role of each of these weights separately. Specifically, evaluate (12)–(14) setting one of the weights equal to zero and the other to unity.

Take first of all the producer-biased STE (\( \alpha_c = 0 \) and \( \alpha_p = 1 \)). The three implicit measures are re-written as:

\[
(12''') \quad s^{pl}\bigg|_{\alpha_c=0, \alpha_p=1} = \frac{(p - p_h)}{(p'_m - p')} \left\{ (p'_m - p') \left\{ -\frac{\Delta_B}{n\Delta_S(0,1)} - 1 \right\} \right\} + \frac{(p - p_m)}{(p'_m - p')} \left\{ p' \left\{ -\frac{\Delta_B}{n\Delta_S(0,1)} - 1 \right\} \right\}
\]

\[
(13'') \quad s^{cl}\bigg|_{\alpha_c=0, \alpha_p=1} = \frac{(p - p_h)}{(p'_m + p'_h)} \left\{ p'_m \left\{ \frac{\Delta_B}{n\Delta_S(0,1)} - 1 \right\} \right\} - \frac{(p - p_m)}{(p'_m + p'_h)} (p'_h)
\]

\[
(14'') \quad \tau^{cl}\bigg|_{\alpha_c=0, \alpha_p=1} = \frac{(p - p_h)}{(p'_h - p')} \left\{ p' \left\{ 1 - \frac{\Delta_B}{n\Delta_S(0,1)} \right\} \right\} + \frac{(p - p_m)}{(p'_h - p')} \left\{ p'_h - p' \left\{ 1 - \frac{\Delta_B}{n\Delta_S(0,1)} \right\} \right\}
\]

\[14\text{ As noted above, agricultural policy is typically biased towards producers in developed countries and towards consumers in developing/transition countries.}\]
where \( \Delta^J_{S, (\alpha_s = 0, \alpha_p = 1)} = (-p')(p'_m - p') - (p')^2 = -p'p'_m > 0 \) and \( \Delta^J_{S, (0,1)} < \Delta_R \). The term
\[
\frac{\Delta^J}{n \Delta^J_{S, (0,1)}} ,
\]
when written out in terms of its components becomes
\[
\frac{\Delta^J}{n \Delta^J_{S, (0,1)}} = \frac{1}{n} \left[ 1 + \frac{p'_h - p'_m}{p'_m} \right].
\]
If it is assumed that \( p'_h = p'_m = -p' \), then
\[
\frac{\Delta^J}{n \Delta^J_{S, (0,1)}} = \frac{3}{n}.
\]

With these assumptions, it is possible to derive necessary and sufficient conditions for the sign of the equivalences in terms of \( \hat{n} \equiv (p - p_m)/(p - p_h) \). Of course, unless \( p_h = p_m \), the value of \( \hat{n} \) is unknown. However, if \( p_h > p_m \), then \( \hat{n} = (p - p_m)/(p - p_h) > 1 \) and a sufficient condition for \( n \) can be derived from this inequality when it is not possible to obtain a necessary and sufficient condition.

Equation (12") becomes
\[
S^{\prime p} \bigg|_{\alpha_s = 0} = [(3 - n)/2n][(p - p_h) - (p - p_m)].
\]
If the term in the square brackets is positive, as seems likely, then a necessary and sufficient condition for the subsidy equivalence to be positive (negative) is that \( n < 3 \) (\( > 3 \)). Thus the producer-biased STE acts as a producer subsidy for \( n = 1 \) or \( n = 2 \) but otherwise it acts as a producer tax, the size of which diminishes as \( p_h \) increases relative to \( p_m \).

With the same assumptions about the slopes of the inverse demand and supply functions, (13") becomes
\[
S^{\prime s} \bigg|_{\alpha_s = 0} = 0.5[ ((3 - n)/n)(p - p_h) - (p - p_m)].
\]
Assuming that \( p_h \geq p_m \) and, therefore, that \( (p - p_h) \leq (p - p_m) \), it can be shown that a sufficient condition is that if \( n > 1.5 \), then \( S^{\prime s} \bigg|_{\alpha_s = 0} < 0 \). Thus this STE will act as a consumer tax for \( n \geq 2 \).

