International Agricultural
Trade Research Consortium

The Basic Economics of an Export Bonus Scheme

By

James P. Houck*

Working Paper #86-1

*The author is a professor in the Department of Agricultural and Applied Economics, University of Minnesota. Correspondence should be addressed to the author at this address:

Department of Agricultural and
Applied Economics
332 Classroom Office Bldg.
University of Minnesota
St. Paul, MN 55108

January 2, 1986

THE BASIC ECONOMICS OF AN EXPORT BONUS SCHEME

A variety of export-enhancing schemes are being promoted as additions to the U.S. agricultural trade policy arsenal. Among them is the export bonus or export payment-in-kind program. The central idea behind such schemes is to use surplus agricultural products, now in government hands, as a premium or bonus to international buyers who purchase import quantities from U.S. commercial sources. Abstracting from operational details, importers (or their purchasing agents) might receive, for example, one free ton of wheat from U.S. Commodity Credit Corporation stocks for every five tons purchased commercially. A limited export bonus scheme of this general type was introduced by the United States in mid-1985.

Supporters argue that a program like this could have numerous advantages. Among them are expanding sluggish export markets for U.S. farm products, reducing burdensome government commodity inventories, boosting farm prices, partially offsetting the negative trade effects of the strong U.S. dollar, and striking back at competitive exporters who seem to be displacing U.S. products with a variety of export subsidies (Amstutz). Skeptics believe that the benefits of such a program are by no means clear and might actually prove harmful to U.S. farmers and other interests if implemented (Rapp).

The objectives of this paper are (1) to present the simple economic analytics of a stylized export bonus scheme, (2) to assess its likely qualitative effects, and (3) to discuss briefly the current U.S. program. This discussion does not provide a specific critique or rationale for any particular export bonus program. Rather, it is intended to contribute to systematic thinking about such programs because they do differ importantly from cash export subsidies. A different, but related, approach is presented by the American

Enterprise Institute (pp. 7-12). Partial equilibrium supply and demand relationships will be employed in this analysis along with some simplifying, but plausible, assumptions.

For example, we will assume that the commodity stocks used to implement the bonus scheme are already in government hands and that these stocks are made available to international traders at no additional costs to them. The "traders" in this context are firms or agencies that act as market intermediaries between importers and exporters. For simplicity, we will rule out the exercise of market power or monopoly among these firms in providing this intermediation. Similarly, we will sidestep consideration of management costs and many administrative details of such programs.

However, we do need to specify the basic operational mechanism. Imagine that Nation A is the exporter originating the bonus scheme. Nation B is an importing nation designated as "eligible" for shipments under the scheme. (Nation B could be one, several, or all potential customers of A.) In our terms, Nation C will be all competing exporters, considered collectively. To operate the program, the government of Nation A announces that it will give premium quantities, at no cost, to market intermediaries who negotiate sales to Nation B. For instance, one free ton of wheat may be given to traders for each five tons of wheat exports that they arrange into Nation B. The traders are free to use the physical bonus quantities in any way they choose. It is this aspect of the program that differentiates it significantly from other export subsidy schemes.

The Basic Analysis: A Marketwide Scheme

In this first instance, we will assume that the export bonus scheme is marketwide in scope. All importing nations are eligible, and Nation A is a

large exporter to the international market. Hence, Nation A displays a positively sloped export supply function, shown as S_x in figure 1, and faces a negatively sloped net import demand relation, indicated by D_m. At the outset, it is important to be clear about the nature of these functions.

The export supply function, S_x, is a short-run schedule of non-government quantities that are available from production and commercial stocks for export at various domestic prices in Nation A plus competitively determined per-unit transfer costs to Nation B, which, in this stylized case, is the entire international import market. To focus attention on the export bonus scheme, we will not complicate the S_x function with other domestic or trade policy considerations. In fact, all we really require is that S_x not be negatively sloped.

The net import demand function facing Nation A sellers is D_m. It is a schedule of quantities demanded by Nation B (all importers) from Nation A at various import prices. This schedule reflects the systematic adjustments, if any, to various import prices by consumers and producers in B plus the systematic adjustments of other exporter nations (C) to these changing prices. The function D_m does not reflect deliberate government policy changes or reactions by official decision makers in B or C. The other exporters simply allow the market to adjust to A's export bonus initiative without altering their own export supply relations or existing policies. We will modify this view later.

