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International Agricultural Trade
Research Consortium

Targeted and Global Export Subsidies
and Welfare Impacts

by

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Working Paper #88-7

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November 1988

ABSTRACT

A three-country model of export subsidies is developed with an exporter, an importer, and a third country, representing the rest of the world, that can act on either side of the market. The welfare effect of an export subsidy targeted toward one importing country is shown to depend on whether the third country is an exporter or an importer, the market shares, and demand elasticities. The possibility of the paradoxical result that the targeted country can lose welfare as a result of receiving a subsidy is demonstrated to exist, and conditions are derived that determine when this result occurs. It is also demonstrated that when the rest of the world is a net exporter, a country offering a targeted export subsidy will suffer a welfare loss, while either its export competitors or the targeted country gains, but not both simultaneously.

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Targeted Export Subsidies and Their Welfare Impacts

Export subsidies have become a widely used trade policy instrument {(Hufbauer and Erb (1984), Low (1982))} and a high priority topic in the current Uruguay round of GATT negotiations. In the literature, special cases where subsidies can be welfare increasing have been discussed {Brander and Spencer (1985), Feenstra (1986), Itoh and Kiyona (1987)}. The focus of this paper is a three-country model of subsidies that allows for an exporting country to target a subsidy to a single importing country. First, the use of export subsidies and the recent literature is briefly reviewed to show that all of the special cases occur due to the presence of market distortions. In the second part of the paper, the model is presented along with the comparative static results. Next, the effect of the export subsidy on prices is derived. The fourth section describes the welfare effects of the targeted export subsidy on all three countries. Finally, the results of the paper are brought together in a summary section.

I. Export Subsidies

Export subsidies, which allow for foreign sales at less than domestic prices, have become prevalent in the 1980s, partially in response to the slowdown in the growth of world trade. This phenomenon is evident from the unusually large number of antidumping and countervailing duty measures that have been invoked recently. For example, during the recent 1980-86 period, there were 1,288 antidumping cases, 775 of which led to duties or other forms of trade restrictions {Finger (1987)}.

Export subsidies on manufactured products are prohibited under GATT rules (Article XVI:4). However, the situation is much different for primary products on which export subsidies are permitted (Article XVI:3). As a result of these GATT

trading rules, export subsidies are much more common for primary products than for manufactures. Between 1975 and 1985 a total of eight subsidy disputes were taken to the GATT; all eight were subsidy disputes in agriculture (Hathaway (1987)).

The most notable U.S. export subsidy schemes apply to agricultural products. For example, for the 1988-89 fiscal year \$4.2 billion are available from the U.S. government in the form of credit guarantees designed to boost farm exports. These credit subsidies are indirect and are meant to be repaid by the importing country, yet more than one-half of this credit may never be repaid (U.S. General Accounting Office). More direct subsidies are paid under the Targeted Export Assistance Program (TEAP) and the Export Enhancement Program (EEP). The EEP began in 1985 and was initially budgeted at \$1.5 billion for 1985-88. In 1988 it was granted an additional \$2.5 billion as part of the U.S. trade bill. The EEP has played an important role in U.S. grain exports. For example, for fiscal year 1987, fifty percent of all U.S. wheat exports were EEP sales. The EEP has lowered the international wheat price by thirty to forty percent (Oleson) with the intent of increasing market share in targeted destinations. An important policy question is whether this type of program is a good strategic trade policy on the part of the United States.

Theoretical analyses of export subsidies have shown several cases where export subsidies may improve welfare. These cases can be shown to result from either domestic or foreign distortions (e.g., failure to exploit the optimal tariff). This is similar to the transfer literature where Bhagwati, et al. (1983) show that transfer paradoxes (where the donor is made better off and the recipient is immiserized) only occur when there are distortions present. Distortions can occur in the domestic economy such that the domestic rate of substitution equals the foreign rate of transformation, but not the domestic rate of transformation (i.e., $DRS = FRT \neq DRT$). They can also exist when the country fails to exploit monopoly power in international trade. In this case, $DRS = DRT \neq FRT$.