Finally, with the same assumptions, (14") becomes
\[
S^{\prime t} \bigg|_{\alpha_s = 0} = 0.5[ ((n - 3)/n) (p_h - p_m) + (p - p_m)]
\]
If \( p_h \geq p_m \), then a sufficient condition
for \( t_{c}^{\alpha} |_{\alpha_{c}=0, \alpha_{p}=1} < 0 \) is that \( n < 1.5 \). Therefore, a producer-biased STE is likely to be equivalent to an import tariff, the size of which increases the greater is \( p_{h} - p_{m} \).

Consider now the consumer-biased STE (\( \alpha_{c} = 1, \alpha_{p} = 0 \)). Making the same assumptions about the characteristics of the inverse demand and supply functions as above, the signs of the equivalences can be determined. From (12):

\[
(12'') \quad s^{\alpha_{c}^*} |_{\alpha_{c}=1, \alpha_{p}=0} = 0.5[(p - p_{h})(3 - n)/n + (p - p_{m})]
\]

If \( p_{h} \geq p_{m} \), then a sufficient condition for \( s^{\alpha_{c}^*} |_{\alpha_{c}=1, \alpha_{p}=0} > 0 \) is that \( n > -3 \), i.e., a consumer-biased STE acts as a producer subsidy for all \( n \). From (13):

\[
(13'') \quad s^{\alpha_{p}^*} |_{\alpha_{c}=1, \alpha_{p}=0} = 0.5[(3 - n)/n][(p - p_{h}) + (p - p_{m})]
\]

i.e., the STE is equivalent to a consumer subsidy for small \( n \) but, otherwise, it is equivalent to a consumer tax. Finally, from (14):

\[
(14'') \quad t_{c}^{\alpha_{c}} |_{\alpha_{c}=1, \alpha_{p}=0} = 0.5[(-p_{h}) + ((2n - 3)/n)(p - p_{m})]
\]

If \( p_{h} \geq p_{m} \), then a sufficient condition is that if \( n < 3 \), then \( t_{c}^{\alpha_{c}} |_{\alpha_{c}=1, \alpha_{p}=0} < 0 \), i.e., the STE is equivalent to an import subsidy for small \( n \) (=1 or 2) but is likely to be equivalent to a tariff otherwise, the size of which increases as \( p_{h} - p_{m} \) increases.

Taken together, the discussion above can summarised in the following proposition:

**Proposition 1:** The implicit policy effects arising from the STE on consumers, producers and trade will depend on the competitiveness of the underlying benchmark and the relative weights on the components of the STE’s objective function. These effects can be offsetting and the net outcome will depend on the difference between the inverse domestic supply and import supply functions. The competitiveness of the underlying benchmark will also influence the sign and magnitude of the implicit domestic consumer and producer equivalents and the implicit tariff equivalent. In general, the signs of the equivalences are ambiguous. But with specific assumptions about the characteristics of the domestic and import inverse supply functions, it may be concluded that a producer-biased STE and a consumer-biased STE will each act as a producer tax, a consumer tax and an import tax unless \( n \) is small, in which case the signs are reversed.
3.2 STE with Exclusive Rights to Import Only

The designation of joint exclusive rights to the STE is only one characterisation of an
STE: another is one in which the exclusive rights are restricted to importing only. In
this market structure, the STE has exclusive rights to import only (superscripted by
SM) and \( m \) private firms (superscripted by \( pM \)) can only procure domestically; both
the STE and the \( m \) private firms compete when selling to consumers. These
restrictions mean that the STE can choose only \( Q_{m}^{SM} \) to maximise its objective
function \( (W = \alpha_{c}CS + \pi_{m}) \); and a representative private firm can choose only \( q_{h}^{pm} \) to
maximise profits, which are given by \( \pi_{h} = (p - p_{h})q_{h}^{p} \).

The first-order conditions for the representative private firm and the STE are given
by:

\[
\begin{align*}
p - p_{h} - (p_{h}^{'} - p^{'})(q_{m}^{pm}) &= 0 \\
p - p_{m} - [p_{h}^{'} - (1 - \alpha_{c})p^{'}]Q_{m}^{SM} &= 0
\end{align*}
\]