Thus, the functions D_m and S_x are excess demand and supply curves in the usual partial equilibrium trade context (Grennes, Chapter 3, and McCalla and Josling, Chapter 2). In a later section, we will discuss a narrow bonus scheme focused on a specific import nation or region. However, the basic reasoning is similar in either case. If nothing further is specified, the intersection of

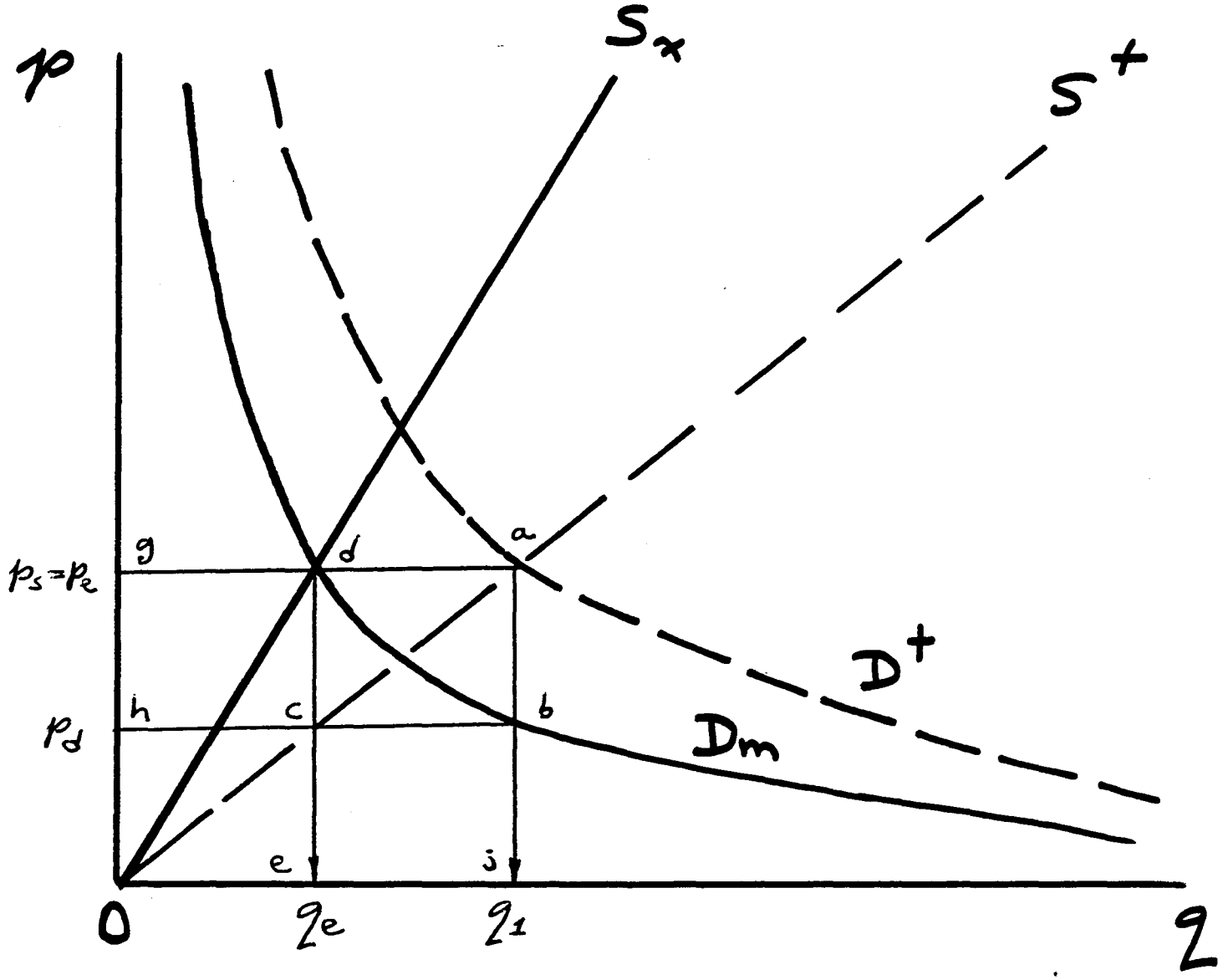

Figure 1. Export bonus with unit elastic demand

S_x and D_m will provide the free trade, benchmark equilibrium with A's existing government stocks isolated from the market. In figure 1, the import price and trade volume from A to B would be p_e and q_e, respectively.

Export Bonus Analytics

Now imagine that Nation A institutes an export bonus program using existing excess inventories that are in government hands. For each unit sold abroad, any trader receives r units from Nation A's excess inventories at no additional cost. In general, r can be any number greater than zero. On the export side, this undertaking by Nation A is reflected in figure 1 by the function labeled S^+. It is the original export supply curve (S_x) plus the horizontal addition, at each export supply price, of the commercial quantity supplied at that price times r. Therefore, S^+ is equivalent to $(1 + r)S_x$. Thus, the function S^+ is a schedule of total supplies from A that are available to the world market at each export supply price in A. It includes commercial sales plus allowable additional exports from government stocks under the bonus scheme.[1/]

Next consider how the average import (or world) price is formed. Traders receive bonus quantities for free. Their ticket to receive this free good is a proportional purchase from commercial channels in A. Receipt of these free supplies allows them to sell internationally at prices less than the market prices inside A. In fact, competition among traders would impel them to do so. (Incidentally, Nation A must institute import controls to prevent a low-priced backwash of imports from swamping the domestic market.)

We can be more specific about the extent of this international price-decreasing effect. With competition among trading intermediaries, the marginal cost of each unit available to buyers is a weighted average of the supply price from A and the "price" of the bonus quantity (zero in this particular case).

