Ranking Production Subsidies and Import Tariffs under Different Scenarios

FRANCESCO AIELLO
Università della Calabria, Dipartimento di Economia e Statistica I-87036 Arcavacata di Rende (CS) - Italy e-mail: f.aiello@unical.it

Bothatari and a production subsidy can be used to protect the import competing industry. Yeh (1971) has shown that if the country is large, a tariff will be superior to a production subsidy, assuming that the level of support required for the import competing industry is not greater than the one needed when the optimum tariff is in operation. Maintaining the hypothesis that exporters do not react to importing country policies, the paper shows that tariffs and subsidies can always be ordered. Tariffs will remain superior to subsidies even if the support guaranteed to domestic producers exceeds that achieved under the optimum tariff. A tariff though is inferior to production subsidy only when the country wishes to produce a quantity significantly in excess of the optimum tariff production.

However, this ranking is sensitive to the behaviour of trade partners. In fact, when foreign suppliers fix their export quantity at the free-trade equilibrium through whatever means, production subsidy is shown to be always superior to tariff.

I. INTRODUCTION

This paper examines what is the best policy when a large importing country tries to pursue the non-economic objective of a given level of domestic production. Even if many new commercial policy instruments (regulations and standards, contingent-procedural protection, procurement rules) allow the achieving of the home objective, only the effects of import tariffs and production subsidies is evaluated. This is done for two order of reasons. First, tariffs and subsidies are the instruments mostly studied in the second best theory and this is done under the framework of general equilibrium modelling. Here the same issue is presented using a partial equilibrium approach. Second, even though the point in question has been explored for four decades, it seems that some questions still remain open when domestic production is constrained at high levels. In fact, when the importing country is large, it is known (Yeh, 1971) that tariff is always better than subsidy when the degree of protection in the import competing sector is not greater than that obtained with the optimum tariff. Nothing is said about what happens for higher levels of production, probably because optimal-tariff arguments hold. That is to say, the choice between tariff or subsidy is a fairly contrived issue when the objective of the active country is to maximize its own national welfare, but, in the author’s view, it turns out to be relevant when the political purpose of an importing country is specifically to increase the welfare of domestic producers or to stimulate output of a particular good assumed to be critical for national food security.

1 Financial support received by the Italian Ministry for University and Scientific and Technological Research is gratefully acknowledged (Research Program of National Scientific Relevance on “The WTO negotiation on agriculture and the reform of the Common Agricultural Policy of the European Union”; Research Unit: Department of Economics and Statistics, University of Calabria, scientific coordinator: Prof. Giovanni Anania).
2 When the country is small, the production subsidy is always superior to the import tariff (Meade, 1955; Corden, 1957; Bhagwati and Ramaswami, 1963). This means that, if the terms of trade are constant, then the importing country achieves higher level of welfare by applying a subsidy instead of a tariff. In a recent paper, Krishna and Panagariya (2000), unifying second best results in international trade, re-emphasize the basic principle that in a small economy the instruments chosen should be those which directly affect the target variable.
3 Many policies are explicitly oriented to provide support to national industry (e.g., above all, EU and USA programmes for increasing farmers’ welfare). In all these cases, for the active country what is relevant is not the impact of such policies on national welfare but that on producers’ surplus.
This article fills this gap by deriving the optimal policy intervention when the importing country cannot use the two instruments simultaneously and by considering two alternative scenarios. The first is the context traditionally analysed by other authors and regards the circumstance in which the comparison between tariff and subsidy is made assuming that foreign suppliers react passively to the policies of the importer. Differently from the existing literature on this topic, this paper ranks tariffs and subsidies whatever the degree of protection provided to domestic producers is: a tariff is preferable if the desired quantity is not too large, while a subsidy is preferred for larger quantities. In the second scenario, that is when exporters react to trade restrictions with policies to restore the original level of exports, subsidy turns to be always superior to tariff.

II. TARIFFS VS SUBSIDIES FOR A GIVEN LEVEL OF DOMESTIC PRODUCTION

The case of an importing country which supports its producers by using a production subsidy or an import tariff is presented in Fig. 1. The left-hand side of Fig. 1 represents the national market of the protected industry, where \( D_A \) and \( S_A \) are the domestic demand and supply schedules. On the right-hand side, \( E D_A \) is the excess demand function of the country \( A \) and \( E S_W \) is the excess supply curve of the Rest of the World. At the free trade equilibrium price, \( P_{FT} \), the country \( A \) produces \( Q_4 \), consumes \( Q_3 \) and, consequently, imports \( M_{FT} = Q_3 - Q_4 \) (Fig. 1).