Aggregating over the \( m \) private firms and re-arranging, (15) can be re-written as:

\[
\begin{bmatrix}
Q_{p}^{pm} \\
Q_{SM}^{m}
\end{bmatrix} = \frac{1}{\Delta_{S}^{M}}
\begin{bmatrix}
[p_{m}^{'} - (1 - \alpha_{c})p^{'}] & 0 \\
0 & p_{h}^{'} - p^{'}
\end{bmatrix}
\begin{bmatrix}
m(p - p_{h}) \\
p - p_{m}
\end{bmatrix}
\]

where \( \Delta_{S}^{M} = (p_{h}^{'} - p^{'})(p_{m}^{'} - (1 - \alpha_{c})p^{'} > 0 \). Again, we assume the second-order and
stability conditions hold. From the structure of the matrix, it is clear that price
discrimination over sources of procurement is no longer possible and that the
procurement choices of the private firms and the STE are now linked only through
consumption. Note also that in terms of the role of the policy weights, it is only the
relative degree of consumer bias (\( \alpha_{c} \)) that now matters; producer bias (\( \alpha_{p} \)) plays no
direct role which is in contrast to the STE with joint exclusive rights.

As before, it is useful to summarise the effects of the relative weights in the STE’s
objective function on both sources of output. These are summarised in the following
Lemma.

**Lemma 2:** In the import only case, both domestic procurement and imports increase
with an increase in the weight in consumer welfare, while the effect of the weight on
producer welfare has no direct effect on domestic procurement. An increase in the
number of \( m \) firms in the domestic market increases domestic procurement but has no
direct effect on imports.
Following the same procedure as above, we can derive the implicit policy measures for the STE which has import rights only using (11) and (16).

(a) Implicit Domestic Producer Subsidy Equivalent

Setting $Q^p_h(s^pM) = Q^S_h$ and solving for $s^pM$, we have:

$$s^pM = \frac{(p - p_h)}{(p'_m - p') \left\{ \left[ p'_m - (1 - \alpha_c) p' \right] \frac{m \Delta_B}{n \Delta_S} - (p'_m - p') \right\}} - \frac{p'(p - p_m)}{(p'_m - p')}$$

(b) Implicit Consumer Subsidy Equivalent

Setting $[Q^p_m(s^pM) + Q^p_m(s^pC)] = (Q^p_m + Q^S_m)$ and solving for $s^cM$ we have:

$$s^cM = \frac{(p - p_h)}{(p'_m + p'_h) \left\{ \left[ p'_m - (1 - \alpha_c) p' \right] \frac{m \Delta_B}{n \Delta_M} - p'_h \right\}} + \frac{(p - p_m)}{(p'_m + p'_h) \left\{ (p'_h - p') \frac{\Delta_B}{n \Delta_M} - p'_h \right\}}$$

(c) Implicit Tariff Equivalent

Setting $Q^p_m(t^cM) = Q^S_m$ and solving for $t^cM$ gives:

$$t^cM = \frac{p'(p - p_h)}{(p'_h - p')} + (p - p_m)[1 - \frac{\Delta_B}{n \Delta_M}]$$

(d) Discussion

In the case of the STE with import rights only, there are both similarities with, and differences from, the comparable measures in the joint rights case. The most obvious similarities are that the weight on consumer welfare and the number of $n$ firms in the benchmark each plays a role as determinants in all the implicit policy measures. The most obvious difference is that the number of $m$ firms that co-exist with the import STE are also important for the domestic subsidy equivalences. Perhaps more notable is that the weight on producer surplus has no impact on the implicit policy measures; this is intuitive since the STE has exclusive rights to operate in the import market only and so cannot directly influence producer surplus.

As in the joint rights case, the sign of each of these policy measures is ambiguous. However, assuming as above that $\alpha_c = 1$, and $p'_h = p'_m = -p'$, some insights
emerge. First, the expression for the producer subsidy equivalence can be written as 
\[ s_{PS}^{PM} |_{c=1} = 0.5[(p - p_h)(3m - 4n) / 2n + (p - p_m)]. \]
In order to make the comparison of this market structure with the benchmark easier to interpret, assume that \( n = m + STE \).

Then:
\[ s_{PS}^{PM} |_{c=1} = 0.5[(p - p_h)[(-m - 4) / (2(m + 1))] + (p - p_m)] \]
For \( p_h \geq p_m \), if \( m < 2 \), then \( s_{PS}^{PM} |_{c=1} < 0 \), i.e., the market structure is likely to act as a producer subsidy unless \( n = 1 \). Second, the expression for the consumer subsidy equivalence becomes:
\[ s_{CS}^{CM} |_{c=1} = -[4(m + 1)^{-1}(m - 2)[(p_h - p_m) + (p - p_m)] \]
A necessary and sufficient condition for the consumer subsidy equivalence to be positive (negative) is \( m < 2 \) (\( m > 2 \)), i.e., the market structure acts as a consumer tax unless \( m = 1 \). And third:
\[ t_{EM}^{CM} |_{c=1} = -0.5(p - p_h) + [(2m - 1) / 2(m + 1)](p - p_m) \]
A sufficient condition for \( t_{EM}^{CM} |_{c=1} < 0 \) is that \( m < 2 \), i.e., the market structure is likely to act as a tariff unless \( m = 1 \).