Itoh and Kiyona (1987) use a model with three goods to show that subsidies on commodities which are marginal goods (defined as goods not exported at all or exported in small quantities under free trade but whose exports can be promoted considerably by export subsidies) can increase welfare. This occurs because of the effects on the production structure. A subsidy on marginal goods causes their production to increase and the supply of nonmarginal goods to decrease, thereby raising the price of the nonmarginal goods and improving the exporter's terms of trade. The distortion in place is the failure to take advantage of the optimal tariff in the nonmarginal good.

Feenstra (1986) presents a case where export subsidies increase welfare in a three-good, two-country model. Feenstra does not show that subsidies are part of an optimal trade policy, although this possibility is not ruled out. Feenstra shows that it is possible for the pattern of substitutability and complementarity across the three goods to allow for a welfare increase. The necessary condition is that the subsidized export be a stronger substitute for another export good, or stronger complement to an import good, in the subsidizing country than abroad. The other country necessarily loses as a result of this strategy since free trade is Pareto optimal for the world as a whole. The distortion in this case is the failure to exploit market power in the second or third good. Feenstra points out that the gain in welfare results from non-zero terms of trade effects in the first good. However, the subsidizing country must also be large in the good where it gains from the change in relative prices. Failure to exploit this market power creates a foreign distortion.

Brander and Spencer (1985) demonstrate that if the commodity is supplied under international oligopolistic conditions, an export subsidy can shift the oligopolistic profit from the foreign to the domestic firms. The existence of an oligopolistic industry implies that there are distortions in the world economy. The model used below assumes perfect competition in production and consumption,

with any distortions being introduced by governments and, therefore, does not directly address this Brander and Spencer case. However, the general conclusion of Brander and Spencer that subsidies can be welfare enhancing only in the presence of distortions is supported by the model.

Krugman (1984) demonstrates that the existence of dynamic scale economies, such as learning and research and development, can justify the existence of export subsidies. In this case, the distortion is in the domestic economy where the social benefit from exports exceeds the private benefit.

Abbott, Paarlberg, and Sharples (1987) present a price discrimination model where the exporting country has market power. Their model is a case where the optimal policy for the exporting country would be to price discriminate and use a combination of export taxes and export subsidies. Abbott, Paarlberg, and Sharples fail to place their model in its proper context. Their results are presented as being a general representation of targeted export subsidies, while, in reality, they are the well-known price discrimination case. They analyze the one case where the exporting country can improve its welfare through price discrimination. In addition, they do not derive any of the welfare effects on the other countries caused by the subsidizing country's actions.

Our model is a generalization of targeted export subsidies when there are three (or more) countries. There is an importer, an exporter, and a third "neutral" country that can be either an exporter or an importer. The effects of the subsidy are transmitted through the price linkage equations because the subsidy causes domestic prices to differ from world prices.

II. The Model

The model consists of three countries (α , β , and γ) and two goods (X and Y). Both goods are produced and consumed by each country. The export subsidy is

applied to good X, and it is assumed that free trade in Y exists. Country α is always an exporter who will offer an export subsidy. Country β , the neutral country, is either an exporter or an importer who has no border policies. Country β can be thought of as a conglomeration of the rest of the world, all the other countries that are not offering or offered a subsidy. When country β is referred to as an importer, this is equivalent to the rest of the world being a net importer (since for those countries not offering export subsidies it makes no difference to which countries their exports are delivered). Similarly, when country β is referred to as an exporter, this is equivalent to saying that country α 's market share is less than country γ 's import demand (again realizing that market share can be reassigned in the absence of transportation costs). Thinking of country β as a conglomeration in this sense allows the concept of a targeted export subsidy to carry over to the case when β is an exporter. In this case, it is clear that the market would reassign the trading flows so that α exports only to γ due to the targeted export subsidy. Country γ is always an importer with no border policies and is the recipient of the export subsidy on good X from country α . The objective of the analysis is to determine the effect of the targeted export subsidy on the welfare levels of the three countries.