The weights are formed from the bonus scheme provisions (r). That is, each unit available to importers will contain the minimum equivalent of (1/1+r) units of commercial product and (r/1+r) units of bonus product. We assume for this discussion that competition or regulation in the import market will keep the consumption price in B equal to the constrained marginal cost of blended units of imports. Hence, the following equation must hold:

(1) $P_d = (1/1+r)p_s + (r/1+r)p_b$

where p_d is the import consumption price measured along D_m, p_s is the commercial export supply price in A, and p_b is the price (or cost) of the bonus quantities to traders (zero in this case). Because D_m is a net import demand function, p_d is also the "world" price paid by importers to any suppliers including Nation A's competitors, C. In principle, p_b could take on any value. However, to qualify as a "bonus" scheme, p_b must be less than p_s. When p_b is equal to zero, the following theoretical price relations hold:

(2) $p_d = (1/1+r)p_s$

and, rearranging

(3) $p_s = (1+r)p_d = p_d + r\ p_d$

The relations in (3) allow us to form D^+ in figure 1. At each import amount, measured along the horizontal axis, D^+ lies above D_m by the per unit value of $r(p_d)$. The function, D^+ is a schedule of commercial export prices from A (p_s) measured at various import volumes that are consistent with (1) each consumption price (p_d) along D_m, and (2) the bonus scheme (r). The D^+ relation does <u>not</u> represent a shift in D_m. It is entirely a creature of D_m and the bonus scheme (r). It simply tells us which p_s must prevail in order to move any given quantity of imports from A into consumption in B, given D_m and r. The reason that p_s and p_d differ is that, with the scheme in place, commercial export

volumes from A are special. They entitle traders to free bonus quantities and are, therefore, more valuable than similar quantities from other sources. They will reflect that value in a higher per-unit price.

The intersection of S^+ and D^+, where A's exports and B's net imports are equal, forms the equilibrium export price from A and the equilibrium total quantity of commercial sales plus bonus exports that can be sold along D_m. In figure 1, this intersection is at point a. The commercial export supply price is p_s; the total quantity q_1 is exported. Of this volume, q_e is supplied commercially and $q_1 - q_e$ is provided as the export bonus. The total volume of q_1 is sold to the importing nations at the lower price of p_d.

Because the commercial export price from A is p_s and the world price is p_d, the per unit implicit export subsidy is $(p_s - p_d)$. This value is shown as ab in figure 1, and can be stated as rp_d or $(r/1+r)p_s$. The total subsidy value is area abcd in figure 1. It can also be stated as $(r/1+r)^2(q_1p_s)$ or its equivalent, $(r^2/1+r)(q_1p_d)$.

Market Effects

In order to assess the effects of an export bonus scheme of the type described above, we compare the scheme's results with the equilibrium prices and quantities that would result in the absence of such a program. In all figures, p_e and q_e denote the equilibrium prices and trade volumes respectively that would occur in the international market with existing policies--at the intersection of D_m and S_x.

For given supply conditions on the export side, the results of an export bonus scheme by Nation A hinge importantly upon the price elasticity of the net import demand it faces, no matter how that function is defined. Figure 1, which we have already described, happens to reflect a unitary price elasticity of

demand (-1.0) along D_m. Figures 2 and 3 reflect inelastic and elastic demand functions, respectively.

In figure 1, p_e and q_e would occur in the original market. The bonus scheme expands <u>total</u> exports from q_e to q_1. But, because D_m is unit elastic, commercial exports from A remain at q_e even though the world price for the importing countries falls to p_d. This proportional fall in the import price of r induces an equivalent proportional increase in total quantity demanded. Hence, the export supply price in Nation A stays at $p_e = p_s$. Export earnings, which were gde0 initially, remain steady under the scheme at hbj0. These results are a consequence of the unitary demand elasticity and the following two price-quantity proportionality contraints: (1) $p_s/p_d = 1+r$, and $q_1/q_e = 1+r$. These constraints are captured by D^+ and S^+, respectively.

When the relevant demand elasticity is -1.0, an export bonus scheme increases the total volume traded and lowers the average price paid by importers to all sellers. The producers in Nation A are not directly benefited because commercial or non-bonus sales do not expand. The excess inventories of q held by the government of Nation A are depleted to the price advantage of the import nations. To the extent that inventory reduction is also sought by Nation A, the bonus scheme is obviously successful. Naturally, these results assume that deliberate price or other retaliation by competing exporters does not occur. More on this point later.

In figure 2, D_m is price inelastic. Otherwise, the relations are the same as in figure 1 with p_e and q_e indicating the original equilibrium price and trade values. As the export bonus scheme is put into effect, <u>both</u> the export supply price (p_s) and the world price (p_d) drop as the intersection of D^+ and S^+ becomes relevant. Total exports do expand, from q_e to q_1. But commercial