Finally, note the outcome when \( \alpha_c = 0 \), i.e., the STE is profit maximising and \( n = m = 1 \). With assumptions made above, it can be shown that \( s_{PM}^{PS} > 0 \), i.e., this market structure always acts as a producer subsidy; \( s_{CS}^{CM} > 0 \), i.e. the structure always acts as a consumer subsidy; and the sign of \( t_{EM}^{CM} < 0 \), i.e., the market structure acts as an import subsidy. Interestingly, in this case and in contrast with the joint rights case, each of the implicit policy equivalent measures is non-zero. The reason is that, on the selling side, a duopoly (1 private firm + STE) is being compared with a monopoly (\( n = 1 \)).

These effects are summarised in Proposition 2:

**Proposition 2:** In the case of a state trading enterprise with exclusive rights to import only, the determinants of the implicit producer measures are: (i) the weight on consumer welfare in the STE’s objective function; (ii) the number of \( m \) firms that co-exist with the STE but can procure only from domestic producers; and (iii) the number of firms in the benchmark. Unless \( n \) is small, this market structure acts as a tariff.

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15 Note that the weight on producer surplus no longer appears in the expressions for the equivalences.
producer subsidy, a consumer tax and a tariff. Note that even if \( n = m = 1 \) and the STE is profit maximising \( (\alpha_c = 0) \), the implicit policy measures are non-zero even though the STE has less extensive exclusive rights than in the joint rights case. This is in contrast to the joint rights case if the STE were to be profit maximising where there is no difference in outcomes between the STE and the benchmark.

Clearly, the nature of the exclusive rights bestowed on the STE has both domestic and trade impacts and when governments introduce market reforms that alter the range of these rights (as in the Japan case we discuss below), the sizes of the implicit policy equivalent measures change but they do not necessarily go to zero. A priori, for any combination of the weights on producer and consumer interests in the STE's pay-off function, one would anticipate that the impact of the STE on consumers, producers and trade would be greater with the joint rights STE compared with the import only STE, given that the nature of the joint exclusive rights extends over both sources of procurement. These issues are highlighted in the application of the theoretical model to the use of an STE in the Japanese wheat market including the recent change in exclusive rights that applied to it.

4. IMPACT OF STATE TRADING IN THE WHEAT SECTOR IN JAPAN

The theoretical model has given important insights into the key factors that are likely to determine the economic effects of STEs in importing countries. These factors are the number of firms in the counterfactual, the extent of the exclusive rights given to the STE and the objective function of the STE. The model can be calibrated using observed price and quantity data and assumed (or estimated) values for the key elasticities. The calibration method follows Dixit (1988).

Specifically, we employ a linear functional form where the inverse demand functions allow for product differentiation between the domestic and imported good. These are given respectively by:

\[
\begin{align*}
  p_h &= a_1 - b_1 Q_h - \gamma Q_m \\
  p_m &= a_2 - b_2 Q_m - \gamma Q_h
\end{align*}
\]

where \( b_1 b_2 - \gamma^2 > 0 \) implies that the goods are not perfect substitutes and the variables are defined as in section 3. The inverse supply function for the domestically-procured commodity is given by:
(25) \[ p_h = f + kQ_h \]

and for the imported commodity by:

(26) \[ p_w = F + KQ_m \]

If \( K = 0 \), we have the small country case and there is no potential for terms of trade effects in the purchase of imports.

Maximising the profit function \((4')\) gives the first-order conditions for representative firm \( i \):

(27) \[
\begin{pmatrix}
(b_i + k)(n+1) & \gamma(n+1) & q_{hi}^p \\
\gamma(n+1) & (b_2 + K)(n+1) & q_{mi}^p
\end{pmatrix} = \begin{pmatrix}
a_1 - f + s_c + s_p^m \\
a_2 - F + s_c - t_e
\end{pmatrix}
\]

which are aggregated over \( n \) firms to give total quantities, \( Q_h \) and \( Q_m \).