The following notation is used in our model:

q^i = the relative price of good X in country i.

u^i = the welfare level of country i.

S = the per unit export subsidy on good X.

$e^i(q^i, u^i)$ = the expenditure function of country i.

$r^i(q^i)$ = the revenue function of country i.

$x^i(q^i, u^i)$ = the compensated import demand function for good X by country i.

The price linkages among the different countries are crucial to the results obtained. There are several cases that can occur:

- (i) Country β is an importer. Country α could pay a general subsidy to both β and γ . This would lead to the well-known result that the exporting country offering the subsidy suffers a loss in welfare and the welfare of the countries receiving the subsidy rises. This case will not be analyzed here.
- (ii) Country β is an importer. Country α pays a subsidy to country γ but sells to country β at the same price that prevails in α 's domestic economy. This is the price discrimination case where, given monopoly power by the exporter, the optimal policy would be to price discriminate. However, if the exporter fails to fully price discriminate, then the subsidy can be seen as a second best price discrimination strategy. For this to work, the exporter must be able to maintain separation of markets and the other standard assumptions of price discrimination must hold. The price linkage equation is

$$(1) q^\alpha = q^\beta = q^\gamma + S.$$

- (iii) Country β is another exporter, and therefore, country α can no longer exercise monopoly power. If country α pays a subsidy on its exports to country γ , then country β will sell to country γ at this lower price. The price linkage equation is

$$(2) q^\alpha = q^\beta + S = q^\gamma + S.$$

Note that country β does not actually make a subsidy payment to country γ . Country β sells at the prevailing world price that is defined as the price paid by the importer and not the domestic price in the exporting country.

Cases (ii) and (iii) are analyzed simultaneously by writing the price linkage equation as follows:

$$(3) q^\alpha = q^\beta + I(\beta)S = q^\gamma + S.$$

$I(\beta)$ is an indicator function. If country β is an exporter, then $I(\beta) = 1$; when country β is an importer, then $I(\beta) = 0$. Similarly to Bhagwati et al., we define the overspending function as follows:

$$(4) \quad c^i(q^i, u^i) \equiv e^i(q^i, u^i) - r^i(q), \quad i = \alpha, \beta, \gamma$$

The value of this function gives the difference between total expenditures and revenues. For the country imposing the subsidy, it represents the cost of the subsidy.

The model can now be written with four equations in four unknowns: $q^\alpha, u^\alpha, u^\beta, u^\gamma$. The equations are as follows.

$$(5) \quad c^\alpha(q^\alpha, u^\alpha) + Sx^\gamma(q^\alpha - S, u^\gamma) = 0.$$

$$(6) \quad c^\beta(q^\alpha - I(\beta)S, u^\beta) = 0.$$

$$(7) \quad c^\gamma(q^\alpha - S, u^\gamma) = 0.$$

$$(8) \quad x^\alpha(q^\alpha, u^\alpha) + x^\beta(q^\alpha - I(\beta)S, u^\beta) + x^\gamma(q^\alpha - S, u^\gamma) = 0.$$

Equations (5) through (7) are the budget constraints of each country. Equation (8) is the market clearing equation for good X. Since this is a two-good model, by Walras' Law, the market clearing equation for good Y can be omitted. The price linkage equation (3) can be used to solve for q^β and q^γ .

Comparative Statics

The price and welfare effects are analyzed through total differentiation of the model. Throughout the paper, subscripts are used to indicate partial differentiation with respect to a variable. For example, $x_q^\alpha = \partial x^\alpha / \partial q$. We assume without loss of generality that $e_u^\alpha = e_u^\beta = e_u^\gamma = 1$ initially. In addition $S = 0$ initially. Using Shepard's Lemma we know that $c_q^i = x^i$. Finally, let $x_q \equiv x_q^\alpha + x_q^\beta + x_q^\gamma$. The differentiated system can be written as follows:

$$(9) \quad \begin{bmatrix} x^\alpha & 1 & 0 & 0 \\ x^\beta & 0 & 1 & 0 \\ x^\gamma & 0 & 0 & 1 \\ x_q & x_u^\alpha & x_u^\beta & x_u^\gamma \end{bmatrix} \begin{bmatrix} dq^\alpha \\ du^\alpha \\ du^\beta \\ du^\gamma \end{bmatrix} = \begin{bmatrix} -x^\gamma \\ I(\beta)x^\beta \\ x^\gamma \\ x_q^\gamma + I(\beta)x_q^\beta \end{bmatrix} dS$$