Let it now be supposed that the objective of country \( A \) is to increase home production from \( Q_4 \) to \( Q_1 \) and to do this it uses the fixed per-unit production subsidy \( S = AZ \) or, alternatively, the fixed per-unit import tariff \( T = CF \). As drawn in Fig. 1, the subsidy shifts the domestic supply curve to \( S_{A1} \), which is the supply expressed as a function of the domestic consumer price. In Fig. 1, \( E D_{A1} \) is the excess demand expressed as a function of the domestic consumer price when the production subsidy is taken into account. With the subsidy, the equilibrium price in the world market is \( P_{W|S} \), the quantity traded is \( M_S \); in \( A \) the consumer price is \( P_{C|S} \), equal to \( P_{W|S} \), and the producers price is \( P_{P|S} \) (the price they receive from domestic

---

4 This restriction is imposed because the entire exercise is to revise part of the literature on this subject working under this assumption (see, i.e., Corden, 1957; Yeh, 1971). In addition, it is useful to recall that optimal-tariff arguments are based on only one instrument (the import tariff) and, thus, the evaluation of the impact on social welfare determined by another instrument (the production subsidy), which is equivalent to tariff, becomes plausible.
consumers plus the per-unit subsidy). The impact of the production subsidy on the welfare level of the country $A$ is:

$$\Delta W_{A|S} = \text{BKRZ} - \text{ABD} \quad (1)$$

This is the net outcome of a gain to consumers of MKRL, a gain to producers of SADM and a loss due to the subsidy expenditure of SAZL (Fig. 1). The desired level of production, $Q_1$, can be obtained with the tariff $T = CF$, which is, therefore, equivalent to the subsidy $S = AZ$. The introduction of this tariff can be represented by a downshift of the excess demand function from $ED_A$ to $ED_{i2}$, which is expressed as a function of the price on the world market when the tariff applies. Market equilibria exist when the price in the Rest of the World is $P_{W|T}$. The domestic consumer and producer prices are $P_{pT} = P_{cT} = P_{W|T} + T$ and the domestic supply is at the required level, $Q_1$. The impact of the tariff on the national welfare of $A$ is equal to:

$$\Delta W_{A|T} = \text{BGFH} - (\text{ABD} + \text{CGK}) \quad (2)$$

because tariff yields a loss to consumers of MKCS and a gain for producers of SADM. Government revenue increases by the amount $ACFH$ (Fig. 1).

Thus, the desired level of domestic production will be achieved by using a subsidy when the welfare associated to this instrument policy is superior to that obtainable with the equivalent import tariff. This occurs when:

$$W_{A|S} > W_{A|T}$$

$$W_{FT} + \Delta W_{A|S} > W_{FT} + \Delta W_{A|T}$$

$$\text{BKRZ} - \text{ABD} > \text{BGFH} - (\text{ABD} + \text{CGK})$$

$$\text{BKRZ} > \text{BGFH} - \text{CGK}$$

$$(\text{BGNZ} + \text{GKRN}) > (\text{BGNZ} + \text{ZNFH}) - \text{CGK}$$

$$\text{GKRN} + \text{CGK} > \text{ZNHF}$$

$$\text{CRN} > \text{ZNHF}$$

where $W_{A|S}$ and $W_{A|T}$ are the welfare levels that the country $A$ achieves when, respectively, either a subsidy or a tariff is used. It is possible to determine if area CRN is larger than area $ZNHF$ using algebra. This more rigorous form of our model provides, inter alia, a parametric version of the welfare changes caused by the equivalent policies $S$ and $T$. So, Equations 1 and 2 can be reformulated as:

$$\Delta W_{A|S}(S; \Theta) = \text{BKRZ} - \text{ABD}$$

$$= -\frac{\delta}{2} \left[ (\frac{\pi + \mu}{\mu})^2 - \delta \mu \right] S^2 + \delta (\pi\sigma - \xi\mu) (\frac{\pi + \mu}{\mu})^2 S$$