The STE with joint exclusive rights maximises the weighted welfare function \((5')\), giving the first-order conditions:

(28) \[
\begin{pmatrix}
(b_i (2-\alpha_c) + k(2-\alpha_p)) & \gamma(2-\alpha_c) & Q_{hi}^{SJ} \\
\gamma(2-\alpha_c) & b_2 (2-\alpha_c) + 2K & Q_{mi}^{SJ}
\end{pmatrix} = \begin{pmatrix}
a_1 - f \\
a_2 - F
\end{pmatrix}
\]

For the STE with exclusive rights to import only and \( m \) private firms restricted to domestic procurement only, the first-order conditions are given by:

(29) \[
\begin{pmatrix}
(b_i + k)(m+1) & \gamma & q_{hi}^{PM} \\
\gamma m(1-\alpha_c) & b_2 (2-\alpha_c) + 2K & Q_{mi}^{PM}
\end{pmatrix} = \begin{pmatrix}
a_1 - f \\
a_2 - F
\end{pmatrix}
\]

Equations (23)-(26) are calibrated using data for the wheat market in Japan. This market is an important case study for several reasons. First, Japan is a key player in the on-going Doha Round negotiations and is commonly seen as a country for which there is limited market access for imported agricultural commodities. Second, the government’s agricultural policy is strongly targeted at the interests of producers rather than those of consumers. And third, state trading enterprises are used to manage the procurement and subsequent domestic sale of certain agricultural commodities. This support to producers is reflected in the data on the nominal rates of assistance in the Japanese wheat sector which the World Bank estimates at around 198 per cent for the 2005-2007 period and a consumer tax equivalent of around 74 per cent for the
same period (Honma and Hayami, 2008). In what follows, other detailed elements of Japanese wheat policy are ignored in the specification of the model (although they could have been incorporated) in order to isolate the effects of changes in market structure on trade and on the distribution of the components of social welfare. Thus, the following analysis is not intended to be a definitive evaluation of the economic effects of Japan's wheat policy.

Market structure does not feature in the policy equivalent estimates given in Honma and Hayami (ibid.). In the past the Japan Food Agency was the dominant feature of the rice and wheat markets, having exclusive rights to procure domestic and imported wheat for sale on the domestic market. This dominance has now been reduced. Since 2002, it has exclusive rights to import only and the private sector procures domestically-grown wheat which competes with imported wheat in the output market.

We calibrate the parameters of the theoretical model based on price and quantity data for the Japanese wheat market in 2000. These data are shown in Table 1 together with assumed values for the key elasticities. However, as the previous discussion has shown, the impact of the STE is highly dependent on the bias in its welfare function, which reflects the overall bias in Japanese agricultural policy. To this end, we use the estimates of Lee and Kennedy (2006) who calculate the relative weights on producer and consumer welfare and which appear consistent with the wheat policies pursued by the Japanese government. Therefore, $\alpha_p(\alpha_c)$ is assumed initially to equal 1.25 (0.75). We also set $n=10$ initially and assume in the case where the STE has import rights only, that the market comprises the same total number of participants, i.e., $m=9$ plus the STE.

TABLE 1 HERE

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16 There are some differences in the methodology applied by these authors and by the OECD in measuring the distortions to incentives in agriculture through the use of producer and consumer subsidy equivalents. However, the direction of the bias is the same and both sources of data are consistent in reporting that Japan is one of the main examples amongst developed countries where distortions to producers, consumers and on trade are the most significant.

17 In particular, we abstract from the use of the tariff-rate quota and the Income Stabilisation Fund that replaced the use of domestic price support which ensured a floor price for farmers. These additional characterisations of the wheat market can be readily incorporated but not add to the insights relating to the manipulation of market structure through the use of the STE (see OECD, 2009).

18 The Japan Food Agency has now been re-named the General Food Policy Bureau (GFPB) (see OECD, 2009a).
Based on the calibrated parameters, we can evaluate the effects of the STE using (22)–(25) above and can highlight how the domestic and trade effects of it have changed following amendments to the exclusive rights that apply. In considering this change, we assume that the bias in Japanese agricultural policy remains unchanged. The results are reported in Table 2. We report two cases: first, where the Japan Food Agency/GFPB has joint exclusive rights; and second, where the Japan Food Agency/GFPB has import rights only and it competes with private firms that procure domestically.