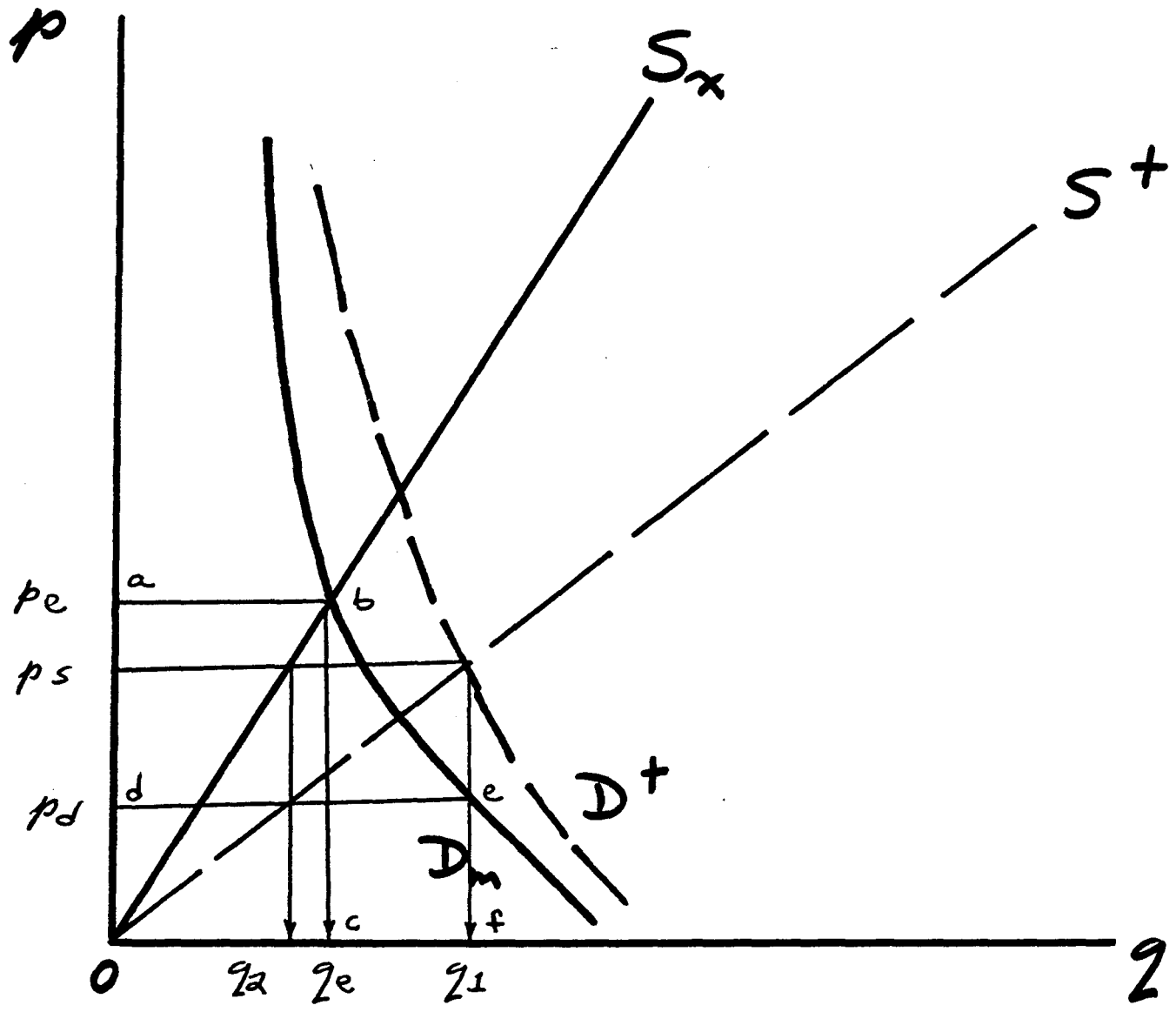

Figure 2. Export bonus with inelastic demand

exports fall from q_e to q_2. All of this is a consequence of the price inelasticity of D_m and the two price-quantity proportionality constraints developed earlier, although now $q_1/q_2 = 1+r$. The only way that the required proportional relation between A's commercial and total exports and between A's export and world prices can occur is at a trade equilibrium featuring lower export prices and a less than proportional expansion in total trade.

Although Nation A's excess inventories decrease by the amount $(q_1 - q_e)$, export earnings fall from abc0 to def0 along the inelastic D_m. With an inelastic net import demand, the export bonus scheme bestows advantage upon import consumers but punishes export suppliers with both lower prices and smaller commercial sales and earnings.

In figure 3, D_m is price elastic, with p_e and q_e indicating the original equilibrium price and trade values. In this case, the instigation of an export bonus by Nation A causes its export supply price $(p_{s)}$, the commercial volume of trade (q_2), and the total volume of trade (q_1) to increase as the intersection of D^+ and S^+ becomes relevant. This is a consequence of the relative price elasticity of D_m and the two price-quantity constraints. The only way that the required proportional relation between commercial and total exports and between export and world import prices can occur is at a trade equilibrium featuring higher export prices for A and a more than proportional expansion in total trade. Commercial export earnings increase from abc0 in figure 3 to def0 along the elastic D_m. Since both prices and trade expand, the earnings of export suppliers in Nation A increase as a result of the policy. As with the other illustrations, the consumption price for import nations falls from p_e to p_d, and the excess inventories q held by Nation A decrease.