(4)

$$\Delta W_{A|T}(T; \Theta) = \text{BGFH} - (\text{ABD} + \text{CGK})$$

$$= -\pi\mu \frac{2\pi + \mu}{2(\pi + \mu)^2} T^2 + \frac{\sigma\pi - \xi\mu}{(\pi + \mu)^2} T$$

(5)

where $\Theta = \{\delta, \sigma, \xi, \pi, \mu \}$ is the set of parameters which characterize domestic and world markets. In order to compare parabolas 4 and 5, a relation between subsidy and tariff $[S = \pi/(\pi + \beta)T]$ is obtained when the policy constraint (the domestic supply with subsidy must be equal to that under tariff regime) is satisfied. This allows to write both Equations (4) and (5) in terms of $T$ (or $S$) and to achieve under the constraint the following results: (1) optimum tariff is lower than optimum subsidy; (b) it exists a point of double equivalence between $T$ and $S$, where they solve the constraint (that is, they determine the same level of production) and allow country $A$ to register the same level of welfare; (c) the positive tariff that makes null country $A$’s welfare change is lower than the correspondent positive subsidy. These four outcomes make it possible to draw the welfare curves as in Fig. 2.

The origin of the axes indicates that if the tariff and the equivalent subsidy are set at zero, then the welfare of $A$ is the one obtained in free-trade ($W_{FT}$). It can be seen that domestic welfare of $A$ rises as the tariff is raised from 0 to $T^*$, which is the tariff at its optimum level. When the production subsidy is implemented in a way that determines a level of production equal to that induced by an equivalent tariff, then the relative welfare change curve ($\Delta W_{A|S}$) exhibits the same increasing pattern, even if the national welfare with tariff is higher than that occurred with the subsidy ($\Delta W_{A|T} > \Delta W_{A|S}$). Thus if the desired production point is not greater than that guaranteed by the optimal tariff, then tariff is superior to subsidy (Fig. 2). These results are also those obtained by Yeh (1971) using a general equilibrium model.

The analysis also gives new criteria for choosing the most efficient policy when the objective is to achieve a target level of output higher than that obtainable by imposing the optimal tariff. This occurs when the production of a good should not fall below a certain level which is supposed to be strategically important from a security food point of view and not achievable with the optimum tariff. This means that importing countries disregard the net implications for their national welfare and pay much more attention to the welfare of only one social groups: the producers. The diagram emphasizes that tariff still remains superior to subsidy even when the desired level of producer support ranges from the one achievable through the optimal tariff and that associated to tariff rate $T_E$. At $T_E$ level, the relative production can also be ensured by introducing a subsidy, given that at point C the concerned policy tools are doubly equivalent. In fact, they allow to get not only the same producer support but also the identical level of national welfare.

Finally, moving from point $C$, any production target can be efficiently pursued by using a subsidy rather than a

---

5 The model is detailed in Aiello (2000) and in http://www.ecostat.unical.it/docenti/aiello/aelapp.pdf.
Thus a production subsidy is better than an import tariff only when the country wishes to produce a quantity significantly in excess of the optimal tariff production (Fig. 2).

III. AND WHEN QUANTITY TRADED DOES NOT CHANGE

Let us specifically consider the world market. The adoption of a production subsidy reduces the quantity traded at $M_S$ level, which is less than free-trade quantity, but more than the quantity ($M_T$) associated with the tariff $T = CF$. If exporters seek to maintain the volume of exports at free-trade level, they ought to apply a policy (i.e. an exports or a production subsidy) that determines a shift of the excess supply curve from $ES_W$ to $ES_{W1}$ when the country $A$ applies the production subsidy $S = AZ$, or from $ES_W$ to $ES_{W2}$ when the importing country protects its national industry by using the import tariff $T = CF$ (Fig. 3).

The case of maintaining the quantity traded at free-trade level has been deeply explored in the literature on gains from trade by taking into account the exporting countries perspectives (Anania and Bohman, 1988, 1990; McDonald, 1990; Schmitz et al., 1986, 1988, 1990). This debate tried to understand whether domestic and trade policies can lead to negative gains from trade and was based on one empirically founded case which occurs when countries react to trade restrictions imposed by importers (i.e., production subsidies or import tariffs) by increasing exports through specific subsidising policies, such as USA’s Export Enhancement Program and marketing loans. The main conclusion these studies arrives at regards the existence of a point of no-gain from trade for exporting countries.