Applying Cramer's Rule to this system, we obtain the following results where $\Delta \equiv -(x_q - x^\alpha x_u^\alpha - x^\beta x_u^\beta - x^\gamma x_u^\gamma)$ and $\tilde{x}_q^i = (x_q^i - x_u^i x^i)$ is the partial derivative of the Marshallian import demand function with respect to the relative price.

$$(10) \quad dq^\alpha/dS = - \{ x_q^\gamma + x^\gamma(x_u^\alpha - x_u^\gamma) + I(\beta)\tilde{x}_q^\beta \} / \Delta$$

$$(11) \quad du^\alpha/dS = \{ (x^\gamma x_q^\alpha + (x^\gamma + x^\alpha)\tilde{x}_q^\gamma + (x^\gamma + I(\beta)x^\alpha)\tilde{x}_q^\beta) \} / \Delta$$

$$(12) \quad du^\beta/dS = \{ x^\beta x^\gamma x_u^\alpha + x^\beta [\tilde{x}_q^\gamma [1 - I(\beta)] - \tilde{x}_q^\alpha I(\beta)] \} / \Delta$$

$$(13) \quad du^\gamma/dS = \{ -x^\gamma \tilde{x}_q^\alpha + (x^\gamma)^2 x_u^\alpha + [1 - I(\beta)] [x^\gamma (\tilde{x}_q^\gamma - \tilde{x}_q^\beta) + (x^\gamma)^2 x_u^\alpha] \} / \Delta$$

The denominator of each expression is the determinant of the (4 x 4) matrix in (9). This determinant, Δ , equals minus the slope of the general equilibrium world excess-demand schedule of good X. If we assume that the system is stable, then the Marshall-Lerner condition implies that $\Delta > 0$.

III. The Effect on Prices

The price in the subsidizing country tends to rise as a result of the subsidy. It is important not to interpret this as the world price because in the case with two exporters all trade (although not all domestic sales) occurs at $q^\alpha - S$. With only one exporter only a portion of trade takes place at q^α . A sufficient condition for dq^α/dS to be positive is for $x_u^\gamma > x_u^\alpha$. Because $e_u^i = 1$ at the point in question, x_u^i is equal to the

Marshallian income effect. Thus, if the income effect in country γ is greater than in α , the domestic price in α will rise. Intuitively, the loss in demand in country α is more than made up for by the increase from γ . Even if this condition does not hold, dq^α/dS tends to be positive.

If country β is an exporter, the same condition ensures that dq^α/dS is positive. The magnitude of the change tends to be more positive when country β is an exporter if it is in the elastic portion of its offer curve. If $\tilde{x}_q^\beta < 0$, then country β is in the inelastic portion of its offer curve. In this part of the offer curve, export supply increases as the relative price of the good rises. This result occurs because when country α is one of two exporters, the export subsidy causes an increase in the quantity of X demanded which requires an expansion of export supply. Contrastingly, in the case where country α is the sole exporter, the increase in import demand in country γ is coupled with a decrease in import demand by country β . Therefore, the net increase in export demand will be smaller. Hence dq^α/dS is always less when country β is an importer than when it is an exporter.