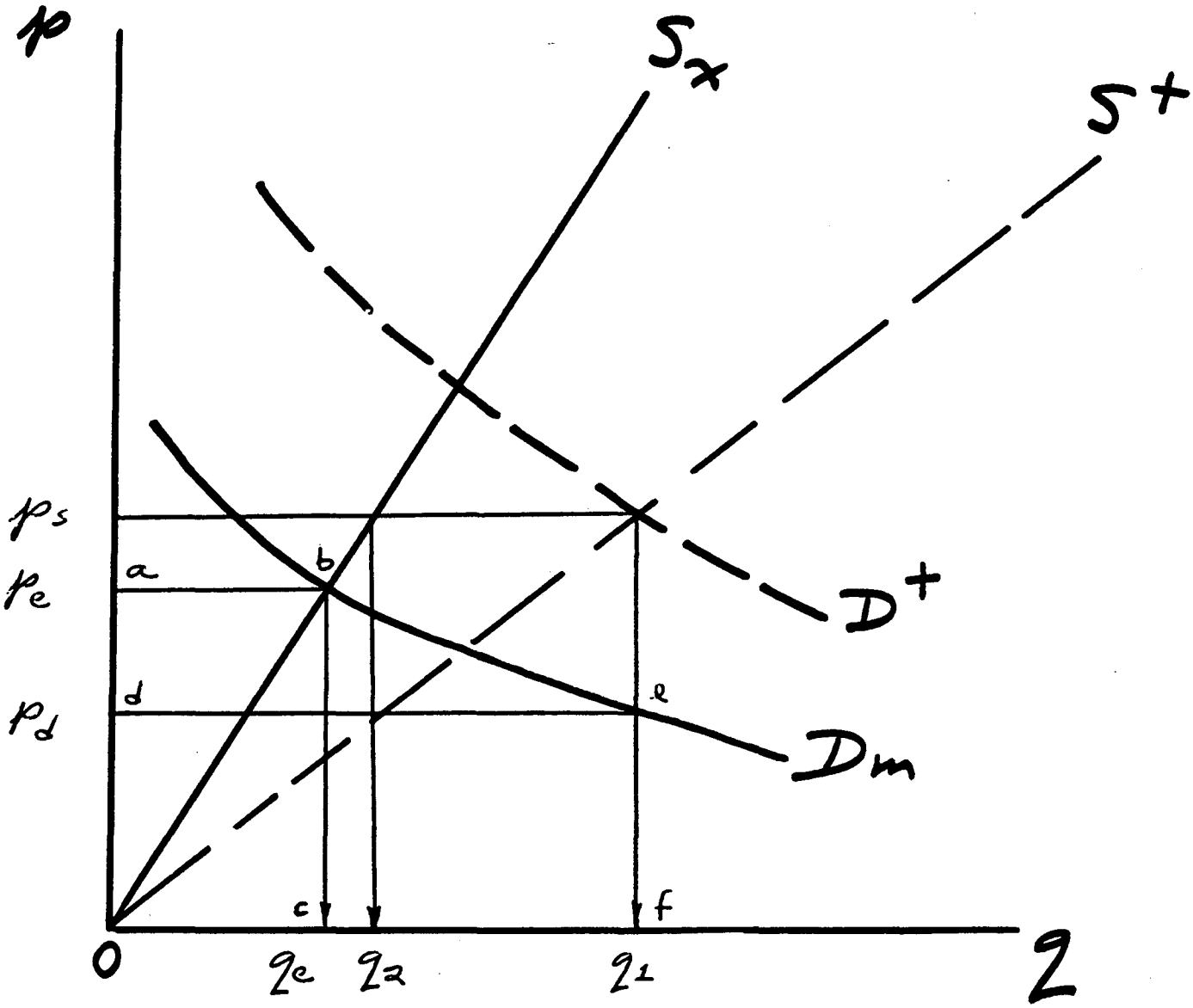

Figure 3. Export bonus with elastic demand

Table 1 summarizes the analytical results for this basic export bonus scheme under the three net import demand elasticity scenarios. The importers benefit under all conditions, but the export suppliers in Nation A obtain positive price and trade results only when the relevant import demand is price elastic. However, surplus inventory depletion occurs in all instances. Because the world price paid by import nations for all quantities falls, we can infer that, in the absence of deliberate retaliation, prices received by competing export suppliers also fall. Should any competing exporters be subsidizing their exports with open-ended payments, the fall in import prices will make this effort clearly more expensive.

Some Analytical Extensions

It is beyond the scope of this paper to be exhaustive about the potential ways that this framework might be adjusted to reflect actual bonus schemes. However, a few extensions of the basic analysis may be suggestive.

An Export Floor Price

There is no floor under world prices of agricultural commodities. However, several trading nations attempt to control downward fluctuations of their own domestic prices. Imagine that Nation A has a floor price for its export bonus product, protected by some mechanism such as non-recourse price support loans or direct government purchase at the minimum price. Suppose further that this floor is also the current level of p_e, the international equilibrium price in the absence of an export bonus scheme. The price inside Nation A can move above p_e but not below.