Let us now look at this problem from the importing country’s point of view. In other words, using the same framework of analysis developed in Schmitz–Sigurdson–Doering and Anania–Bohman, this is an attempt to rank tariffs and subsidies under the condition that exporters maintain their volumes traded at free-trade levels.

As Fig. 3 points out, when the shifts of the excess supply schedule are taken into consideration, the resulting picture in country $A$ is largely different from the one presented in Fig. 1. On one hand, with the production subsidy, the
relevant consumer price is now $P_{C1}$, that is the world price in the new equilibrium $E_3$ (Fig. 3) – and the producer price is $P_{P1}$. At these prices country $A$ consumes $Q_6$, produces $Q_7$, and registers a net change in its own welfare of the amount $(B'KR'Z' - A'B'D')$. On the other hand, when country $A$ imposes the import tariff $T = CF$ and exporting countries shift their excess supply curve to $ES_{W2}$, domestic prices in $A$ do not change with respect to free-trade equilibrium levels, but national welfare increases by the amount of the tariff revenue collected (area $DKTJ$ in Fig. 3).

In such a context, the problem concerning the choice of the best policy aimed at increasing domestic production is promptly solved. In fact, when world market equilibrium is $E_4$, domestic production remains at free-trade level. On the other hand, the imposition of the production subsidy $S = AZ$ implies that the excess supply curve shifts to $ES_{W1}$, the equilibrium in world market is $E_3$, and this generates an increase of production in $A$ from $Q_4$ to $Q_7$ (Fig. 3). Put differently, one policy (the import tariff) substantially fails to achieve the main national objective, whereas the other (the production subsidy) shows itself to be effective, even if the level of internal production achieved ($Q_7$) is less than the scheduled one ($Q_1$) (Fig. 3). Country $A$ evidently adopts the subsidy instead of the tariff since its interests are still anchored to the level domestic production.

**IV. CONCLUDING REMARKS**

The focus of the paper is to establish a hierarchy between an import tariff and a production subsidy when they are equivalent in terms of the support they guarantee to domestic producers of a large country.

This model is very similar to that of the early theorists (Bhagwati, Corden) in endogeneous price and one-good trade analysis and it leads to some interesting results about any possible ranking of tariffs and subsidies. In

---

6 As the domestic production is the relevant variable of the entire analysis, the findings imply that in such a scenario the effects on national welfare of country $A$ caused by each policy can be disregarded. It does not make any sense to compare country $A$’s welfare changes when one policy is totally ineffective, while the other tool proves to be superior because it, in some way, allows the pursuit of the national objective. In addition, in country $A$ the increase of public revenue under tariff regime could be used as a redistributive device for increasing producers surplus by an amount higher than the one observed with the adoption of the subsidy (area $S'AD'M$ in Fig. 3). This aspect is disregarded because welfare distribution issues go behind the purpose of this paper.
In fact, when import tariff and production subsidy are used to provide the same level of protection for domestic producers and excess supply curve remains fixed, then the analysis shows that it is always possible to identify the most efficient policy in order to achieve a given level of production and the choice depends on at which level the importing country wants to constraint the domestic production. This is a meaningful result which generalizes the conclusions obtained by many other authors on this subject (e.g., Bhagwati and Srinivasan, 1969; Bhagwati, 1971, Yeh, 1971). On the other hand, a case notably investigated into the literature on gains from trade is considered, i.e. the analysis of world market equilibrium when exporters observe a change in the world market equilibrium and provoke shifts of excess supply curve in order to maintain the quantity traded at the level of free-trade. Under this scenario the superiority of production subsidy with respect to the import tariff is observed. Again, this is an interesting result based on the fact that import tariff is totally ineffective, because it actually does not determine any change in the domestic production. Thus, the superiority of direct to oblique intervention is re-emphasized as, in this framework of analysis, the production subsidy is the only policy that directly affects the target variable.

REFERENCES


McDonald, B. J. (1990) Domestic farm policy and the gains from trade: comment, American Journal of Agricultural Economics, 72, 1087–90.