**TABLE 2 HERE**

There are two important insights that arise from these results. First, the STE did indeed cause a trade distortion, although the extent of it has been significantly reduced following the change in exclusive rights that apply. When the STE had joint exclusive rights, the tariff equivalent was around $688 per tonne – which is 115 per cent of the world price in the benchmark. Following the change in the exclusive rights, the tariff equivalent would have fallen to $341 per tonne or 57 per cent ad valorem. Second, while for both sets of exclusive rights the STE acts as an impediment to imports at the same time, it acts as a tax on consumers and a subsidy for producers. For the case in which it has joint exclusive rights, the size of the producer subsidy is substantial, being 315 per cent of the producer price in the benchmark. The corresponding value for the consumer tax is 55 per cent of the consumer price of the imported wheat. These impacts are substantial and suggest significant distortions arising from the manipulation of market structure.

The results from a sensitivity analysis of the initial calibration are given in Table 3. The initial calibration and the assumptions associated with it (see Table 1 for the details) are shown in the first row. Throughout the remainder of the table, we report how the domestic producer and consumer effects and the tariff equivalent effects vary when the underlying assumptions are changed. Reading across the table, it is clear that the domestic producer and consumer effects and trade distorting effects are all lower in the imports only case compared with the joint rights case. These results are consistent with expectations that the policy equivalents will decrease when less extensive rights apply to the STE (for any given policy weights).
The parameter that appears to have the greatest impact is the relative bias in the STE's objective function, reflecting the re-distributional aims of the government. A greater bias towards (against) producers (consumers) results in significant changes to the values of all of the equivalences across both cases. For changes to the other parameters, there is some sensitivity. For example, increasing the domestic supply elasticity lowers the implicit producer subsidy effect arising from the presence of the STE. This reflects the fact that in the benchmark, there will be less capacity for firms to exploit upstream suppliers and hence these suppliers have relatively less to gain from the presence of the producer-biased STE. With respect to the implicit consumer subsidy equivalent, the most sensitive parameters appear to be the competitiveness of the underlying benchmark, which results in the implicit tax being higher at greater $n$, and the higher demand elasticity, which lowers the implicit tax effect of the STE.

**TABLE 3 HERE**

The equivalences defined above are designed to provide a transparent way of identifying the trade effects and the domestic effects of the STEs. Associated with these equivalences are changes in welfare that are caused by the presence of the STE. A summary of them is given in Table 4 where the comparison is made with the private sector counterfactual. The results are based on the price and quantity data generated from the initial calibration (Table 2). Reflecting the observation that the producer and consumer equivalences are larger in the joint rights case than in the import only case, the differences in producer and consumer surplus are correspondingly also greater. Specifically, the effect of the STE with joint rights is to increase producer surplus by 284 per cent, to decrease consumer surplus by 23 per cent, to increase total profits by 63 percent and, overall, to reduce social welfare by 3 per cent. The welfare of the exporting region is reduced by 31 per cent. For the STE with import rights only, the welfare effects of the STE remain considerable. Compared with the benchmark, producer surplus is 90 per cent greater; consumer surplus is 13 per cent lower, total profits are 44 per cent greater, domestic social welfare is 1 per cent smaller and the welfare of the exporting region is 16 per cent smaller. Therefore, while both specifications of the STE achieve the government's policy objective of redistributing the components of social welfare towards producers,
they do so at a cost to consumers and to overall social welfare when compared with the private benchmark.

**TABLE 4 HERE**

Finally, to reiterate, the exercise reported here is not intended as a definitive evaluation of the effects of the STE that operates in the Japanese wheat market nor of Japan's wheat policy. Rather, the important point is that the theoretically-consistent framework developed in section 3 can be used to evaluate the effects of STEs that arise in different environments and that the model can be applied using observable data. This feature increases the transparency of the likely domestic, trade and welfare effects of STEs and, in turn, provides trade negotiators with better information when evaluating alternative modalities.

In this light, how do we appraise the position taken by Japan (and South Korea) in the Doha Round in which it was claimed that the impacts of importing STEs are primarily domestic in nature with only a limited impact on market access? In part, the Japanese position is justified: STEs do have a substantial impact on the domestic market with considerable effects on both producers and consumers (Tables 2 and 4). But contrary to that claim, the STE also has a substantial external impact (Table 4), even with weak terms of trade effects (Table 3). Therefore, the continuing existence of the STE with import rights only is of direct importance to exporting countries that want greater access to the Japanese wheat market.