This situation is depicted in figure 4 with S and S^+ both truncated at p_e, Nation A's floor price. Now assume that an export bonus program is inaugurated.

Table 1. Analytical Results for a Simple Export Bonus Scheme by Nation A

Item	Import Demand Elasticity		
	Unitary	Inelastic	Elastic
Export price to A	n.c.	-	+
Import (world) price	-	-	-
Total trade volume	+	+	+
Commercial trade volume	n.c.	-	+
Export earnings	n.c.	-	+

where

(+) = increase

(-) = decrease

(n.c.) = no change

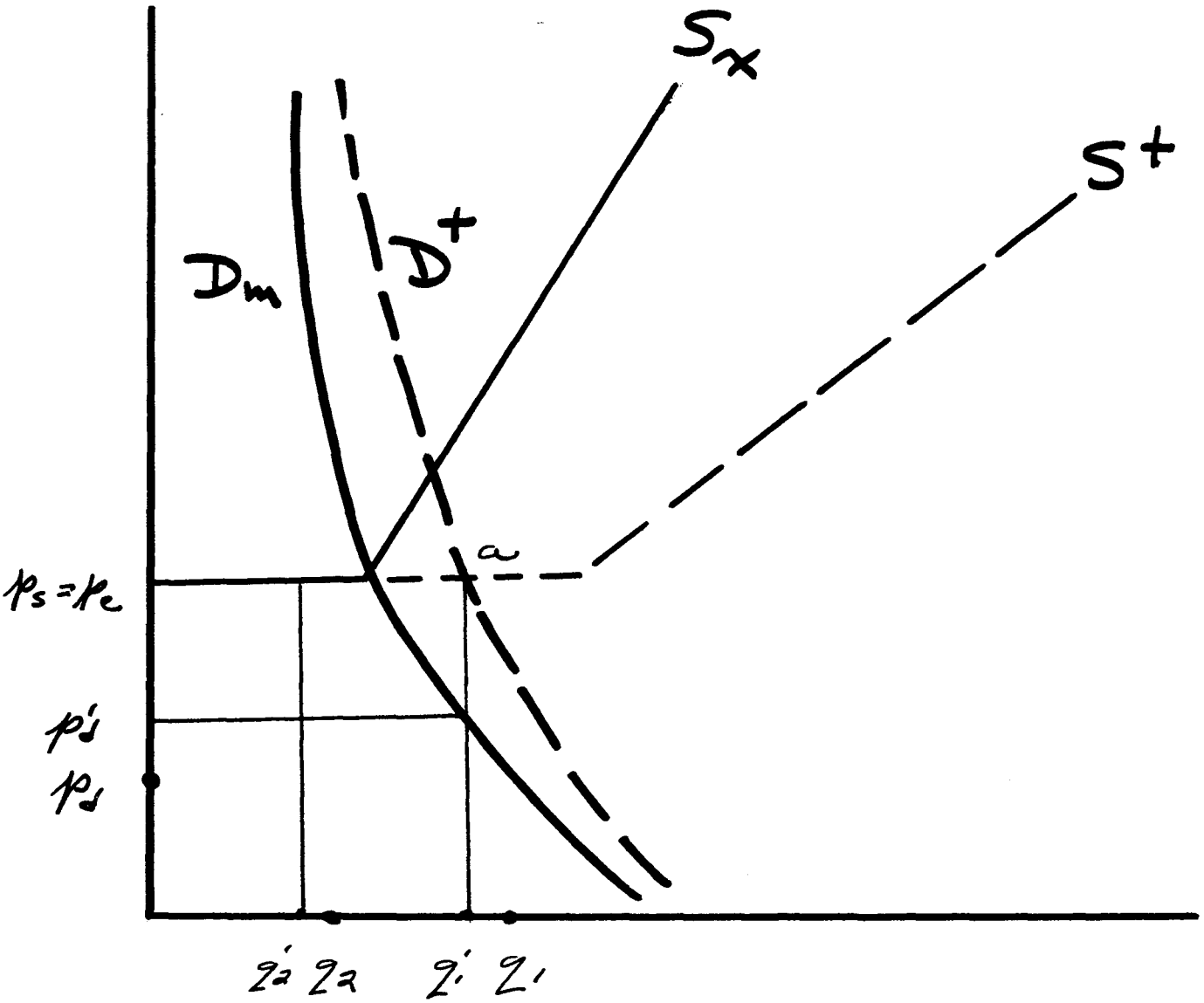

Figure 4. Export bonus with inelastic demand and export price floor.

If D_m is unit elastic or price elastic, all results are as depicted in figures 1 and 2, respectively, because there is no downward pressure on p_s. However, if D_m is inelastic, some differences crop up in the reasoning. These are illustrated in figure 4.

With no floor on p_s, an inelastic D_m will cause p_s to fall in Nation A as the export bonus scheme is implemented. But if p_s cannot fall, then other compensating adjustments occur. The relevant intersection of D^+ and S^+ is now point a in figure 4, on the flat, truncated portion of S^+. Total exports will be q_1' and the world import price will be p_d'. Notice that q_1, q_2, and p_d from figure 3 are shown on figure 4 for comparison. With a floor price, q_1' is less than q_1, indicating that total exports fall. Also, p_d' is higher than p_d, indicating that world prices paid by importers are higher.