IV. Welfare Effects

To help analyze the welfare effects caused by the subsidy, the relations in (11) through (13) are rewritten below in terms of Δ , dq^α/dS , and the quantities traded.

$$(14) \quad du^\alpha/dS = - \{ x^\gamma \Delta + x^\alpha (dq^\alpha/dS) \} / \Delta$$

$$(15) \quad du^\beta/dS = - x^\beta \{ (dq^\alpha/dS) - I(\beta)\Delta \} / \Delta$$

$$(16) \quad du^\gamma/dS = x^\gamma \{ \Delta - (dq^\alpha/dS) \} / \Delta .$$

These equations often allow for easier comparison of two countries' welfare changes.

The Subsidizing Country

The welfare of the subsidizing country always falls when the neutral country is an exporter. However, the welfare effect is ambiguous when the neutral country is an importer.

In the case where the neutral country is an exporter, $(x^\gamma + x^\alpha)$ must be positive for world trade to balance. Therefore, du^α/dS is unambiguously negative, using (11) to see this. This extends the result from trade theory that offering a general subsidy is always welfare decreasing to the case when you subsidize only a targeted importing country in the presence of another exporter or net exporting group. If β represents an net exporting group, in this case its exporters are supplying both its importing members and some of country γ 's import demand.

If the neutral country is another importing country, then the possibility arises of a paradox where the subsidy causes welfare in the exporting country to rise. In this case, the sign of du^α/dS is ambiguous. This can be explained by the fact that the exporter is failing to take advantage of its market power in good X. The use of the subsidy captures some of the benefits of market power but still leaves country α with less than the maximum attainable welfare. In a similar manner to the case of transfers, the paradox arises from the presence of a distortion (the failure to exercise market power).

The necessary and sufficient condition for du^α/dS to be negative when the third country is an importer is:

$$(17) \quad (dq^\alpha/dS)/\Delta < -x^\gamma/x^\alpha.$$

In the case when country β is in autarky ($x^\gamma = x^\alpha$), then $du^\alpha/dS < 0$ must hold. Note that $-x^\alpha > x^\gamma$ when β is an importer. Thus, the right-hand side of (17) is less than unity. Further, as the share of α 's exports going to γ increases (and consequently the share going to country β decreases), du^α/dS tends to be negative (because the right-hand side of (17) increases). This result follows because country α is exploiting β

through the targeted subsidy to γ . The larger β 's share of country α 's exports, the more opportunity to earn extra revenue by the price discriminating scheme of a targeted subsidy, and the more likely that country α 's subsidy will be welfare improving. In terms of equation (7), this argument relates to the term $(x^\gamma + x^\alpha)\tilde{x}_q^\gamma$. Since $(x^\gamma + x^\alpha) = -x^\beta$ and \tilde{x}_q^γ is negative (assuming X is a normal good), as x^β increases so does du^α/dS .

The Neutral Country

The welfare of the neutral country falls when it is the victim of price discrimination (when $dq^\alpha/dS > 0$). However, if it is another exporter, then it may earn free rider benefits or be a victim of country α 's strategy. The effect of the subsidy on the neutral country also depends on the change in world price due to the subsidy and on the slope of the world excess demand curve.

In the case where country β is an importer, equation (15) shows that du^β/dS is equal to minus net imports times the change in the price of its imports due to the targeted subsidy. Thus, for normal conditions on the change in the price of the good in the domestic market of the country offering the subsidy ($dq^\alpha/dS > 0$), when country β is an importer it suffers a drop in utility due to the subsidy.

When country β is an exporter, the effect on its utility is more complex. The change in utility (still from equation (15)), du^β/dS , is now equal to net exports times the sum of dq^α/dS and the slope of the world excess demand curve ($= -\Delta$). The price linkage equation (3) can be used to show that with country β an exporter, the change in α 's domestic price is equal to one plus the change in β 's exporter price. Thus, an exporting country β gains (loses) utility due to α 's targeted subsidy if and only if $(\Delta - dq^\beta/dS)$ is less (greater) than unity.