5. SUMMARY AND CONCLUSIONS

State trading enterprises are instruments of government policy that essentially involve the manipulation of market structure through the designation of exclusive rights that are designed first, to re-distribute welfare between producers and consumers (and taxpayers), and second, to deal with market distortions. While there has been considerable progress in measuring and publicising more traditional instruments of trade policy, which has eased progress in trade negotiations and improved the transparency of the magnitude of a wide range of policy instruments, the measurement of the potential impacts of STEs both domestically and on trade remains relatively underdeveloped. Fundamentally, STEs are a non-tariff measure but they may or may not be "anti-competitive". The contribution of this paper has been to show that this claim of anti-competitiveness depends upon the nature of
the unobserved counterfactual, on the redistributive weights given to the STE by government and on the extent of the exclusive rights designated to the STE.

Arguably, issues relating to government manipulation of market structure are more difficult to address in the trade negotiating process. The economic effects of this manipulation are not transparent and their identification requires a comparison with a counterfactual benchmark and knowledge of how competitive this benchmark might be, rather than the comparison of prices with and without price policy instruments, e.g. a tariff. Making good this deficiency is hindered by the fact that state trading enterprises vary by commodity sector, by their application across countries and, in particular, by the extent of the exclusive rights that apply. In this paper, we have presented a theoretically consistent framework that focuses on the implicit policy impacts on domestic producers and consumers and on trade that arise from the presence of the state trading enterprise. The resulting equivalences can be used to evaluate the effects of STEs that arise in different environments and which make allowance for the differences in exclusive rights that are bestowed on STEs in importing countries. It also allows for different perceptions of the extent of domestic competition that could arise in the absence of the STE.

There are obvious extensions to the above framework that would be of interest. First, a richer characterisation of the environments in which STEs exist can be provided. For example, many STEs compete with private firms in the domestic procurement market or the private sector may have a limited role in procuring imports. In some instances, STEs operate in conjunction with other policy instruments. STEs may also have higher unit costs than private firms. The model in section 3 can be extended to deal with these different characterisations, this article confined to two cases of STEs that are widely used in practice, the results from which are (relatively) intuitive given the characterisation of exclusive rights. Moreover, STEs may pursue a wider range of objectives than those considered here (see OECD, 2001), the analysis in this paper being limited to the redistributional aims implemented through the STE, to the WTO definition of STEs, and to the categorisation of them by MAST as "anti-competitive". Nevertheless, further analysis that captures the heterogeneity of STEs across various countries and the market structures in which they exist is clearly warranted.
REFERENCES


van Tongeren, F. J. Beghin and S. Marette, "A Cost-Benefit Framework for the Assessment of Non-Tariff Measures in Agro-Food Trade," OECD Food, Agriculture and


## Table 1: Calibration Data and Parameters – Japanese Wheat Market, 2000

<table>
<thead>
<tr>
<th>Data and elasticities</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demand elasticity</td>
<td>0.25</td>
</tr>
<tr>
<td>Elasticity of substitution</td>
<td>5</td>
</tr>
<tr>
<td>Domestic retail price</td>
<td>$903/tonne</td>
</tr>
<tr>
<td>Retail price of imported good</td>
<td>$1023/tonne</td>
</tr>
<tr>
<td>Sales of domestically produced commodity</td>
<td>735000 tonnes</td>
</tr>
<tr>
<td>Sales of imported good</td>
<td>5245000 tonnes</td>
</tr>
<tr>
<td>Export supply elasticity</td>
<td>5</td>
</tr>
<tr>
<td>Domestic supply elasticity</td>
<td>0.25</td>
</tr>
<tr>
<td>Domestic producer price</td>
<td>$800/tonne</td>
</tr>
<tr>
<td>Import price</td>
<td>$596/tonne</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Calibrated Parameters</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$b_1$</td>
<td>0.001415626</td>
</tr>
<tr>
<td>$b_2$</td>
<td>0.000711467</td>
</tr>
<tr>
<td>$\gamma$</td>
<td>0.000490279</td>
</tr>
<tr>
<td>$a_1$</td>
<td>4515</td>
</tr>
<tr>
<td>$a_2$</td>
<td>5115</td>
</tr>
<tr>
<td>$k$</td>
<td>0.004353741</td>
</tr>
<tr>
<td>$f$</td>
<td>-2400</td>
</tr>
<tr>
<td>$K$</td>
<td>0.0000227264</td>
</tr>
<tr>
<td>$F$</td>
<td>476.8</td>
</tr>
</tbody>
</table>