With a given bonus program of r and an effective floor price, commercial or non-bonus exports will decrease in proportion to the fall in total exports. In particular, both q_1/q_2 and q_1'/q_2' are equal to (1+r). Because the floor price prevents p_d from falling as far as otherwise, total returns from exports when D_m is inelastic do not decrease as much as with no floor.

Government inventories will fall with a floor price in place, but not as much as with no price intervention. First, bonus dispositions from stocks will be less since q_2' is less than q_2 and the bonus award is proportional to these commercial exports. Secondly, protection of the floor price may require the government of Nation A to expand its acquisition of inventories domestically.

A Targeted Bonus Scheme

One important extension or special case of the basic analysis occurs if Nation A targets the bonus scheme on only one or a few import markets. When the focus of attention is narrowed in this way, the definition of both the demand

and supply functions may need to be altered even though the analytical argument remains much the same.

The demand function D_m becomes the schedule of import quantities demanded by eligible Nation B from Nation A at various prices offered by trading intermediaries, net of whatever systematic adjustments occur in the supplies and prices of other international buyers and sellers. No deliberate retaliation is reflected in D_m. Moreover, the demand function for this market need not be viewed as a strictly behavioral relation in the traditional context of economic theory. It might include, for instance, a schedule of administrative responses by officials in a planned economy as changes occur in available import prices.

The supply function, S_x, in the targeted case is a schedule of commercial quantities that export traders will supply from Nation A for shipment to Nation B at various prices. It is sensible to think of S_x as being much more price elastic (flatter) for a targeted program than for a marketwide scheme. That is, large relative quantity changes can be envisioned for a given import market without much change occurring in A's export prices. The polar case in this regard includes perfectly horizontal S and S^+ functions over relevant export sales volumes from Nation A to Nation B.

In this narrower case, the fundamental results of table 1 hold for Nations A and B, with some reservations. First, if S and, hence, S^+ are horizontal or nearly so, then A's export price will not respond much to an export bonus scheme no matter how generous it is. Second, the total volumes exported to the targeted importer will expand, but commercial exports and export earnings will expand or contract depending upon whether D_m is elastic or inelastic, respectively. Third, if the import price to Nation B is pressed below that for other, non-bonus markets, then the potential re-sale and transhipment of the product out of Nation B must be dealt with.

Retaliation

No matter how a bonus scheme is managed or how narrow its focus, an implicit export subsidy is involved. Recall this expression for the per-unit subsidy.

(4) $p_s - p_d = r\, p_d$

The value of this subsidy is directly related to the generosity of the bonus offering (r) and the level to which import prices are impelled (p_d). Hence, all of the international political as well as economic implications of export subsidies likely will come into play when such a scheme is implemented.

For example, it is sensible to consider how things will change if other, competing export nations deliberately retaliate in targeted markets by meeting the import price decreases with equivalent export subsidies. (Of course, the question of retaliation is not necessarily restricted to the targeted case--it is a general issue.) One can visualize the effects of retaliation in numerous ways.

For example, suppose that D_m is the net import demand for Nation B, faced by Nation A, taking into account the supply relations of other, competing export sellers. Then as other sellers meet A's bonus scheme in B by adjusting their own supply functions with export subsidies, D_m shifts to the left. This shift occurs because the price of a close substitute for Nation A's product decreases. Any leftward shift of D_m will diminish the benefits for Nation A in an elastic market and make things even worse in an inelastic situation.

Full retaliation by all of Nation A's competitors will result in a somewhat expanded overall market in Nation B featuring lower import prices and larger export subsidies all around. The expansion in the total target market will be

shared among the competing exporters in relation to their relative export supply elasticities.

The only situations in which a bonus scheme can increase Nation A's export prices occur when either (1) the basic import demand faced by the bonus-granting exporter is price elastic and retaliation by other traders is absent or incomplete, or (2) retaliation is complete but the relevant import demand is so price elastic that even when other exporters' increased sales are taken into account the remaining trade expansion for the bonus-granting exporter is proportionately larger than the import price reduction.

Retaliation against a targeted export bonus scheme need not be confined to competing exporters. Other international customers of Nation A, not favored by the targeted scheme, may deliberately divert all or part of their usual or planned import purchases away from Nation A to other supply sources. They may do so even at some net increase in per-unit costs in order to pressure A into either abandoning the targeted program or expanding it to themselves. This policy maneuver is difficult to illustrate in our diagrams. Generally speaking, such a move by other importers would rearrange trade flows to, at least, the short-run disadvantage of Nation A.

In-Kind Input Bonuses

One suggested modification of the export bonus concept involves using excess grains indirectly as input subsidies for livestock product exporters. For example, market intermediaries making sales of frozen, ready-to-cook chickens to a targeted importing nation might receive proportional quantities of feed grains from government stocks to offset some of the usual production and marketing costs. This maneuver is essentially the same as a direct, cash export

subsidy since the in-kind payments are tendered in a relatively fungible product, distinct in form and use from the actual export commodity.