While no simple elasticity representation seems possible, the relation between the difference of two slopes and unity suggests that some sort of elasticity concerning the flexibility of world and (β 's) domestic prices is what determines whether country

β is made better or worse off by the targeted subsidy. While this elasticity remains elusive, multiplying the condition above through by negative one presents a good intuitive interpretation. If the change in world excess demand from an increase in world price plus the change in world price due to a subsidy (both of which are likely to be negative values) exceeds negative one, country β 's utility will rise. This could occur if β was in an elastic enough portion of its offer curve. Otherwise, β 's utility will decline.

The Targeted Country

Country γ 's welfare can increase whether β is an exporter or an importer. However, there are cases where γ is immiserized from the targeted subsidy from α . The changes in γ 's utility caused by the subsidy are simpler than those for β but similar. Irrespective of whether β is an importer or an exporter, du^γ/dS is positive if and only if $[\Delta - (dq^\alpha/dS)]$ is positive. If $dq^\alpha/dS = dq^\gamma/dS + 1$ is used to substitute into the above relation, we get the clearest resemblance to the case of country β . Again multiplying by negative one, the result is that if the change in world excess demand from an increase in world price plus the change in world price due to a subsidy (both of which are likely to be negative values) is less than negative one, country γ 's utility will rise. That is $du^\gamma/dS > 0$ if and only if $(-\Delta + dq^\gamma/dS) < -1$.

The above results imply that in the case where country β is an exporter, only one of β and γ can receive a gain in utility from the subsidy since the necessary conditions are mutually exclusive. This is an especially interesting result and makes intuitive sense. In a "normal" world we expect a targeted subsidy given to country γ to make it better off. If through some "paradox" or special set of circumstances the subsidy lowers the utility in γ , similar to an immiserizing transfer, the same set of circumstances ensures that the neutral exporter, country β , receives a free gain in utility from country α 's actions. Also recall that when β is an exporter, country α is always reducing its own utility level by offering this targeted

subsidy. The conclusion is that when β is an exporter, α is committing certain folly by providing a subsidy, with the only doubt being whether it is helping the country given the subsidy or α 's export competitors.

V. Summary and Conclusions

From equations (11) through (16), a number of general results can (or have) been derived. First, when the neutral country is also an exporter, country α must suffer a loss of utility as a result of offering a targeted subsidy. Further, from (15) and (16) it can be seen that when β is an exporter either β or γ must suffer a loss in utility while the other benefits from the subsidy. Thus, two countries are made worse off to the benefit of the third, with the instigator (country α) being one of the losers.

When the neutral country is an importer, none of the welfare effects can be signed unambiguously, but the following relations hold. If α gains utility from the subsidy, β must lose utility. Using equation (14), this result follows from the fact that α can only gain utility if dq^α/dS is positive. From (15) it is obvious that $dq^\alpha/dS > 0$ implies du^β/dS is negative. It can also be shown, using (14) and (16), that if α loses utility from the subsidy, γ must gain utility. This result is derived by substituting $(x^\beta + x^\gamma)$ for $-x^\alpha$ and noting that $x^\gamma/(x^\beta + x^\gamma) < 1$. Using the first result, in the unlikely, but possible, event of γ suffering a loss in utility by receiving a subsidy, α will gain utility and β will lose utility. The same substitution for $-x^\alpha$ allows a simple proof by contradiction of this last result.

The purpose of this paper is to analyze the welfare impacts of targeted export subsidies. This was accomplished with a three-country, two-good model. One country was assumed to be the subsidizer, the second to be the recipient, and the third to be neutral. The results show that the neutral country's market position (importer or exporter) and its market share influence the welfare results for all the countries. The effect of the subsidy on the domestic price in the country offering the

subsidy and the slope of the world excess demand function are both crucial to the welfare results. In general, a targeted export subsidy will reduce the utility of the subsidizer unless targeted towards a country with a small market share and/or a higher than normal income elasticity of demand.

Targeted export subsidies for agricultural exports have been used extensively by the United States since 1985 to regain market share. The results of this paper suggest this is a suboptimal trade policy. In agricultural trade, the neutral countries tend to be net exporters, and thus the United States stands to lose welfare as a result of targeted export subsidies.

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