Data on domestic production, sales and imports come from FAO. Import prices are calculated as unit values from import value and volume data from the FAO. Domestic producer and retail prices are sourced from USDA. No available studies produce demand and supply elasticities though the values chosen are broadly consistent with elasticity data in other developed countries. Table 3 deals with sensitivity analyses with respect to these chosen parameters. The FAO data were sourced from [www.fao.org](http://www.fao.org) and the USDA data was sourced from [www.ers.usda.gov](http://www.ers.usda.gov)
Table 2: Domestic and Trade Effects of the Japan Food Agency in the Wheat Market (US$ per tonne)

<table>
<thead>
<tr>
<th>Type of STE</th>
<th>Producer Subsidy Equivalent(^a)</th>
<th>Consumer Subsidy Equivalent</th>
<th>Tariff Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Joint Exclusive Rights</td>
<td>1187</td>
<td>−561</td>
<td>688</td>
</tr>
<tr>
<td>Import Only</td>
<td>417</td>
<td>−302</td>
<td>341</td>
</tr>
</tbody>
</table>

Note: \(^a\) The equivalences are measured from a benchmark that is defined as an \(n\)-firm oligopsony/oligopoly. The data and the parameters used to calculate the functions are given in Table 1 and the policy weights are \(\alpha_p = 1.25; \alpha_c = 0.75\).
Table 3: Sensitivity Analysis of the Domestic and Trade Effects of the STEs

<table>
<thead>
<tr>
<th></th>
<th>Producer Subsidy Equivalent</th>
<th>Consumer Subsidy Equivalent</th>
<th>Tariff Equivalent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SJ $^a$</td>
<td>SM</td>
<td>SJ</td>
</tr>
<tr>
<td>Benchmark Case $^b$</td>
<td>1187</td>
<td>417</td>
<td>−561</td>
</tr>
<tr>
<td>More Elastic Demand Elasticity $^c$</td>
<td>1378</td>
<td>189</td>
<td>−275</td>
</tr>
<tr>
<td>More Elastic Domestic Supply $^d$</td>
<td>505</td>
<td>418</td>
<td>−572</td>
</tr>
<tr>
<td>Weaker Terms of Trade Effects $^e$</td>
<td>1140</td>
<td>378</td>
<td>−508</td>
</tr>
<tr>
<td>More Competitive Benchmark ($n=50, m=49$)</td>
<td>824</td>
<td>455</td>
<td>−865</td>
</tr>
<tr>
<td>Different Weights ($\alpha_p = 1.5; \alpha_c = 0.5$)</td>
<td>2224</td>
<td>809</td>
<td>−1149</td>
</tr>
</tbody>
</table>

Note: $^a$ SJ is the STE with Joints exclusive rights and SM is the STE with import rights only

$^b$ Data as reported in Table 1 and policy weights $\alpha_p = 1.25; \alpha_c = 0.75$

$^c$ Elasticity of demand equal to 0.75

$^d$ Elasticity of supply equal to 0.5

$^e$ Export supply elasticity equal to 20.
Table 4: Welfare Effects of STEs with Joint Rights and Import Rights only
(Percentage difference from the private sector benchmark)

<table>
<thead>
<tr>
<th></th>
<th>$SJ^a$</th>
<th>SM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difference in Producer Surplus</td>
<td>284</td>
<td>90</td>
</tr>
<tr>
<td>Difference in Consumer Surplus</td>
<td>−23</td>
<td>−13</td>
</tr>
<tr>
<td>Difference in Total Profits</td>
<td>63</td>
<td>44</td>
</tr>
<tr>
<td>Difference in Social Welfare (Japan)</td>
<td>−3</td>
<td>−1</td>
</tr>
<tr>
<td><strong>Difference in Exporting Region's Welfare</strong></td>
<td>−31</td>
<td>−16</td>
</tr>
</tbody>
</table>

Note: $a$ SJ is the STE with joint exclusive rights; and SM is the STE with exclusive rights to import only. The parameters are given in Table 1 and the policy weights are given in Table 2.
Figure 1. A Pure Middleman and an STE

Note: the subscript $i$ takes the values $h$ and $m$ for home procurement and imports, respectively.