As with a cash export subsidy, this form of intervention will tend to cause the price in the import nation to fall and the price in the export nation to rise. In technical terms, the international supply price of chickens would fall by the input subsidy amount at each export quantity -- the function S_x faced by importers would shift downward by the per-unit value of the subsidy.

The 1985 U.S. Export Enhancement Program

In May 1985, the U.S. Secretary of Agriculture announced the implementation of a three-year, $2 billion export bonus program, using CCC stocks. The major stated objectives of this effort, officially termed the Export Enhancement Program, are "first, to increase U.S. farm exports; and second, to challenge unfair trade practices of competitor nations" (Amstutz). In the first six months of its operation, the scheme had been employed for targeted sales of wheat and wheat flour to five North African and Middle Eastern nations--Algeria, Egypt, Yemen, Morocco, and Turkey.

In all cases, in-kind bonuses were to be available to the various export firms successfully negotiating sales. It is too early to assess the impact and implications of this program, especially the character and extent of retaliation by other export nations. However, the published sales prices and in-kind bonuses for a couple of cases enable us to approximate the value of some variables in our theoretical analyses (U.S. Dept. of Agriculture).

For example, 135 thousand metric tons of soft red winter wheat were sold to Algeria under the program in October 1985. The import price (p_d) was $103 per ton and the bonus value awarded was $41 per ton. Hence, the export value (p_s)

was $144 per ton. From equation (4) the implicit value of r, the proportional bonus, was 0.40, $(p_s/p_d - 1)$. A simultaneous hard red winter wheat sale of 170 thousand tons to Algeria was negotiated with an import price of $111 per ton and a bonus award of $43 per ton. This makes the export value $154 per ton and the implicit value of r equal to 0.39. Considering these two sales together, the total volume of 305 thousand metric tons represents 219 thousand tons of commercial sales volume and 86 thousand tons of stock disposals from CCC holdings.

Two sales of wheat totaling 500 thousand metric tons were made to Egypt in mid-September 1985. The import price of this wheat (unspecified varieties) was $110 per ton, and the bonus award averaged about $22 per ton, making the export value $132 per ton. In this instance, the implicit value of r was 0.20. In this case, the commercial sales volume was 417 thousand tons and the stock disposal equivalent was 83 thousand tons. Although these data provide little evidence about the overall performance of the Export Enhancement Program, they do illustrate the general dimensions of the subsidies involved, the markets to which they have been targeted, and the extent of stock disposal achieved.

Summary

An export bonus scheme of the general kind described here will tend to increase total trade volume for the implementing nation. The per-unit import price to the target nations will tend to fall. The implementing nation will dispose of excess stocks.

Whether or not a bonus program generates increased commercial sales, higher export prices, and stronger foreign exchange earnings depends importantly on the price elasticity of the relevant import demand function, net of deliberate adjustments and retaliation by other traders. If this function, however defined, is elastic, export prices, commercial sales quantities, and exchange

earnings will expand. If it is inelastic, prices, commercial trade, and earnings will decline. Retaliation by other trading nations always will offset some or all of the possible trade expansionary and export price-increasing effects of an export bonus scheme.

The 1985 U.S. Export Enhancement Program is a narrowly targeted export bonus scheme of the general type discussed in this paper. It is not yet possible to assess fully its results or the extent of offsetting retaliation by competing exporters.

Footnotes

1. In a fundamental sense, the export bonus idea is a mirror image of the proportional import quota. In the latter case, import quotas for a commodity are issued in a fixed proportion to amounts of domestic production purchased by domestic users. The economics of such import quota schemes is discussed by McCulloch and Johnson, by Grossman, and by Corden (pp. 45-50).

References

American Enterprise Institute, Issues in 1985 Agricultural Legislation, Legislative Analysis No. 54, Washington, D.C., August 1985.

Amstutz, Daniel G., Statement Before the Subcommittee on Operations, Research, and Foreign Agriculture, House Committee on Agriculture, Under Secretary for International Affairs and Commodity Programs, U.S. Dept. of Agriculture, October 8, 1985.

Corden, W.M., The Theory of Protection, Oxford: Clarendon Press, 1971.

Grennes, Thomas, International Economics, Englewood CLiffs, N.J.: Prentice-Hall, 1985.

Grossman, Gene M., "The Theory of Domestic Content Protection and Content Preference," Quarterly Journal of Economics, 95 (1981):583-603.

McCalla, Alex F., and Josling, Timothy E., Agricultural Policies and World Markets, New York: Macmillan Publishing Co., 1985.

McCulloch, Rachel, and Johnson, Harry G., "A Note on Proportionately Distributed Quotas," American Economic Review, 63 (1973):726-32.

Rapp, David, "Doubts about Export Program May Derail Farm Policy Changes," Congressional Quarterly, 43 (1985):1103-6.

U.S. Department of Agriculture, USDA Accepts Bids Under the Export Enhancement Program, News Division Press Releases Nos. 945-85, 951-85, 1046-85, and 1062-85, Sept. 17, 18, and Oct. 16, 18, 1985, respectively.